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Megatrends in Agriculture, Food Industry and Food Markets

An Empirical and Holistic Approach

Henning Otte Hansen

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Preface

Megatrends are large transformative global forces that define the future. Therefore, it is important to identify and understand megatrends because understanding the past is the best opportunity to make qualified guesses about the future.

Megatrends can be used as a direction or milestone for the future, and they often have a major impact on businesses, economies, industries, societies and individuals. Megatrends can also reveal development which is undesirable in the short or long term in the future, and which must be influenced and changed. In this way, megatrends can contribute to building an improved foundation for political decisions.

Agriculture, the food industry and food markets are shaped by megatrends, societal development and disruptions. Some megatrends are specific to agriculture, the food industry and food markets, while others are more general and apply to several sectors or to the entire society.

The understanding of megatrends increases once an overview of all significant and coherent megatrends has been obtained, and once they have been documented empirically. At the same time, it is also important that the drivers behind the megatrends are explained and that possible disruptions that can change megatrends are identified—in this case with a focus on agriculture, the food industry and food markets. The aim of this book is to illuminate, identify and explain these subjects.

I would like to thank "Fællesfonden" and the Department of Food and Resource Economics, the University of Copenhagen, for their support

with preparing this book. Thanks also to Stuart Wright for his help with the editing, and thanks to several South Korean students for their assistance during their internship at the department.

Sources and Statistical Data

Writing a book with more than 70 megatrends with an empirical approach and with more than 250 figures requires the use of many and often quite different databases and other sources. Some sources are essential and are used to illustrate a specific trend, or a few specific trends. These are directly acknowledged throughout the text. Other, also very useful sources and statistical data, contribute to a large number of figures and often less explicitly where data is retrieved from several openly accessible web-based sources.

These sources are gratefully acknowledged below, including abbreviations used as references in the text. Details of how these sources were used can be obtained by contacting the author.
These sources are:

FAO	Food and Agriculture Organization of the United Nations	https://www.fao.org/faostat/en/#home
L&F	Danish Agriculture and Food Council	https://agricultureandfood.dk/
Dan. Brew.	Danish Brewers' Association	https://bryggeriforeningen.dk/
Dan. Dairy	Danish Dairy Board	https://danishdairyboard.dk/
Stat. Den.	Statistics Denmark	https://www.dst.dk/en
Stat. Swe.	Statistics Sweden SCB	https://www.scb.se/en/
Stat.Can.	Statistics Canada	https://www.statcan.gc.ca/en/start
Swe. Agr.	Swedish Board of Agriculture (Jordbruksverket)	https://jordbruksverket.se/statistik
USDA	United States Department of Agriculture	https://www.usda.gov/
World Bank	The World Bank	https://databank.worldbank.org/
OECD	Organisation for Economic Co-operation and Dev.	https://www.oecd.org/agriculture/
WTO	World Trade Organisation	https://www.wto.org/
UN Comtrade	UN Comtrade database	https://comtradeplus.un.org/
Eurostat	Eurostat Database	https://ec.europa.eu/eurostat/
KOSIS	Korean Statistical Information Service	https://kosis.kr/eng/
FiBL	Research Institute of Organic Agriculture	https://statistics.fibl.org/index.html
ILO	International Labour Organization	https://www.ilo.org/
ABARES	Austr. Bureau of Agr. and Resource Econ. and Sciences	https://www.agriculture.gov.au/abares
FRED	Federal Reserve Economic Data	https://fred.stlouisfed.org
	United States Census Bureau	https://www.census.gov
	Office for National Statistic (UK)	https://www.gov.uk/government/
	The AgIncentives Consortium	http://www.ag-incentives.org
	Davidjacks.org	https://davidjacks.org/
	Federation of Danish Cooperatives	https://agricultureandfood.dk/

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Copenhagen, Denmark
April 2024

Henning Otte Hansen

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CHAPTER 1

Introduction

A megatrend is a significant trend, development or process. However, the term megatrend has not been clearly defined, and many different interpretations and aspects of megatrends can be found in the relevant literature. Almost every study has its own definitions and delimitations of megatrends.

Nevertheless, examining some of the definitions can give a sense of what the term megatrend encompasses:

According to John Naisbitt, who coined the term, megatrends are *large transformative processes with global reach, broad scope, and dramatic impact* (Naisbitt, 1982).

A more recent definition from the OECD (2016) describes megatrends *as large-scale social, economic, political, environmental or technological changes that are slow to form but which, once they have taken root, exercise a profound and lasting influence on many if not most human activities, processes and perceptions*. Furthermore, the OECD asserts that with such relatively stable drivers, megatrends are likely to continue for some time into the future.

EY (2022) describes megatrends as *large, transformative global forces that define the future by having a far-reaching impact on business, economies, industries, societies, and individuals*.

Furthermore, ESPAS (2019) describes megatrends as *trends that occur on a large scale; they therefore affect large groups of humans, states, regions,*

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and in many cases, the entire world. … their lifespan is normally at least a decade, and often longer. Most importantly, megatrends are linked to our present and are therefore phenomena we can already observe today. Because mega-trends are measurable, and affect many, and for a long period of time, they lend a previously foggy future an increased degree of visibility.

Additionally, according to PwC (2016), megatrends are *macroeconomic and geostrategic forces that are shaping the world. They are factual and often backed by verifiable data. By definition, they are big and include some of society's biggest challenges—and opportunities.*

Finally, the European Commission (n.d.) defines megatrends as *long-term global driving forces that are observable in the present and are likely to continue to have a significant influence for a few decades.*

Therefore, having read several prominent definitions, it is clear that megatrends are not just trends. In this book, megatrends are large global trends that are long-lasting, can be empirically documented and have a major impact on businesses, economies, industries, societies and individuals. Furthermore, megatrends can also be used as a direction for the future.

The focus of this book is agriculture, the food industry and food markets and the internal and external factors that surround and influence them. Agriculture and the food industry are often considered as one coherent integrated sector. They are both part of a value chain in which the individual links are in many cases strong. However, when it comes to internal factors such as structural development, internationalization and forms of ownership, the development in agriculture is different from the development in the food industry.

Some megatrends can have a broad impact on society. This applies, for example, to demographic developments, digitization and climate change. In contrast, other megatrends affect specific parts of society, and this book focuses on some of the megatrends that are of particular significance to agriculture and the food industry, including agricultural and food markets and food supply.

The book also has an empirical approach. This means that megatrends are documented to the greatest extent possible by statistical and empirical data. As emphasized by PwC (2016), "*megatrends are factual and often backed by verifiable data*", while the European Commission (n.d.) adds "*that megatrends are observable in the present and are likely to continue*". The intention of the empirical approach is to strengthen the scientific platform for the analyses.

The book also has a holistic approach in that all significant economic, structural, political and market megatrends are identified. An overall cross-sectional picture of all megatrends is interesting because the sector is influenced by—and follows—many different megatrends, with various directions and drivers. A narrow description of megatrends may, therefore, be deficient if it is to be the platform for an overall strategic plan for a company or an industry.

Although megatrends are important as a long-term guide, shocks that are impossible to prevent or even predict will invariably influence them. Furthermore, it is also evident that new megatrends, which we are unable to anticipate or identify, will emerge in the future. For this reason, the book also includes a number of potential disruptions, e.g., new technologies, political or economic changes or potential external shocks, which can set new agendas and directions for agriculture and the food industry.

Finally, the content of the book is intended to be non-normative, which means that megatrends are identified, described and assessed without regard to preferences or political positions. The advantages and disadvantages of megatrends may be highlighted based on economic criteria, while political or emotional conclusions or recommendations are left to the readers.

One might ask: Are megatrends interesting or important at all? Megatrends are largely based on historical developments, and in a world of great change, perhaps the focus should be more on the future than on the past. Or in other words: What can megatrends be used for? Do megatrends matter?

Mapping and describing megatrends can have several purposes:

Megatrends can be used to reveal and explain a historical development. An understanding of the connections between drivers, megatrends and societal impacts can be useful when assessing the effects of political and economic interventions—understanding the present can help us predict the future.

Megatrends can also be used to project a historical or current development: if megatrends are consistent and substantiated, they are likely to continue into the future, although considerable uncertainty is associated with this. This allows us to predict potential upcoming challenges and opportunities. Understanding the past is the best opportunity to make qualified guesses about the future.

Today the world is characterized by far greater changes and more uncertainty and unpredictability than in previous periods. However, in

these changing times, a number of more stable trends still exist, and they can be used as important indicators in both the short and long term. By identifying these megatrends and the underlying driving forces, we can reduce both risk and vulnerability in the future.

The identified and described megatrends will:

- visualize the current development,
- identify underlying and explanatory drivers and factors,
- show future challenges, threats and opportunities,
- give a picture of a future development which may or may not be influenced.

In this book, approximately 75 megatrends and 6 disruptive or new potential trends in agriculture and the food industry have been identified, although the list is not exhaustive and it may transpire that some megatrends are relatively short-lived.

Systematizing and structuring all megatrends in logical groupings is a challenge: Megatrends can affect several subject areas at once: Technology may simultaneously be a driving force behind changes to the structure, markets, resource composition and value chains—and also a disruptive change. However, in this book, megatrends are grouped into the following 10 categories, while a category with potential disruptions is added:

- Agriculture and agricultural structures

  The structural development of farms and agriculture: The number and size of farms, the ownership and specialization in different parts of the world, etc.

- The food industry

  The structural development of food companies and the food industry: Size, globalization, M&As and their overall goals.

- Food value chains

  The structure and integration in the value chain and the respective position of companies in the value chain and their market power.

- The position of agriculture
  The economic and structural significance of agriculture and the food industry in different regions.

- Agricultural and trade policy
  The aims and content of agricultural and trade policy, and its impact on agriculture, the food industry and food markets.

- Markets
  Market conditions, trade and globalization. How prices change from the farm gate to the retail level.

- Consumption and consumers
  Food demand and consumption and the economic, welfare and demographic drivers behind changes in consumption.

- Resources
  Inputs in agricultural production, productivity and resource scarcity. Changes and trends in inputs.

- Food supply
  World food situation, food crises and global diversion of production.

- Disruptive or new potential trends
  New future trends, drivers and disruptive changes that may influence existing megatrends.

Placing megatrends into groups makes it easier to obtain an overview, although the groups and the placement of the individual megatrends can always be discussed.

References

ESPAS. (2019). Welcome to 2030: The mega-trends. In *ESPAS, Global trends to 2030: Challenges and choices for Europe* (pp. 7–21). European Strategy and Policy Analysis System (ESPAS). https://doi.org/10.2872/074526

European Commission. (n.d.). *EU FORESIGHT: What is the Megatrends Hub: How to use megatrends to make your work future-proof*. Retrieved February 8,

2024, from the Megatrends Hub: https://knowledge4policy.ec.europa.eu/sites/default/files/what_is_the_megatrends_hub_and_how_to_use_it.pdf

EY. (2022). *Megatrends that will shape our future*. Retrieved from Global Management Forum: https://www.globalgovernmentforum.com/megatrends-that-will-shape-our-future/

Naisbitt, J. (1982). *Megatrends: Ten new directions transforming our lives*. Warner Books.

OECD. (2016). Megatrends affecting science, technology and innovation. In *OECD, OECD Science, Technology and Innovation Outlook 2016* (pp. 21–76). OECD Publishing. https://doi.org/10.1787/sti_in_outlook-2016-en

PwC. (2016). *Five megatrends and their implications for global defense & security*. PricewaterhouseCoopers LLP. https://www.pwc.com/gx/en/government-public-services/assets/five-megatrends-implications.pdf

CHAPTER 2

Structure of Agriculture

2.1 Introduction

Development and trends in agriculture often reflect a changed structure: Fewer, larger and more specialized farms are pervasive trends in agricultural development—at least in high-income countries. The structure of agriculture and not least the structural development are visible signs of a changing industry.

Structural development in agriculture is important for several reasons:

Firstly, relatively clear megatrends in the structural development of agriculture can be identified. Development follows the same track across national borders, which makes it possible to predict the direction of structural development.

Secondly, structural development is a way of improving competitiveness in agriculture. Structural development is often the result of exploiting economies of scale, so it creates improved efficiency, earnings and competitiveness.

Thirdly, structural development, e.g., fewer, larger and more specialized farms, is the visible manifestation of the industrialization of agriculture. In many cases, structural development is controlled or limited by socio-economic or socio-political considerations and preferences.

Fourthly, socio-economic and societal development is affected by the structural development of agriculture. The agricultural labor force is released and can be used in other industries with stronger growth

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and work intensity. Furthermore, structural development also leads to a demand for technology in other sectors.

Structural development in agriculture can be defined and described in many different ways, but it is more than just the total number and size of the individual farms. For example, factors such as specialization, concentration, types of ownership, vertical integration, globalization and farmer demographics can help to describe the structure.

In recent years, structural development in agriculture has assumed even broader meaning. With a greater focus on vertical integration, structural development now encompasses all the links in the value chain from research and development, supply and agricultural production to processing, refining, distribution, marketing, retail and consumption, so that today, the entire food system is involved.

The structural development now takes place in new dimensions, where industrialization, commercialization and business development are in focus.

A number of indicators can be used to describe the structural development of farms:

The number of farms is an important parameter in terms of the structural development of agriculture. While structural development in developed and developing countries is rather similar, it is very different between developed and developing countries. The development in the number of farms is also a trend which is very visible to the rest of society.

Farm size is also a very visible result of structural development. Although the average size of the farms conceals a widespread, and although size can be measured in several different ways, it is still an important yardstick. In terms of national regulations, farm size is one of the structural parameters which is regulated.

Size can be measured as:

- Land (owned or operated)
- Labor
- Livestock units
- Turnover
- Value added
- Capital

Specialization describes the production setup of individual firms. Specialization increases if, for example, there is a shift toward less diversified production on the individual farms. Specialization in livestock production also occurs when, e.g., there is a reduction in the number of farms with mixed livestock, i.e., farming with both cows and pigs. Also here we are dealing with a very significant development.

Increasing concentration will occur if large farms secure an increasing share of the total production. For instance, one can analyze whether the largest 20 percent of farms are accounting for an increasing share of total production. Similarly, one can analyze whether the small farms are becoming relatively smaller.

In general, the concentration is becoming more widespread. Concentration takes place on individual farms with the big farms acquiring an increasing share of total production.

Concentration also occurs geographically with production becoming more concentrated in areas that have the greatest comparative advantage. Livestock production can develop very differently between areas. Indeed, livestock density has been increasing substantially in certain geographical regions.

Forms of ownership is central as it describes the ownership structure of the farms with distinctions being made between different types, e.g., private, tenancy, limited liability company, cooperative, fund, etc.

Vertical integration including specific contract production highlights the food industry's connection and dependence on suppliers of raw produce (farmers) and buyers (retail). The entire value chain from research and development to the final end user is often involved. With increasing vertical integration, farms become increasingly part of the industrial process, which arises from consumers' demand and can be traced back through the value chain to the farmers. Vertical integration and the value chain are discussed in more detail in Chapter 4.

Input factors in agriculture are also rapidly changing and are also an essential part of structural development. Input factors in this context include labor, capital and education. The change in input factors manifests itself in, e.g., the share of full and part-time farmers and off-farm earnings.

Globalization/internationalization are also sometimes included in the description of structural development. The farms' relative sales on the export markets often increase over time, so international orientation is an

important structural characteristic of the farm changes. Farmers' investments in foreign agriculture and cooperation with farmers abroad can also be included in the description of the structural development in agriculture.

Although clear global trends in the structural development of agriculture can generally be observed, in certain areas, there are significant differences in the development between low- and high-income countries. Therefore, structural development in low- and high-income countries is treated separately in the areas in which there are significant differences.

When analyzing megatrends in the structural development of agriculture, it is important to identify the underlying driving forces. If the driving forces are stable and constant, the structural development will probably continue in the same direction—all other things being equal.

Theoretically, it is easy to identify a number of drivers of structural change, but it is much more difficult to demonstrate any statistical causality. Therefore, in practice, it is difficult to identify and document the specific causes of structural development.

Several explanations for the difficulty in demonstrating a causal relationship can be identified:

- Firstly, many permanent and many different factors may impact agriculture, and it may be impossible to separate the individual effects and their consequences.
- Secondly, a long or short period may occur between exposure and a visible consequence. Lags are important in structural development.
- Thirdly, in general, agriculture and farms are so heterogeneous that responses to the impacts may vary considerably between farmers.
- Fourthly, to some extent, farmers may expand and buy farms for non-economic motives. Incorporating such motives in an empirical explanation of agricultural structural development is difficult.
- Finally, a stimulus (e.g., an income increase) may have very different and perhaps contrasting effects depending on the circumstances.

As structural development encompasses several aspects, several reasons for the development can also be identified. Contract production occurs for special reasons, while changes in, e.g., ownership or agricultural structures have other causes.

Based on the theoretical and empirical assessments of the structural impacts on agriculture, a general overview of the causes of structural development in agriculture is provided in Table 2.1.

Table 2.1 Structural development in agriculture: Drivers and impacts

Technology Technology can replace labor, thereby increasing emigration from agriculture, which may include both employees and owners. However, technology may also result in an increase in part-time farming and the optimal size of farms, and in this way, farm size, concentration and specialization can be increased. Finally, as a result of improved traceability, technology can also strengthen and support vertical integration in the value chain
Earnings Improved earnings in agriculture will limit emigration and increase immigration as agriculture becomes a more attractive workplace and investment. The ability and willingness to invest also increase, which increases the size of the existing holdings. Good stable earnings can lead to increasing specialization as the need for risk diversification is reduced
Wages Outside Agriculture In general, rising wages and incomes in the economy will push resources (labor and capital) out of agriculture and into other industries and make it more difficult for agriculture to attract labor
Infrastructure Infrastructure includes, for example, access to markets, capital, education, advisory services, etc. Well-developed infrastructure can strengthen specialization and large-scale operations. Good infrastructure can support part-time farming as access to alternative employment, good transport options, market for services, etc., favors part-time farming. Efficient infrastructure can also strengthen vertical integration and thus the division of labor between agriculture and the supply and food industry
Legislation In many countries, the aim of legislation is to influence and control structural development (Vranken et al., 2021). By restricting mergers, acquisitions and access to the purchase of agricultural properties, both migration and concentration can be limited. Backward vertical integration (companies' acquisition of agricultural assets) can be restricted through legislation and the organization of farmers in cooperatives and producer associations can be supported. Agricultural and environmental legislation can both limit and support specialization

Source Own presentation

2.2 Developed Countries: Number of Farms

Structural development calculated in terms of the number of farms is largely uniform in the high-income countries. Over an almost hundred-year period, the number of holdings in countries as diverse as Denmark, Sweden, the Netherlands, Canada and the USA exhibited fairly similar development, cf. Fig. 2.1.

As can be seen, the development in the number of farms is almost identical development in the five countries. It is remarkable that the number of agricultural holdings in Denmark remained almost constant right up until the beginning of the 1960s. This was mostly due to agricultural policy regulation, which delayed structural development and maintained a relatively large number of farms. The development was fastest in the USA and in Canada, which was due to more advanced agricultural technological development and mechanization as well as a greater demand for labor from other industries, which pulled labor out of agriculture. The number

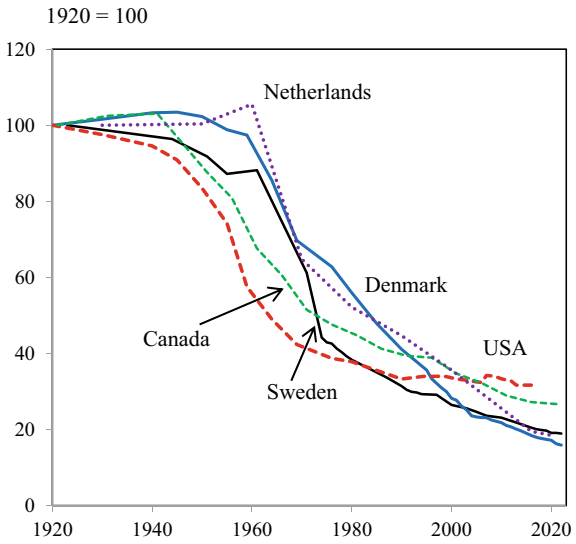


Fig. 2.1 Development in the number of agricultural holdings in selected countries (*Sources* Own calculations based on USDA [several issues b], Statistics Sweden [several issues] and statistical data from FAO, Jordbruksverket [Sweden], Statistics Canada and Statistics Denmark)

of farms in the USA has remained almost constant in recent decades, which is, to a certain extent, due to changed definitions and methods of calculation.

The figure also shows that the development began in earnest in the 1950s. When considering the entire period, the development in the number of agricultural holdings in the five countries was virtually identical and with the same result: The number of agricultural holdings reduced to 20–30 percent of the previous level in all countries. It seems that the industrialization and mechanization of agriculture in the 1950s and 1960s influenced structural development to a significant extent.

When analyzing structural development over the very long term, it becomes apparent that it is not just a linear trend, but rather involves different phases and an almost cyclical process. Examples from Sweden and Denmark, which publish relatively consistent long-time series on the structural development of agriculture, illustrate this, cf. Fig. 2.2.

The development can be divided into the following three phases: In the second half of the nineteenth century, the number of farms increased; in the first half of the twentieth century, the number was relatively constant, while subsequently it has been continuously decreasing. The latest development can largely be explained by technological change: By using machines (tractors, combines, milking machines, milking robots, etc.) economies of scale arise, which can only be exploited on increasingly large—and thus also fewer—farms.

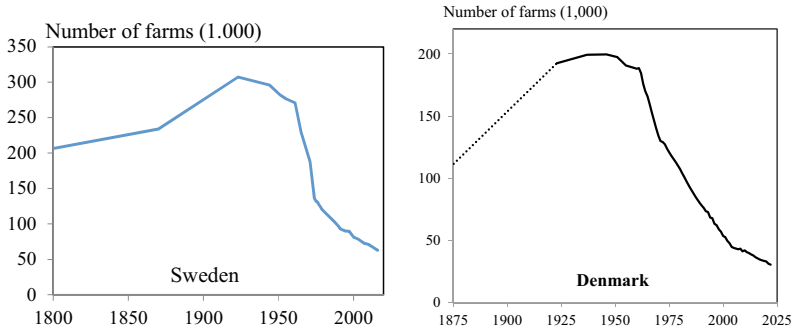


Fig. 2.2 Long-term development in the number of farms: Denmark and Sweden (*Sources* Own calculations based on Statistics Sweden [several issues] and statistical data from Jordbruksverket [Sweden] and Statistics Denmark)

Showing the change in the number of farms over a long period is complicated because the definition of a farm has changed over time: In some periods, "houses with just a very small plot of land" are included as farms. However, in recent decades the definition of what constitutes an agricultural holding has been tightened. Therefore, the time series are not become completely consistent or comparable over time. Nevertheless, despite these uncertainties, some relatively clear trends can be identified.

In all EU countries, the number of agricultural holdings is decreasing year by year. In the period 1950–2020, approx. 75 percent of all farms were closed when analyzing the original six EU countries as one group, cf. Fig. 2.3.

Regardless of the period or number of member states included, the trend toward fewer and fewer holdings is clear.

It is noteworthy that, in recent years, the development is strongest in the least developed countries, while the most developed countries exhibit far weaker structural development. This is largely due to the fact that as early as the 1960s and up to the 1990s, the rich countries experienced strong development toward fewer agricultural holdings, and the pressure

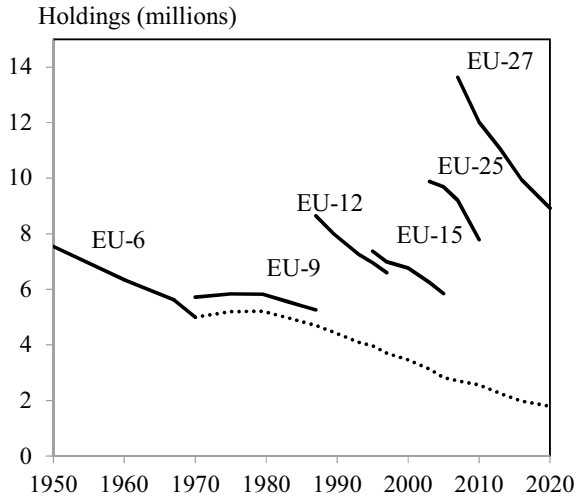


Fig. 2.3 Number of agricultural holdings in the EU 1959–2020 (*Note* Definitions are not consistent throughout all years. *Source* Own presentation based on European Commission [several issues] and statistical data from Eurostat)

for further structural development diminished. However, for all countries, the number of agricultural holdings in the period decreased significantly.

2.3 Developed Countries: Farm Size

The size of the agricultural holdings is a very visible manifestation of structural development. The availability of technology and the utilization of economies of scale, which are important driving forces behind structural development, create a trend toward larger agricultural holdings.

Size is an imprecise term because it can be calculated in many ways. Therefore, several methods of calculating farm size must be used to obtain a fair picture of the trends.

The average size of agricultural holdings—measured in several different ways—varies considerably between countries—even within the EU. The agricultural holdings in the Netherlands are many times larger than they are in, e.g., Romania—depending on how size is calculated. Furthermore, the Netherlands also has by far the largest average holdings in terms of production value, but in terms of the number of hectares, the country is far lower cf. Table 2.2.

The pattern is clear—the largest farms are to be found in Northern and Western Europe, while the smallest are found in Eastern and Southern Europe. Therefore, the general picture reveals that the richest countries have come furthest in terms of structural development, while small farms are typically found in the poorest countries.

In the Western world, the trend is generally very clear in the direction of ever-larger holdings—a development that has especially gained momentum in recent decades, cf. Fig. 2.4.

Figure 2.4 illustrates that the five countries have developed almost identically when considering the entire period. The agricultural holdings have become approx. 3–5 times larger, although the development during the twentieth century has been different.

Furthermore, the development in the size of livestock holdings has also largely followed international patterns, cf. Fig. 2.5.

As can be seen, the countries have apparently followed a relatively uniform pattern. Especially in recent decades, structural development has been strong, but even when viewed over a longer period, structural development in, e.g., pig production has been almost exponential. In the figure, the Y axis is logarithmic, and the development almost follows a straight line for all three countries in recent past decades.

Table 2.2 Different measures of the average size of farms in the EU, 2020

	Hectare per holding	*Dairy cows per holding*	*Pigs per holding*	*Broilers per holding*	*Standard output per holding 1,000 EUR*
Belgium	37	45	1364	36,618	218
Bulgaria	22	7	21	1,593	19
Czechia	130	129	382	27,796	
Denmark	75	180	3,764	45,192	287
Germany	61	62	713	29,279	178
Estonia	60	49	1,866	24,200	48
Ireland	36	76	1,197	15,694	46
Greece	7	25	43	266	11
Spain	25	46	533	6,085	41
France	61	57	833	9,153	134
Croatia	12	8	17	293	15
Italy	11	38	336	10,834	45
Cyprus	3	116	631	1,186	18
Latvia	28	9	31	3,250	17
Lithuania	19	5	20	469	15
Luxembourg	66	73	923	400	185
Hungary	11	32	27	1,483	15
Malta	1	65	416	4,400	11
Netherlands	32	97	2,767	78,079	415
Austria	20	18	109	4,358	46
Poland	10	9	64	1,968	18
Portugal	14	34	47	289	20
Romania	4	2	3	23	4
Slovenia	7	12	12	715	17
Slovakia	74	31	78	7,549	75
Finland	45	35	996	56,947	71
Sweden	48	85	1,083	45,000	82

Source Own presentation based on statistical data from Eurostat

The conclusion is that the development reflects clear international trends, and that the development has been relatively uniform and almost predictable.

The figures illustrate the change in size in selected industrialized countries. However, a characteristic is that the development has been particularly strong in the economically highly developed countries, while lower and lower-middle-income countries do not appear to have undergone similar rapid structural development. By comparing the countries' level

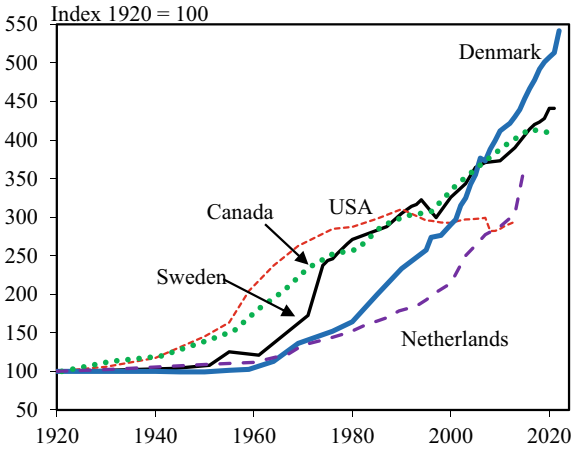


Fig. 2.4 Size of agricultural holdings (hectares/holding) in Denmark, the USA, Sweden, the Netherlands and Canada. Index 1920 = 100 (*Sources* Own calculations based on USDA [several issues b], Statistics Sweden [several issues] and statistical data from FAO, Jordbruksverket [Sweden], Statistics Canada and Statistics Denmark

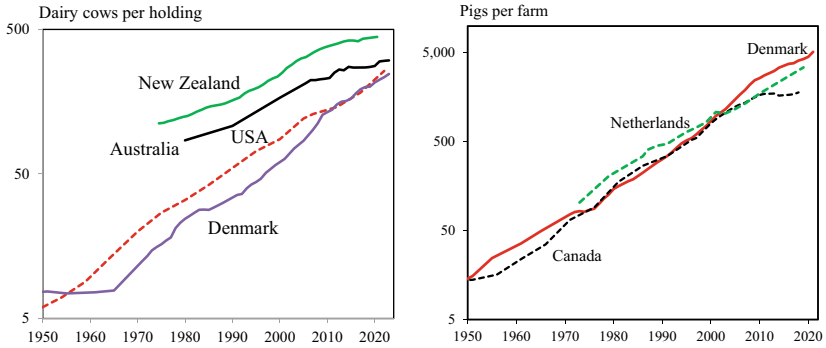


Fig. 2.5 Long-term development in the number of pigs and the number of dairy cows per holding in selected countries (*Note* Logarithmic Y axis. *Sources* Own calculations based on USDA [several issues b], European Commission [several issues], DairyNZ [several issues] and statistical data from Eurostat and Statistics Denmark)

of economic development and their farm size—calculated as both land size and number of livestock per farm—it becomes apparent that there is a clear correlation: Farm size and herd size increase with increasing economic development, cf. Fig. 2.6.

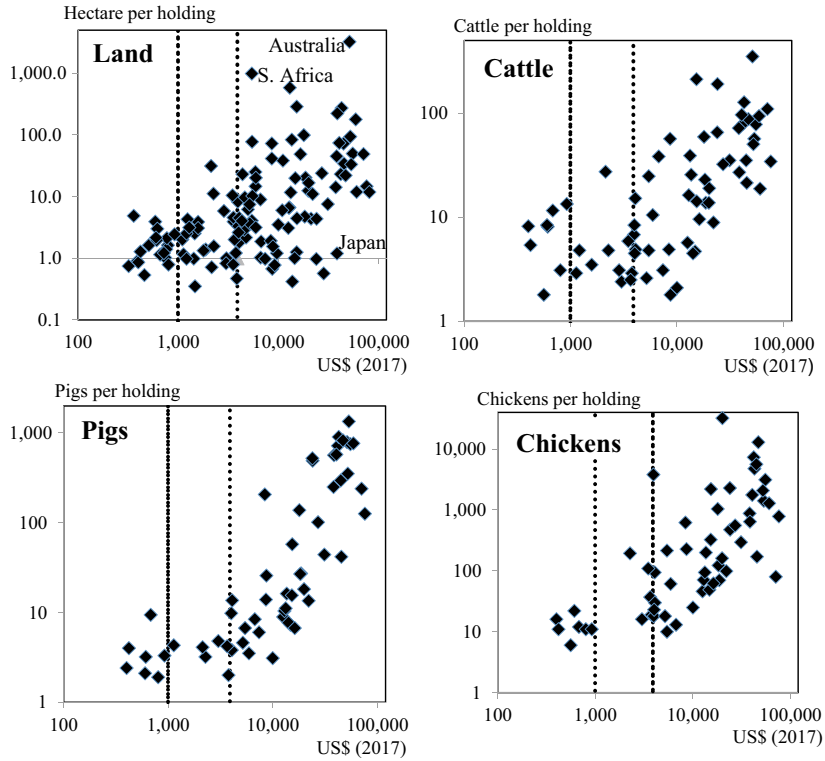


Fig. 2.6 Size of farms and herds and GDI per capita (*Note* Structural data for 2010 or last year with available data. GDI data for 2017. Some countries with deviant positions are indicated. Logarithmic scale on both the X and Y axis. The vertical lines illustrate two levels: "Low-income countries" [<996 USD per capita] and "Lower-Middle-Income countries" [996–3896 USD per capita], cf. definitions by World Bank: *World Development Indicators*. *Source* Own presentation based on statistical data from FAO and World Bank)

Figure 2.6 presents the size of farms and herds as a function of GDP per capita for up to 140 countries. As can be seen, for livestock in particular, there is a clear correlation between the countries' economic welfare (GDI per capita) and herd size. However, a few countries do not follow this pattern, but this is often due to political conditions, which lead to the regulation of structural development.

The figures also demonstrate that the correlation is highest for livestock, and that there seems to be no clear correlation for the lower and lower-middle-income countries. The correlation seems to be lowest for pig holdings in the poorest countries.

Although the analysis is based on cross-sectional data, a dynamic interpretation is possible, and we can assume that the development in each country over time will follow the pattern shown in Fig. 2.6 as the countries become increasingly rich. This dynamic interpretation is supported by the development, in which the size of farms and livestock herds have shown for a long period in the developed countries.

2.4 Developed Countries: Specialization

Specialization in agriculture—and in many other industries—has been increasing in recent years. In this context, specialization occurs on the individual farms, whereby production becomes less mixed and less diversified, so that farmers can focus on one single branch of production.

Increased specialization is due to technological developments that are increasingly creating economies of scale. Furthermore, increasing demand for specialized knowledge means that farmers focus on fewer or perhaps only a single branch of production.

One example is poultry production, which previously took place on almost all farms. With increasing specialization and division of labor, poultry production is now occurring on increasingly fewer farms. The remaining poultry production now takes place on larger often very specialized farms. This development is not an indication that poultry production has lost importance, but rather it is an indication of industrialization and specialization.

The development is visible in many countries. For example, Fig. 2.7 presents the share of farms with poultry in the USA, Sweden and Denmark over a long period.

The constant or even increasing share after 2000 is mainly due to several very small farms with a relatively small number of animals.

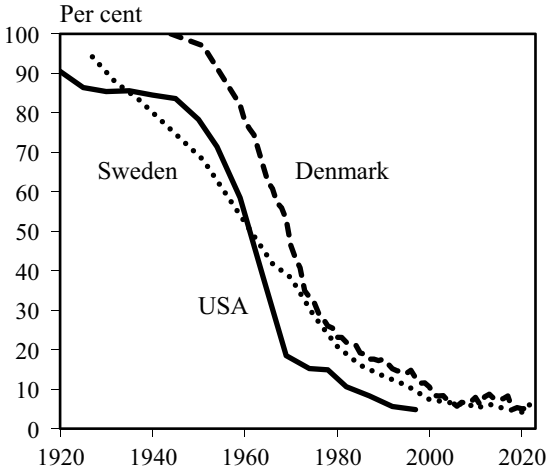


Fig. 2.7 Share of farms with poultry (*Note* USA: With chickens. Denmark: With hens. Sweden: With hens, without chickens. *Sources* Author's own presentation based on USDA [several issues a], Statistics Sweden [several issues] Eurostat [several issues], and statistical data from Eurostat, and Statistics Denmark)

The general trend toward greater specialization and less diversified agriculture depicted in Fig. 2.8 is quite common in the Western world.

Similarly, pig production has become highly specialized with a focus on specific parts of pig production in agriculture. For example, in Denmark, which is among the largest exporters of pork in the world, continuous specialization dominates, whereby full-line farms with both sows and fattening pigs represent an ever decreasing share of the farms, cf. Fig. 2.9.

In a full-line (integrated) system, a pig producer has control over all stages of production from sows to fattening pigs and can fatten all his pigs for slaughter. In contrast, and instead of full-line, other pig producers specialize in the production of either piglets or fattening pigs.

A similar trend can be seen in the USA, where the farrow-to-finish approach is becoming less important, cf. Fig. 2.10.

From 1992 to 2009, the number of US pig producers who used the farrow-to-finish approach, decreased from 50 to 25 percent. In the same period, the number of pig producers specializing in feeder-to-finish increased from 20 to 50 percent.

Focusing on the development in the EU countries, a similar trend can be observed. Furthermore, in the EU, the trend toward greater specialization and less diversified agriculture is evident, cf. Fig. 2.11.

The trend toward increasing specialization is visible in several areas. For example, in Denmark, in 1950, around 90 percent of all holdings

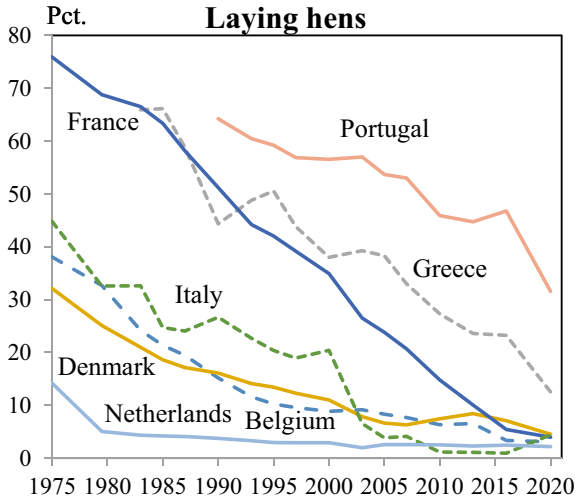


Fig. 2.8 Specialization. Share of farms with laying hens (*Sources* Author's own presentation based on USDA [several issues a], Statistics Sweden [several issues] Eurostat [several issues], and statistical data from Eurostat, and Statistics Denmark)

had diversified production, defined as holdings with both pigs and cows, cf. Fig. 2.12. However, this share has since fallen and in 2021 it was only approx. 2 percent.

This development is driven by significant advantages to be gained from both specialization and economies of scale. At the same time, a well-developed market for inputs has supported the development.

A similar pattern can be seen in other developed countries, although the extent and speed of the development has varied.

Specialization can also be seen in other areas in the USA, where the development, especially in the latter half of the twentieth century, has been significant, cf. Fig. 2.13.

Figure 2.13 illustrates that farm operations have become increasingly specialized and less diversified—from an average of about five commodities per farm in 1900 to about one per farm in 2000. This development reflects the production and marketing advantages that can be gained by concentrating on fewer commodities. The development is also supported

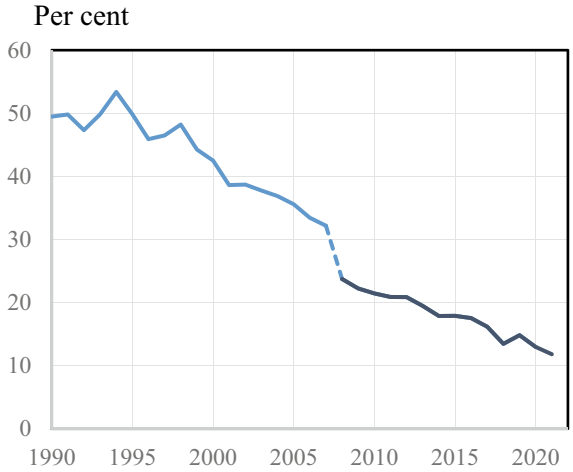


Fig. 2.9 Specialization: Integrated pig farms (farrow-to-finish) as a percentage of the total in Denmark (*Sources* Own calculations based on statistical data from Statistics Denmark)

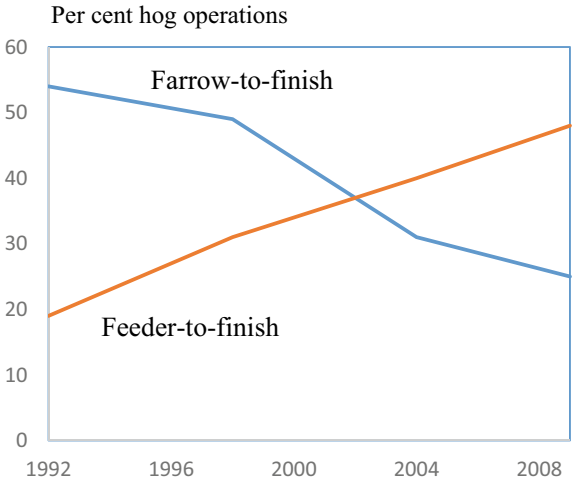


Fig. 2.10 Hog operations by type in the USA, 1992–2009 (*Source* McBride & Key, 2013)

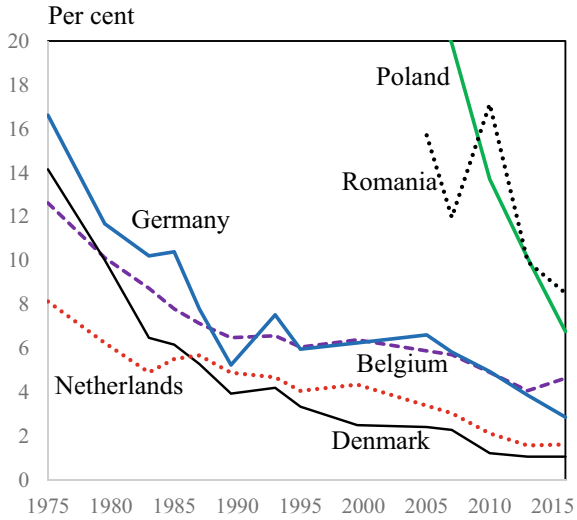


Fig. 2.11 Extent of mixed livestock (percent of total) (*Note* Holdings with mixed livestock [mainly granivores and mainly grazing livestock] as a percent of all holdings with livestock. Eurostat's definitions are used. *Source* Own calculations based on statistical data from Eurostat)

by farm price and income policies that have reduced the risk of depending on the returns from only one or a few crops (USDA, 2005).

2.5 Developing Countries: Number of Farm Holdings

While the trend is very apparent in the EU and other developed countries, when examining structural development from a global perspective, the picture is not so clear. On the one hand, there are countries which exhibit relatively uniform development in the direction of ever fewer farms—a trend that has been in progress since the mid-1900s.

On the other hand, there are the developing countries, where we see the opposite trend, i.e., the emergence of an increasing number of new farms, resulting in an increase in the total number of farms. Demographics, relatively low emigration away from agriculture and very small growth in the agricultural sector are the main explanations as to

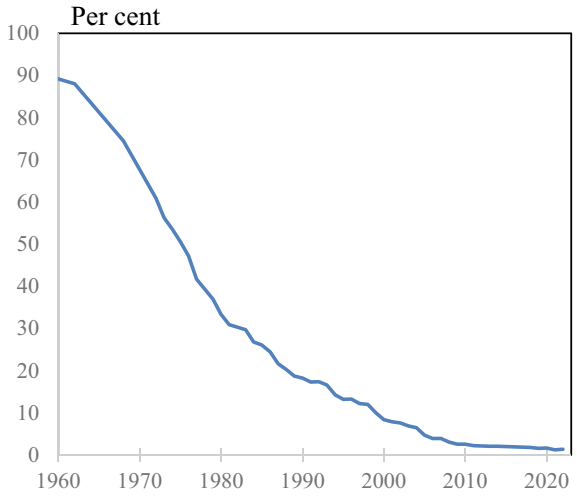


Fig. 2.12 Share of farms with both cattle and pigs in Denmark (*Source* Own calculations based on statistical data from Statistics Denmark)

why structural development is so different in most developing countries compared to developed countries.

For example, major countries such as India, Egypt, Indonesia and the Philippines have experienced a significant increase in the number of farms, see Fig. 2.14.

The figure also includes data for African countries with shorter statistical documentation, although the trends are still relatively consistent.

In general, the trend toward an increasing number of farms can be identified in several developing countries. A very clear international picture can be drawn in which the number of holdings is increasing in the poorer countries, while it is decreasing in the richer countries, see Fig. 2.15.

The figure illustrates that the number of holdings in developing countries is increasing, while it is decreasing in more developed countries. The pattern and correlation can be explained by several factors, which are discussed in the introduction. The emigration of farmers to other sectors in developed countries is a major factor.

Both "push and pull factors" are present: Labor is being pushed out of agriculture due to low wages and because workers are being replaced by

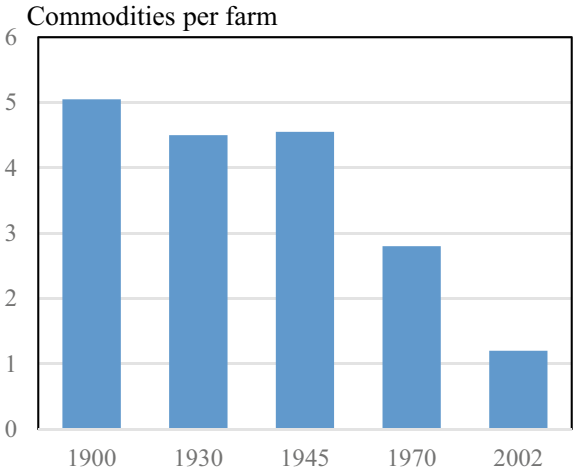


Fig. 2.13 Specialization in agriculture in the USA 1900–2002 (*Note* The average number of commodities per farm is a simple average of the number of farms producing different commodities [corn, sorghum, wheat, oats, barley, rice, soybeans, peanuts, alfalfa, cotton, tobacco, sugar beets, potatoes, cattle, pigs, sheep and chickens] divided by the total number of farms. *Source* USDA, 2005)

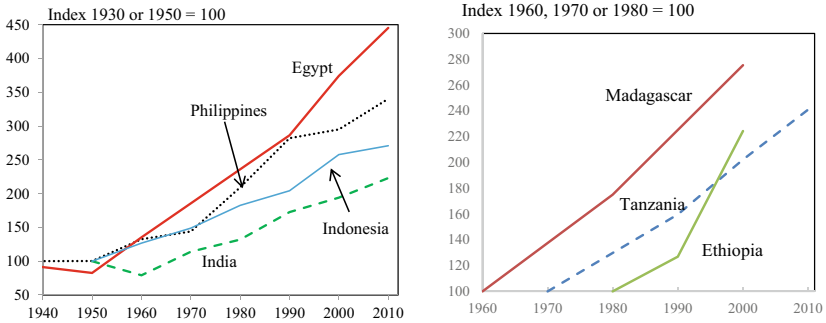


Fig. 2.14 Trends in the number of farms in selected countries (*Source* Own calculations based on statistical data from FAO)

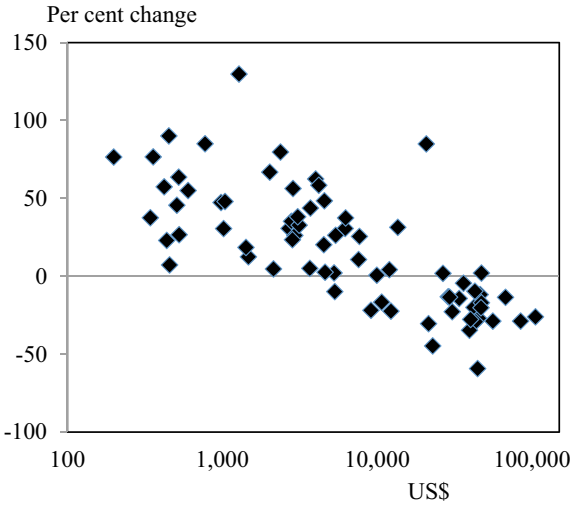


Fig. 2.15 Percent change in number of holdings 1990–2000 and GDP per capita (*Note* Change 1990–2000 or last recent decade with available data. *Source* Author's own presentation based on statistical data from FAO and World Bank)

technology, and labor is being pulled away from agriculture by industries with labor shortages. The utilization of economies of scale and mechanization are also important factors that explain both emigration and structural development toward fewer and larger holdings in the most developed countries.

2.6 Developing Countries: Size of Farm Holdings

The general increase in the number of holdings in developing countries is also affecting the structure of agriculture including the size of the agricultural holdings. On the whole, a correlation between the size of farm holdings and the countries' level of economic development is also apparent in developing countries: In the poorest countries, the holdings are small, and they are generally becoming smaller over time.

At the global level, there is a clear trend toward an increasing number of farmers and others who are economically active in agriculture. As the total amount of agricultural land is only increasing slightly, the agricultural land per farmer is decreasing.

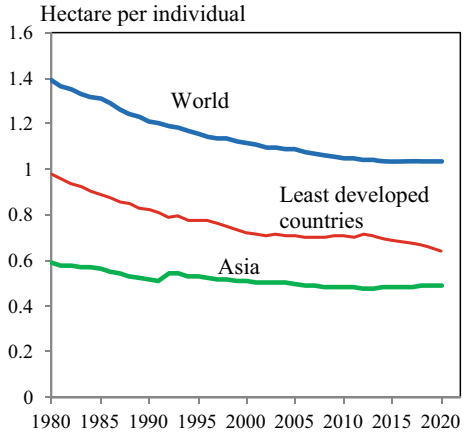


Fig. 2.16 Farm structure: Arable land per economically active individual in agriculture (*Source* Author's own presentation based on statistical data from FAO)

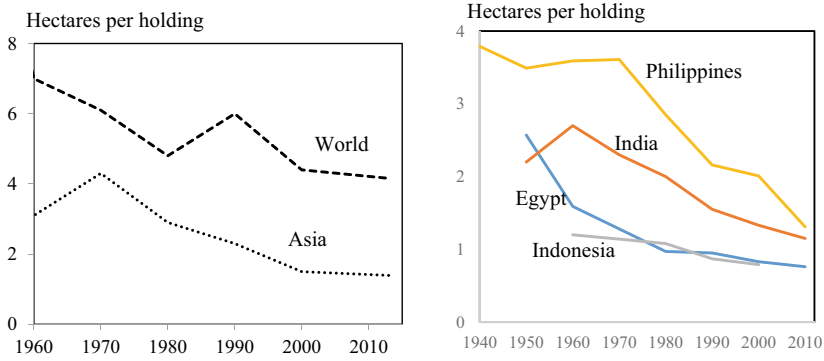


Fig. 2.17 Farm structure: Average number of hectares per holding (*Note* Medians of averages. *Source* Own presentation based on FAO [2013] and other statistical data from FAO)

This trend is particularly pronounced in Asia and in the least developed countries, cf. Fig. 2.16.

Calculating the amount of arable land per economically active individual in agriculture is a method of illustrating farm structure. However, a more detailed analysis, which examines the total area per farm, reveals an almost identical picture: On average, the agricultural holdings are becoming increasingly small in developing countries, see Fig. 2.17.

Figure 2.17. presents the average global trends in farm size, in the world and in Asia. The figures for continents and the world include a selection of countries as data is only available for a limited number of countries. Therefore, the figures for the world and Asia are supplemented by selected countries for which a longer time series is available.

2.7 Concentration

Concentration is also an important aspect of structural development. Concentration is a measure of whether the production, agricultural area, livestock, etc., are distributed relatively equally, or whether, e.g., a relatively small number of farms account for a large share.

Increasing concentration can be illustrated by calculating, e.g., the total output produced by the largest 5 percent or 20 percent of agricultural holdings. If these largest farms are obtaining an increasing share, it is a sign of increasing concentration.

Concentration can also be illustrated by calculating the number of farms needed to produce, e.g., 75 percent of the total production. Concentration at the farm level—or rather inequality—can also be measured using the Gini coefficient, whereby a high coefficient illustrates high inequality and high concentration.

Concentration in agriculture is changing, although no clear unambiguous megatrends can be identified. Significant differences are apparent between countries, branches of production and years. An important explanation is that, in almost all countries, legislation is used to control structural development in agriculture—in many cases to avoid concentration becoming too high. From a political perspective, allowing just a few individuals or companies to own a substantial share of the agricultural land is undesirable. Such restrictions on the size or growth of other businesses have not been applied unless there was a risk of reduced competition on the market or even the formation of a monopoly.

The consequences of such restrictions are that the economic and technological driving forces behind increasing concentration (including especially economies of scale) are limited or restricted.

The global picture in terms of concentration in the agricultural sector has many dimensions and exhibits a widespread. The largest 5 percent of holdings account for as little as 8 percent (Republic of Korea) and as high as 89 percent (Barbados) of the total agricultural area. Therefore,

Fig. 2.18 illustrates concentration in agriculture for approx. 60 countries ranked by the countries' income per capita.

The countries with the lowest concentration are Finland (12 percent), Luxemburg (14 percent), Switzerland (16 percent), Norway (17 percent) and Denmark (22 percent). The Nordic region is thus characterized by a very even and non-concentrated agricultural structure.

With regard to the global picture, Europe—together with Asia and Africa—is characterized by low concentration, while South America, in particular, has a highly concentrated agricultural structure. Important countries with very high concentration in South America include Peru, Paraguay and Venezuela.

There is not necessarily any direct causality between the level of economic development (income) and concentration in agriculture. Instead, while the two processes can be considered to be parallel, they are more or less independent of each other.

In countries with a very significant agricultural sector, the distribution of wealth in society also depends on the level of concentration in agriculture. If a very small proportion of the population owns a large share of

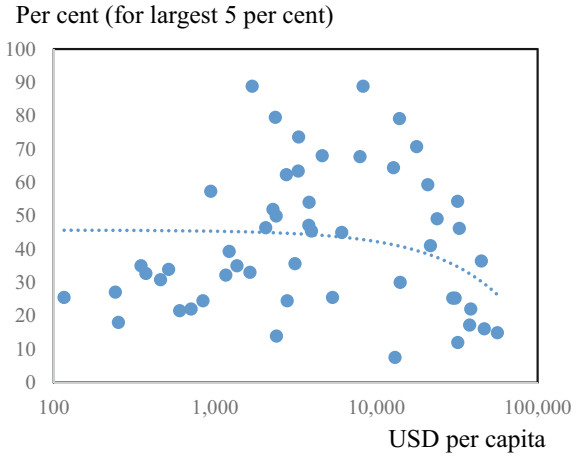


Fig. 2.18 Concentration in agriculture and countries' income per capita (*Note* The largest 5 percent of farms' share of the total agricultural area. Trend line included. *Source* Own presentation based on FAO [2001] and statistical data from World Bank)

the agricultural land, they will also account for a significant share of the country's total wealth. As can be seen in Fig. 2.19, there is a significant correlation between concentration in society as a whole and in agriculture.

It should be noted that the Gini coefficients for agriculture are based on the distribution of agricultural land among farms, while the Gini coefficients for society as a whole are based on income, or in some cases, consumption. Despite these methodological differences, the correlation is strikingly high. The conclusion is that concentration in agriculture can probably be explained by conditions both internal and external to the agricultural sector.

Calculating the change in concentration at the global level or for larger regions is challenging as the data must be rather consistent and comparable between countries and over time. However, data for the USA and for the EU countries make it possible to show longer-term trends.

Figure 2.20 presents the percentage of farms required to produce 75 percent of the market value of agricultural products in 1987–2017. In general, the share has exhibited a downward trend since 1987, which

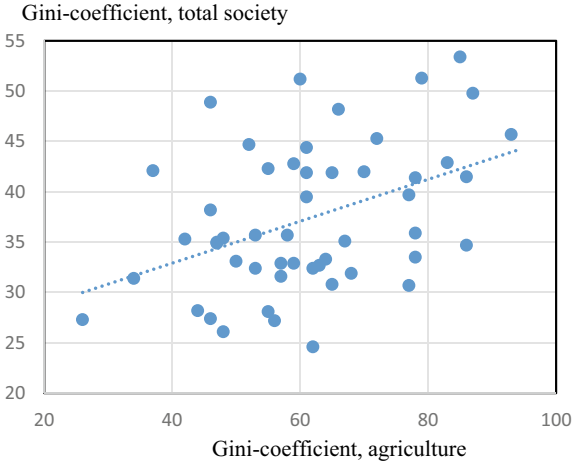


Fig. 2.19 Concentration in agriculture and in society as a whole: Distribution of agricultural land and income of the whole society (*Note* Gini coefficient for agriculture: Distribution of agricultural land between farmers. Gini coefficient for society: Distribution of income among all inhabitants. *Source* Own presentation based on [FAO, 2001] and statistical data from World Bank)

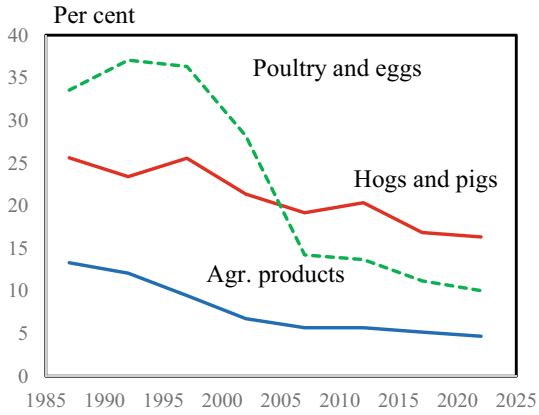


Fig. 2.20 USA: Fewest number of farms accounting for 75 percent of sales (*Note* 1987–1997: Poultry and poultry products. 2002–2017: Poultry and eggs. *Source* Own presentation based on USDA [several issues b])

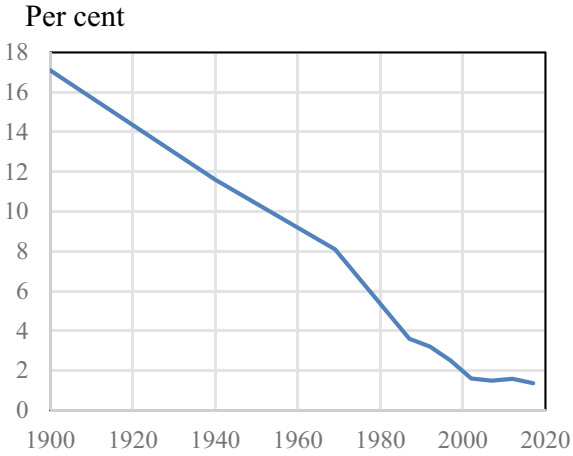


Fig. 2.21 USA: Fewest number of farms accounting for 50 percent of sales (*Note* Data for the years: 1900, 1940, 1969, 1987, 1992, 1997, 2002, 2007, 2012 and 2017. *Sources* Peterson and Brooks [1993], USDA [several issues a], USDA [several issues b])

means increasing concentration. In 1987, 13 percent of farms produced 75 percent of sales, but the share had decreased to 5 percent by 2017.

Figure 2.21 shows the very long-term change in concentration in agriculture in the USA.

In the EU countries, the change in concentration is more varied, which is due to several factors including differences between the countries' legislation and the transition from a planned to a market economy. However, there is a clear pattern toward greater concentration (inequality), although this trend is the least pronounced in the economically most developed countries, cf. Fig. 2.22.

The conclusion is that concentration in agriculture is changing, although no clear unambiguous megatrends can be identified. In the USA, concentration is increasing substantially. Economic development (income) and concentration in agriculture seem to be negatively correlated in some groups of countries. Concentration in agriculture in a country can probably be explained by conditions both internal and external to the agricultural sector.

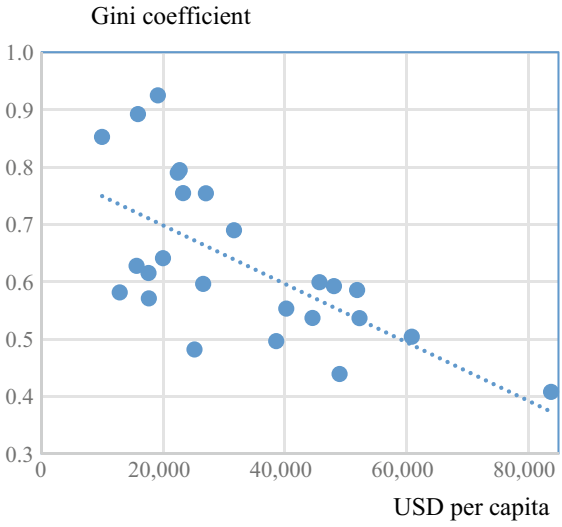


Fig. 2.22 Concentration in agriculture in the EU (2016) (*Note* Concentration measured by Gini coefficient for the distribution of the agricultural area. *Source* Own calculations based on statistical data from Eurostat and World Bank)

2.8 Polarization

There is a general global trend toward increasing polarization in agriculture. In this context, polarization means greater differences between groups of farmers. The polarization can cause extreme political groups of farmers to emerge.

Polarization may take the following forms:

- Full-time/part-time farming
- Family owned/investor owned
- Subsistence/market-based agriculture
- Large/small holdings
- Diversified/specialized agriculture
- Organic/conventional agriculture
- Small scale/large scale
- Local markets/international markets
- Short/long value chains
- Hobby agriculture/commercial and industrial agriculture

Several of the listed polarization trends are analyzed in more detail in subsequent sections of this chapter.

Polarization is not only the result of—or part of—increasing concentration, whereby relatively few large farms account for an increasing share of production. It is also the result of different business models, goals, production systems and greater heterogeneity.

While the relative extent and the form of polarization may vary, Fig. 2.23 is an illustration of the different types of polarized agriculture.

The degree of polarization varies between countries and often depends on the countries' level of economic development. Whereas Fig. 2.23 presents idealized polar opposites, in reality of course, many farmers and farms will occupy intermediary positions on the continuum, which is not necessarily static as some farmers may be, e.g., in the process of transitioning to a different form of agriculture.

On the one hand, there is a relatively small number of very large farms which are run as commercial ventures and which account for more than 80 percent of production. On the other hand, there is a large number of smaller farms which may be in the process of being closed and which are dependent on external income, and cannot be described as commercial farming. The differences between the two groups are increasing.

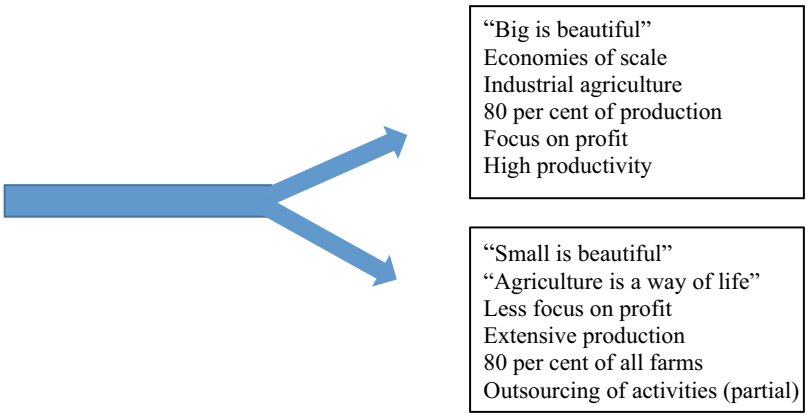


Fig. 2.23 Illustration of increasing polarization in agriculture (*Source* Own presentation)

With increasing polarization, groups of farmers may have particular preferences and interests, which may create tension between farmers in the same country. Farmers in one country may decide to collaborate with groups of farmers with similar interests in other countries.

Polarization between small family-based and, to a certain extent, self-sufficient and subsistence agriculture and large, often company-owned, industrial agriculture is often observed in livestock production. Such a phenomenon occurs in, e.g., transition countries, where large industrial pig and poultry farms—largely run and owned by processing companies and foreign investors—account for a very large share of the country's total production. Parallel to this, there are a large number of very small farms.

Figure 2.24 illustrates an example of such polarization.

The figure shows that 87 percent of all pig holdings have 1–2 pigs, and they produce 34 percent of all pigs. However, only a few very large holdings—0.01 percent or 110 holdings—produce 45 percent of all pigs. The middle group, which consists of medium-sized pig farms, is almost non-existent in terms of the number of farms and the number of pigs.

Another example of the reduction in the size of the middle group is provided in Fig. 2.25, which illustrates the change in the number of very small, medium and large holdings in Denmark from 1982 to 2020.

The figure shows the share of holdings in relation to their size, measured in hectares per holding. As can be seen, the very small and the

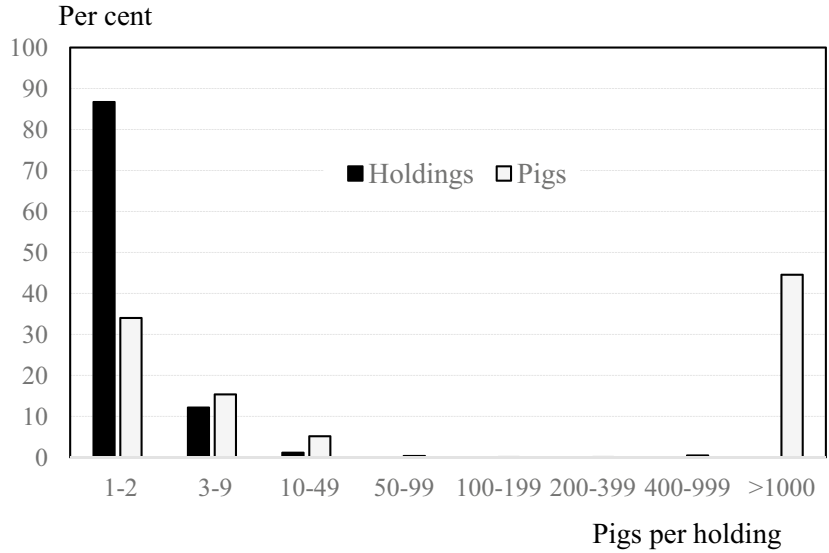


Fig. 2.24 Structure of pig farms in Romania (2016) (*Source* Statistical data from Eurostat)

very large holdings account for a relatively large share of the total number of holdings, and the share is increasing, while the share of medium-sized holdings is decreasing. The large farms are becoming even larger, while the middle group is coming under pressure and the very small hobby and part-time farms are continuing and are almost unaffected by the development. While these very small farms are increasing in number, their relative importance in terms of production and employment is decreasing.

A similar development is occurring in the USA, where the middle group is also becoming smaller, while the market share of the large holdings is increasing and the small holdings are maintaining the status quo, cf. Fig. 2.26.

Polarization is also apparent in the division between full-time and part-time agriculture. These two forms of farming may be based on completely different business models. A clear trend toward an increasing number of part-time farms can be seen in several countries, cf. Fig. 2.27.

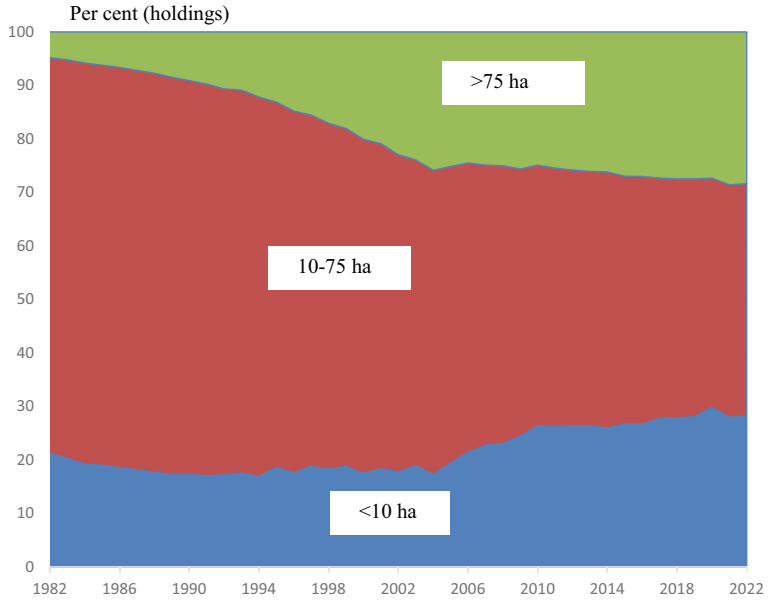


Fig. 2.25 Change in the number of very small, medium and large holdings in Denmark 1982–2022 (*Source* Own calculations based on statistical data from Statistics Denmark)

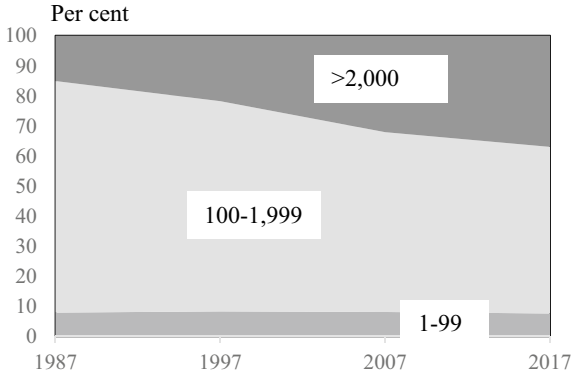


Fig. 2.26 Change in the number of very small, medium and large holdings (acre) in the USA 1987–2017 (*Source* Own presentation based on MacDonald [2020])

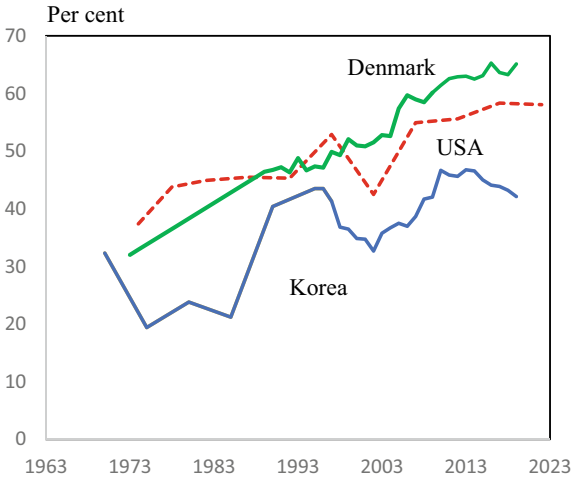


Fig. 2.27 Part-time farming in the USA, Korea and Denmark (USA: Principal operator by primary occupation: Other. Denmark: Full-time means at least 1665 hours of work on the farm per year. *Source* USDA [several issues b], OECD [1999] and statistical data from Statistics Denmark)

The definition of part-time farming varies between countries and also over time. Nevertheless, the figure illustrates a fairly clear trend for the three countries.

The trend toward increasing polarization is not just random because a number of underlying driving forces which can explain the development can be identified.

On the one hand, excess labor is occurring in agriculture due to technological development. At the same time, higher salaries and better working conditions in other industries are attracting labor away from agriculture, which means there are both push and pull effects.

On the other hand, labor is often locked in agriculture. Labor is a fixed asset which, to a large extent, is very specific and has a low alternative value in other businesses. Therefore, agricultural labor is not particularly mobile and is relatively difficult to move out of the sector. In addition, for many, farming is not just a profession, but also a home, a network and sometimes also an asset. The countryside and rural culture can also contribute to maintaining the rural population and reducing emigration.

These two opposing driving forces create excess labor in agriculture, on the one hand, but at the same time, create conditions that mean that labor tends to remain in agriculture, which results in the emergence of hobby and part-time farming.

Polarization is likely to continue as objectives for international competitiveness, on the one hand, and rural development and multifunctionality, on the other, must be addressed. Polarization is thus necessary to meet the very different agricultural policy goals at the same time.

When widely different agricultural policy goals must be met (cf. Sect. 6.2), it is difficult to consider the agricultural sector as one industry. It may be necessary—and useful and appropriate—to introduce specific agricultural policy initiatives that target particular types of agriculture. Some types of agriculture will be most appropriate for developing rural areas and biodiversity, while others will be most suitable in terms of agricultural production and employment. In this way, agricultural policy can contribute to a more heterogeneous and polarized agriculture.

2.9 Transnational Land Acquisitions, Foreignization or Land Grabbing

Agricultural land is becoming an increasingly scarce resource (Sect. 9.2), which means there is growing interest in buying and investing in it. Therefore, the phenomenon of "Transnational land acquisitions", otherwise known as "Foreignization" or "Land grabbing", is now higher up on the agenda. There are several definitions of the concept including:

> Transnational land acquisitions refer to the procedure of acquiring land (and freshwater) resources in foreign countries. It is often called 'land grabbing'. Most commonly, investors or investing countries are located in the developed world, while the 'grabbed' land is usually in developing countries. (EEA, 2016)

> "Land grabbing" is generally understood to mean a process of large-scale acquisition of agricultural land without consulting the local population beforehand or obtaining its consent. Ultimately, this diminishes the scope of the local population to manage a farm independently and to produce food. The owner also has the right to use the resources (land, water, forest) and the profits arising from their use. This can lead to a situation in which

established agricultural land use is abandoned in favour of other activities. (EESC, 2015)

Land grabbing may involve both direct acquisitions and leases/concessions. In Africa, it almost exclusively involves leases or concessions, while direct acquisition is more prevalent in the Americas. In Eastern Europe, both forms are common. Concessions primarily concern forestry but also mining.

Transnational land acquisitions in developing countries have increased. The following drivers explain this development:

- The financial crisis created greater interest in investments in stable less volatile assets with no or very little downside.
- The food crisis in 2007–2008 and the higher prices of a number of agricultural commodities made investments in agricultural land more attractive.
- The potential for growth in agriculture in many industrialized countries has been limited by increasing environmental legislation, which has resulted in more land being taken out of production for the benefit of nature and limited the supply of agricultural land, etc., which has stimulated interest in investing in agricultural land in less developed countries.
- Improved logistics and global value chains have also supported this development. European investments in, e.g., the flower industry in Africa have demanded an efficient transport route for the flowers back to the markets in Europe.
- Increasing prices for agricultural land in many developed countries have also made investment in agricultural land in less developed countries more attractive.
- In line with the rising share prices worldwide after the financial crisis, investors have " been increasingly demandingalternative investments", i.e., investments in assets other than listed shares and bonds. Forests and agricultural land belong to this group of investments.
- A need to broaden the spread of the portfolio—diversification—geographically has also made the acquisition of land in less developed countries more attractive.

- Liberalization of the capital markets including opportunities to acquire agricultural land and assets abroad has also supported the development.
- A focus on food security and global value chains has been an important driver for countries with a major net import of food. China and countries in the Middle East have invested heavily in the agricultural sector in, e.g., Africa in order to secure future food supplies, cf., for example, Walsh (2018). Food-importing countries can no longer rely on sourcing food on the market and are, therefore, attempting to gain more direct control of their food supply.
- With increasing interest in bioenergy and biodiesel, investing in palm oil plantations is also becoming more attractive. In Asia, the palm oil sector is the primary target of investments (Lay et al., 2021).

Transnational land acquisitions have both advantages and disadvantages: On the one hand, foreign investments may lead to the transfer of technology, efficiency, modernization, employment and a number of other direct or indirect benefits. On the other hand, transnational land acquisitions may also result in the uncontrolled use of resources to the detriment of the local population as the potential for securing a local food supply is often reduced.

The extent of foreign investment in agricultural land is often difficult to calculate. The acquisitions are not always registered, and intermediate forms also exist such as shared ownership or long-term leases, which are similar to acquisitions.

However, the following sources suggest that foreign investment in agricultural land has occurred to a significant extent:

- According to von Braun and Meinzen-Dick (2009), large-scale land deals accounted for 20 million hectares between 2005 and 2009.
- According to Zagema (2011), the total was 227 million hectares in 2000–2010.
- According to Müller et al. (2021), foreign investors have acquired approximately 90 million hectares of land for agriculture during the past two decades.

As can be seen, the estimations of the total amount of land vary widely. However, another source exists in the form of the Land Matrix Initiative

(LMI), which is an independent global land monitoring initiative that continuously collects data on and documents transnational land acquisitions in low- and middle-income countries with a focus on transnational deals in the agricultural sector.

Figure 2.28 presents an estimate of the longer-term extent of transnational land acquisitions in the form of both the purchase and lease of agricultural land.

The 10 most important target countries according to contract size are, in descending order, Indonesia, Ukraine, Russia, Brazil, Papua New Guinea, Argentina, the Philippines, Ethiopia, Myanmar, and South Sudan. The investors come primarily from the EU, the USA, China and India (Lay et al., 2021).

As can be seen in the figure, there was a substantial increase up to and including 2012 followed by a period of stagnation and then a more gradual increase. This can probably be explained by changes in both supply and demand: several countries have introduced restrictions on the foreign acquisition of agricultural land, which has limited the supply.

According to Toulemonde (2021), during the last 20 years, upward of 35 million hectares of land in Africa have been sold to foreign investors, which corresponds to 14 percent of Africa's total arable land.

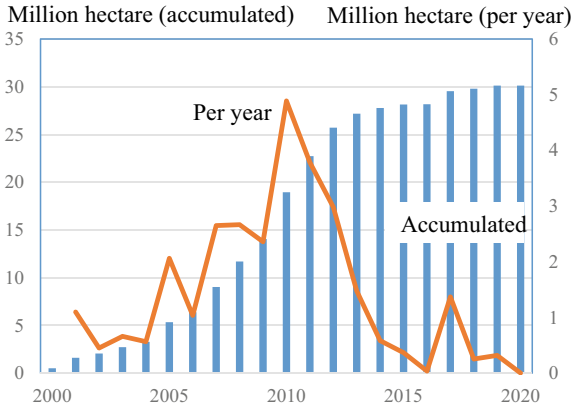


Fig. 2.28 Concluded agricultural deals, 2000–2020 (*Note* The survey only covers large-scale international [cross-border] agreements. *Source* Lay et al., 2021)

The development during the past few decades has caused concern in several places, cf. Baker-Smith and Attila (2016), Lay et al. (2021), UNCTAD (2021), von Braun and Meinzen-Dick (2009), World Bank (2018).

Figure 2.28 raises the question of whether this development is a blip or part of a long-term trend. The answer depends on how the underlying drivers will develop.

On the one hand, continued significant differences in productivity between agriculture in developed countries and less developed countries will make investments in agriculture in developed countries attractive to investors. Technology can be transferred and exploited. At the same time, the market for agricultural land in developed countries will also be under pressure: The agricultural area is not expanding and demand is high, which may shift the focus to less developed countries. Major net food importing countries will continue to attempt to increase their access to food through, among others, making investments in countries that can potentially supply food.

On the other hand, the pressure on the market for agricultural land is stronger in most less developed countries: the population is increasing (e.g., Africa's population is expected to double by 2060) and incomes are rising, both of which will increase demand for food and thereby demand for agricultural land. The agricultural land area per capita is much smaller in less developed countries than it is in developed countries, so agricultural land is an even more scarce resource in the former. Finally, biofuels produced on large plantations in less developed countries but owned by foreign investors are unlikely to increase significantly in the future for political and regulatory reasons.

Transnational land acquisitions will probably continue, but future growth will be modest compared to the previous situation.

2.10 Ownership

Forms of ownership in agriculture are also changing, and megatrends can also be identified here. These changes are a natural consequence of the structural development toward ever larger and more industrialized farms: Family ownership is coming under pressure due to the increase in farm size as it is becoming increasingly difficult for individuals to gain access to sufficient capital and financing—by acquisition and during subsequent production and operation.

The change in forms of ownership including self-ownership has not been well documented statistically at the international level, which is probably because the concept of forms of ownership has not been clearly defined and insufficient information has been collected in the individual countries. Concepts such as "family farm", "leased" and "partnership" may apply to the same company. In addition, information about the real owners (the owners behind the companies) is not available in all cases.

However, studies and statistics do exist which can be used to provide an overview of the different forms of ownership in agriculture.

Lowder et al. (2014) map forms of ownership and structures in agriculture based on data from the FAO. However, the data is uncertain as it, e.g., may be difficult to distinguish between agricultural holdings and subsistence farming. In the study, the conclusion is, among other things, that there are more than 570 million agricultural farms in the world, of which more than 500 million are family owned.

Data from 52 countries reveal that in 48 of the countries, more than 90 percent of holdings are owned by an individual, a group of individuals or a household. In the remaining four countries, between 80 and 90 percent of the farms are owned by households or individuals with only a very small proportion being owned by a company, a cooperative or by the state. In terms of agricultural land, the share owned by households or individuals is lower (on average around 70 percent) in most countries.

Data presented by Lowder et al. (2014) indicate that the extent of family ownership does not appear to be correlated with a country's level of economic development, and no trends can be identified.

In the USA, the USDA (several issues b) monitors any changes in the number of farms, their size, form of ownership, structure, etc. Selected time series for significant forms of ownership are presented in Fig. 2.29.

As the figure shows, corporate ownership increased in importance in the period. Conversely, the extent of individual and family ownership decreased.

In general, the share of family and individual farms is decreasing, but the extent of the decrease depends on how it is calculated: While the share of holdings is almost constant, the share of land and sales including the sale of pigs is falling considerably. In terms of pig production, family and individual farms' share halved during the period, cf. Fig. 2.30.

As can be seen, corporate-owned farms are relatively large in terms of both area and production, although family and individual farms are still important forms of ownership in terms of the number of farms. The

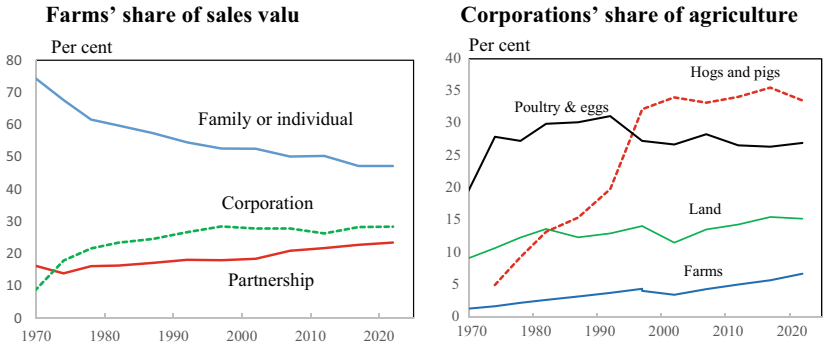


Fig. 2.29 Ownership in US Agriculture (*Source* Own presentation based on USDA [several issues b])

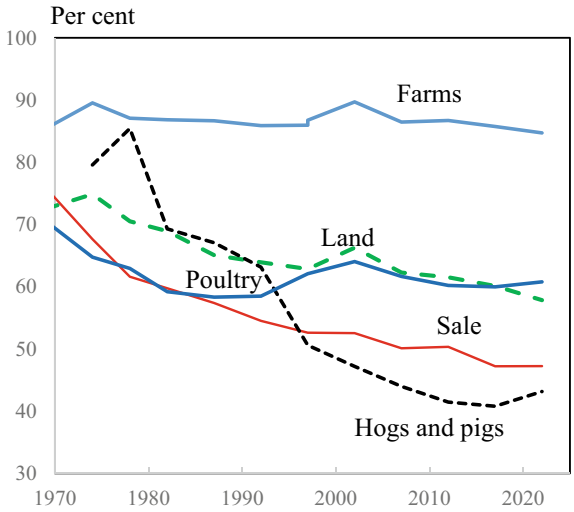


Fig. 2.30 Family and individual farms' share of the total in the USA (*Source* Own presentation based on USDA [several issues b])

market shares of the remaining forms of ownership including partnerships remained rather constant during the period.

The conclusion of an analysis by Zhang et al. (2018) of agriculture in the State of Iowa, USA is that there has been a continuous shift away from family ownership and tenancy toward more industrialized ownership structures such as trusts and corporate ownership. Therefore, the proportion of agricultural land in family ownership or tenancy halved from 80 percent in 1982 to approximately 40 percent in 2017.

A survey of agriculture in the EU in 2020 found that almost 95 percent of all agricultural holdings were classed as family farms, defined as farms on which 50 percent or more of the regular agricultural labor force is provided by family members (Eurostat, 2022). Family farms were the dominant farm type in all member states, although in France, a sizeable minority was non-family farms (43 percent).

Another statistical calculation by Eurostat for 2016 found only slight changes in forms of ownership over time. The share of agriculture which the EU defines as family farming only fell from 97 to 96 percent, cf. Eurostat (2018). However, the share of family-owned farms and agricultural land exhibits a long-term downward trend, cf. Fig. 2.31.

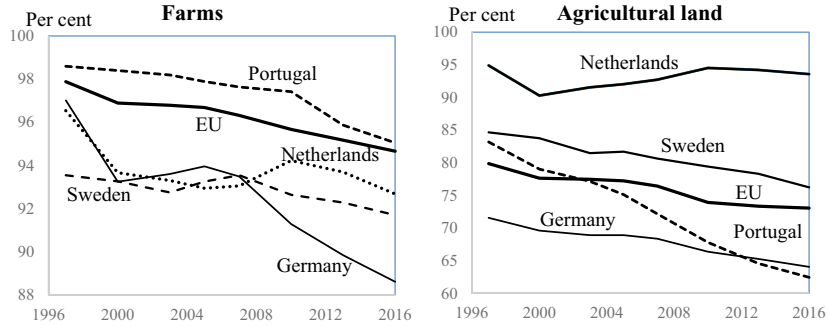


Fig. 2.31 Share of family ownership of agricultural farms and land 1997–2016 (*Notes* Family ownership = "Single holder holding" or "holder's being a natural person". The EU is a weighted average of countries with data for the entire period: Belgium, Denmark, Germany, Ireland, Greece, Spain, Luxembourg, Netherlands, Austria, Portugal, Sweden and Finland. *Source* Own presentation based on statistical data from Eurostat)

The figures show that the share of family-owned farms is greater than the share of family-owned agricultural land and that family-owned agriculture is, on average, much smaller than the other farms, which are typically owned by corporations.

The importance of family-owned farms vs. company-owned farms in the EU varies significantly depending on several factors: company-owned farms are significantly larger in terms of total area and livestock intensity. Family ownership is the dominant form of ownership for small and medium-sized farms, while company ownership is dominant when it comes to farms with a large area, cf. Fig. 2.32.

In line with the trend toward increasingly large and intensive livestock farming, corporative ownership of large livestock farms has also increased. Fig. 2.33 shows that traditional family-owned farms are declining in importance with increasing herd size in pig production.

About half of the large specialized pig farms are family owned, while the remainder are company owned. Assuming that the company-owned

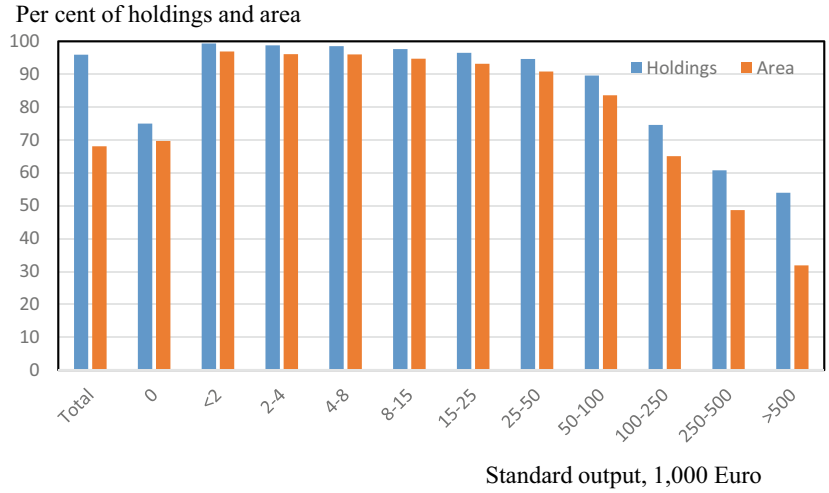


Fig. 2.32 Share of family-owned holdings in the EU as a share of all holdings depending on the size (standard output) of the holdings (2016) (*Note* Family-owned holdings are defined here as those that are run by a single owner or their spouse or other family member. *Source* Own calculations based on statistical data from Eurostat)

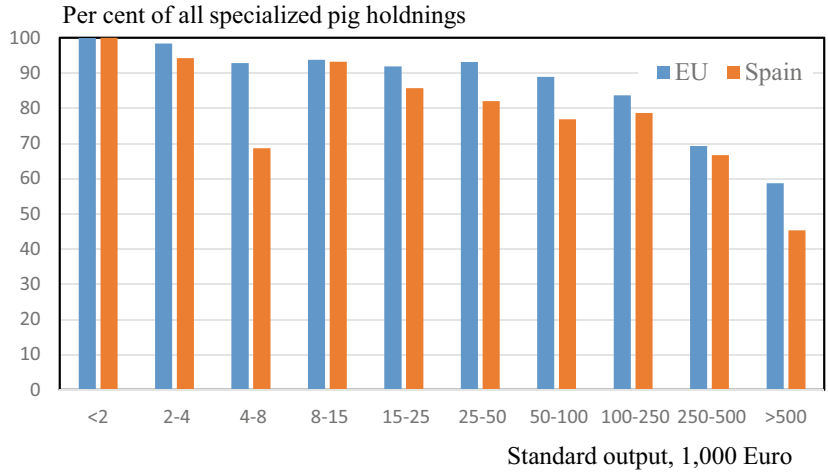


Fig. 2.33 Share of family-owned specialized pig holdings in the EU as a share of all specialized pig holdings depending on the size (standard output) of the holdings (2016) (*Note* Family-owned holdings are defined here as those that are run by a single owner or their spouse or other family member. *Source* Own calculations based on statistical data from Eurostat)

farms are among the very largest, an even larger share of the pig population will come from company-owned farms in line with the continuous structural development and utilization of economies of scale.

2.11 From Subsistence Farming to Market-Based Farms

As a result of economic development, industrialization and increasing economic welfare, the focus of agriculture changes from self-sufficiency to a market orientation, which involves a transformation from subsistence agriculture to commercial, or market-based, agriculture. The trend is rather clear.

Subsistence agriculture is self-sufficient agriculture, whereby the farmers only produce enough food to feed their own families and possibly the local area. Subsistence agriculture thus differs from commercial agriculture (industrial agriculture, market-based agriculture) in that, in the latter, all or most of the production is sold on a market.

In subsistence farming, the needs of the family and not market prices determine what the farmer produces on the farm.

Subsistence agriculture is not clearly defined and the term semi-subsistence agriculture is also used. Different degrees of subsistence farming occur when a part of the production is sold to local people.

Subsistence agriculture in its various forms is very important in global agriculture: Subsistence agriculture is most widespread in sub-Saharan Africa, Southeast Asia and in parts of South and Central America. In East Africa, subsistence agriculture accounts for between 70 and 90 percent of total production (European Parliament, 2007).

In 2013, on almost 75 percent of the very small farms in the EU, more than half of the production was consumed on the farm. 43 percent of the very small farms were considered subsistence farming. A very large proportion of the very small farms in Latvia, Romania and Slovenia were considered subsistence farming (Eurostat, 2016). In this context, very small farms are those with a standard production of < €2000, of which there are approx. 4.2 million in the EU, which corresponds to almost 40 percent of all farms. Therefore, calculated in terms of the total number of farms and people involved, subsistence agriculture is relatively important, but in terms of production and turnover, the importance is relatively limited.

Small farms, which in a development perspective are often synonymous with subsistence agriculture, account for 80 percent of total food production in developing countries (Gustavsson et al., 2011). At the same time, they account for approx. 2/3 of the world's rural population of just over 3 billion people, the majority of whom live in absolute poverty, and they comprise half of the world's undernourished population (Fan et al., 2013). According to von Braun and Lohlein (2003), around 440 million farmers in developing countries still practice subsistence agriculture to a significant extent.

In general, subsistence agriculture is declining in terms of its relative importance while market-oriented agriculture is becoming increasingly important. The potential for a transformation from subsistence agriculture to market-oriented agriculture is closely related to economic development and agricultural structural development: Low income, small farms, weak industrial development and subsistence agriculture are often linked. Several factors may explain the extent of subsistence agriculture, but examples indicate that there is a correlation between the level of economic development and the importance of subsistence agriculture, cf. Fig. 2.34.

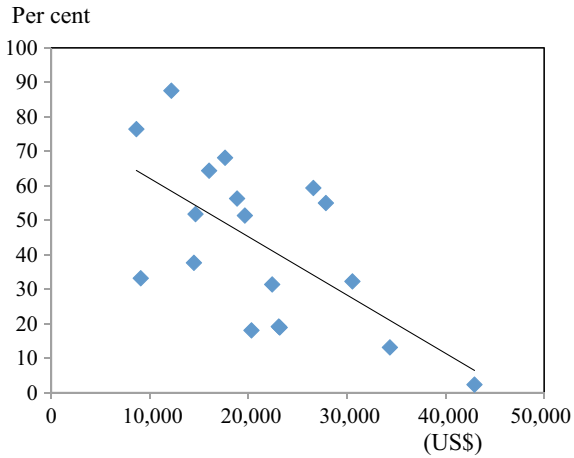


Fig. 2.34 EU: Share of all farms where more than half of the production is for self-sufficiency—as a function of GDP per capita (*Note* 2013 or latest year with available data. *Source* Own calculations based on statistical data from Eurostat and World Bank)

The graph only includes EU countries for which the share (percentage of all farms on which more than half of the production is for own consumption) > 0. This means that countries that do not report production for their own consumption are not included. However, the countries that are not included are typically high-income countries, which strengthens the correlation.

The figure confirms that subsistence farming is most important in countries with relatively low-income per capita and that the share decreases with increasing income.

When examining the development over time in the EU, a relatively clear trend toward the declining importance of subsistence agriculture emerges, cf. Fig. 2.35.

The figure shows that the share of farms with significant (>50%) production for self-sufficiency fell in the period 2005–2016.

Figures 2.34 and 2.35 highlight the importance of subsistence agriculture in agriculture as a whole. However, its relative importance decreases with increasing farm size, but it remains important among the very small farms. In Greece, which has been through a very tough economic period

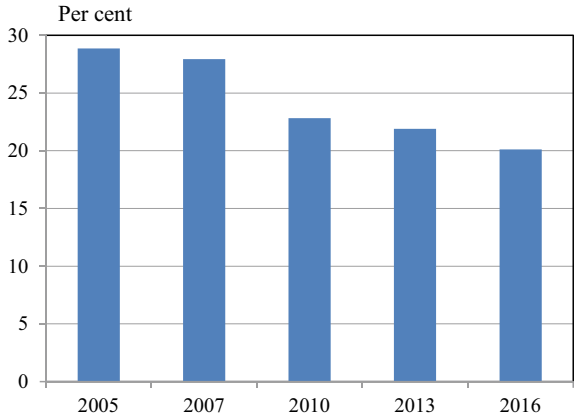


Fig. 2.35 Shares of all EU agriculture where more than half of the production is for self-sufficiency (*Note* GDP-weighted average for EU countries where the proportion > 0. This means that countries that do not report production that is consumed on the farm are not included. *Source* Own calculations based on statistical data from Eurostat)

with high unemployment, subsistence farming has been increasing in importance among the very small farms, cf. Fig. 2.36.

The increase in the EU since the 2010s mainly occurred in Italy, Spain and Portugal, where the number of small subsistence farms increased both in percentage and in absolute terms, which is probably a consequence of the particularly deep economic recession that affected these countries. Generally speaking, subsistence agriculture is a possible buffer in recessions, when falling earnings and employment push labor back into agriculture, thereby ensuring people have the very basic necessities.

Von Braun and Meinzen-Dick (2009) calculated that the total number of subsistence farms in Central and Eastern European Countries (CEEC) and in the "New Independent States" (NIS) was approx. 42 million in 1999. The authors also find that the number of subsistence farms per 1,000 inhabitants and as a percent of the total number of farms is correlated with a country's level of economic development, cf. Fig. 2.37.

At the global level, the change from subsistence agriculture to market-based agriculture and industrial agriculture is occurring in several ways. In some cases, the change is supported by government initiatives, while

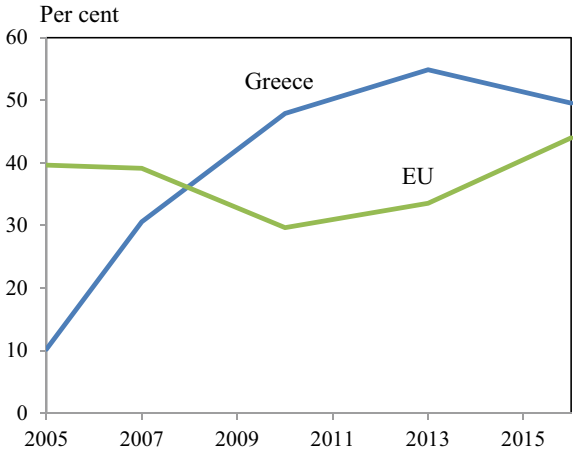


Fig. 2.36 Small farms where the share of consumed production > 50 percent (2005–2016) (*Note* Small farms = < €2000 per year in standard output. GDP-weighted average for EU countries where the proportion > 0. This means that countries that do not report production that is consumed on the farm are not included. *Source* Own calculations based on statistical data from Eurostat and World Bank)

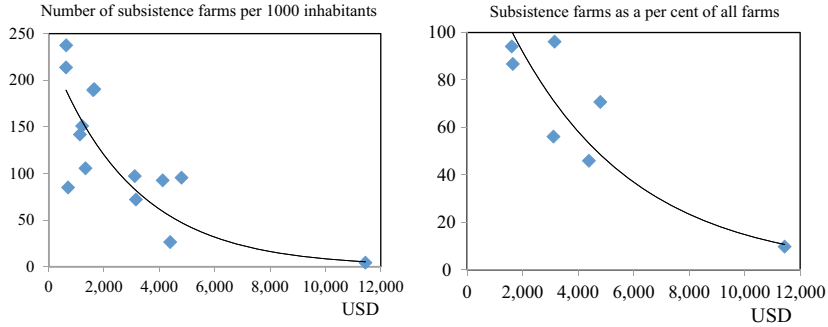


Fig. 2.37 Number of subsistence farms in CEEC and NIS as a function of the countries' GDP per capita (*Note* The authors define subsistence agriculture as farms with < 1 ha. Comparing the total number of farms across countries is uncertain due to different calculation methods. *Source* Own presentation based on FAO [2013], OECD [2000], von Braun and Meinzen-Dick [2009] and statistical data from Eurostat, FAO and World Bank)

in others, the change is occurring automatically in step with the country's industrial development. Finally, in some countries, the change is taking place very slowly because the right conditions are not present or because a change away from subsistence agriculture is undesirable or unfortunate from a political or a food security perspective.

A number of factors or conditions must thus be present—to a greater or lesser degree—in order to enable and facilitate the commercialization and market orientation of agriculture and ensure that a global trend continues:

Infrastructure and Market Access

In order that commercial market-oriented agriculture is viable, it is crucial that there is a market for the goods that the farmers produce. The market may be anything from a local marketplace or a local butcher to a larger cooperative dairy or an international customer. Roads, possibly cold stores, transport facilities, veterinary control, no unnecessary middlemen, etc., may also be prerequisites for the development of commercial agriculture.

Education and Advisory Services

In many cases, large-scale production demands that the farmers acquire new skills as they will have to become business managers.

Supporting Legislation and Judiciary

An increase in market-oriented agriculture implies increasing trade in raw materials, machinery, services, agricultural products, etc. This presupposes the possibility of short- and long-term agreements and contracts and that non-compliance has consequences. Opportunities to buy land and secure ownership through legal documents are also important. Corruption and bribery may also be barriers to the development of market-oriented agriculture.

Access to Capital

Commercial farming and market-oriented agriculture are typically relatively large, and capital is needed to purchase inputs such as seed,

machinery, fertilizer, buildings, animals, etc. Furthermore, it will often be necessary to obtain loans for the acquisition of agricultural holdings and to finance the daily operations.

Political Stability

Business development—which a transformation from subsistence farming to market-oriented farming basically is—involves investment and long-term economic initiatives, and it requires a certain degree of predictability, which means that political stability is an important factor in this context.

Whether a transformation from subsistence farming to market-oriented farming will be a global trend in the future also depends on whether the development is supported and stimulated. Several arguments for and against a move away from subsistence agriculture toward more market-oriented agriculture can be put forward.

The arguments in favor of a move away from subsistence agriculture toward market-oriented agriculture include the following:

- Subsistence agriculture is vulnerable in the event of a poor harvest or poor growth, which reduces the families' primary food base.
- Subsistence agriculture foregoes the potential benefits that could be derived from optimal specialization and division of labor. Subsistence agriculture is typically diverse.
- Subsistence agriculture cannot increase yields or production at the same pace as other forms of agriculture, as access to better varieties, plant protection, commercial fertilizers, etc., is limited.
- Subsistence farming means that there is no significant income from the sale of goods, which makes it difficult to pay for the family's education, health care, etc.
- A large workforce is engaged in subsistence agriculture, which in the short or long term could obtain a higher salary in other sectors.
- The growth in the world's population with 57 percent now living in urban areas necessitates a market-oriented agriculture that can supply the urban population. Subsistence agriculture does not produce enough food to supply the urban population.

The arguments in favor of preserving and supporting subsistence agriculture include the following:

- Families in subsistence farming are not negatively affected by food crises or large increases in food prices.
- Subsistence agriculture retains and utilizes labor that might otherwise be unemployed in the cities.
- Subsistence farming can secure the family's food when family members are hit by unemployment in other sectors and seek to return and work in agriculture. Subsistence agriculture is thus a buffer that can absorb some labor.
- Subsistence farming is diverse and does not depend on the use of pesticides or fertilizers, which can have a beneficial effect on the environment.
- Subsistence agriculture can result in significant yields per hectare using labor as the major input.
- Maintaining subsistence agriculture reduces the risk of agriculture and agricultural land being taken over by external investors in the long term. Subsistence agriculture also protects family-owned agriculture and limits the potential disadvantages (environmental, cultural, animal welfare, etc.) of industrial agriculture.

The conclusion is that a megatrend in the form of a gradual global transformation from subsistence agriculture to commercial and market-based agriculture can be identified. The change is occurring gradually and there are many intermediate forms of agriculture on the continuum with subsistence agriculture at the one end and market-oriented agriculture at the other. Governments and other stakeholders can either encourage or hinder such a development through economic and political interventions.

References

Baker-Smith, K., & Attila, S. (2016). *What is land grabbing? A critical review of existing definitions*. Eco Ruralis. https://www.farmlandgrab.org/uploads/attachment/EcoRuralis_WhatIsLandGrabbing_2016.pdf

EEA. (2016). *Transnational land acquisitions. The European Environment Agency*. Retrieved February 13, 2023, from https://www.eea.europa.eu/data-and-maps/figures/transnational-land-deals-1

EESC. (2015). Opinion of the European Economic and Social Committee on "Land grabbing—A warning for Europe and a threat to family farming". *Journal of the European Union* (C 242/15). https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014IE0926&from=SK

European Commission. (several issues). *The agricultural situation in the European Union*. Office for Official Publications of the European Communities.

European Parliament. (2007). *Strategy for a strengthened partnership with the Pacific Islands: Resolution*. https://www.europarl.europa.eu/doceo/document/TA-6-2007-0022_EN.html?redirect

Eurostat. (2016). *Agriculture, forestry and fishery statistics: 2016 edition*. Publications Office of the European Union. https://doi.org/10.2785/917017

Eurostat. (2018). *Agriculture, forestry and fishery statistics. 2018 edition*. Publications Office of the European Union.https://doi.org/10.2785/340432

Eurostat. (2022). *Farms and farmland in the European Union—Statistics*. Eurostat. https://ec.europa.eu/eurostat/statistics-explained/SEPDF/cache/73319.pdf

Eurostat. (several issues). *Agriculture: Statistical yearbook*. Luxembourg and Bruxelles.

Fan, S., Brzeska, J., Keyzer, M., & Halsema, A. (2013). *From subsistence to profit: Transforming smallholder farms*. International Food Policy Research Institute (IFPRI). https://doi.org/10.2499/9780896295582

FAO. (2001). *Supplement to the Report on the 1990 World Census of Agriculture—International comparison and primary results by country (1986–1995)*. FAO. Food and Agriculture Organization of the United Nations. https://www.fao.org/3/y2816e/y2816e.pdf

FAO. (2013). *2000 world census of agriculture. Analysis and international comparison of the Results (1996–2005)*. Food and Agriculture Organization of the United Nations (FAO). http://www.fao.org/fileadmin/templates/ess/ess_test_folder/World_Census_Agriculture/Publications/WCA_2000/Census13.pdf

Gustavsson, J., Cederberg, C., Sonesson, U., van Otterdijk, R., & Meybeck, A. (2011). *Global food losses and food waste: Extent, causes and prevention*. Food and Agriculture Organization of the United Nations (FAO). Retrieved from https://www.fao.org/3/i2697e/i2697e.pdf

Lay, J., Ward, A., Eckert, S., Flachsbarth, I., Kubitza, C., Nolte, K., & Giger, M. (2021). *Taking stock of the global land rush: Few development benefits, many human and environmental risks*. Bern Open Publishing. https://doi.org/10.48350/156861

Lowder, S. K., Skoet, J., & Singh, S. (2014). *What do we really know about the number and distribution of farms and family farms worldwide? Background paper for The State of Food and Agriculture*. Food and Agriculture Organization of the United Nations (FAO). https://www.fao.org/3/i3729e/i3729e.pdf

MacDonald, J. M. (2020). Tracking the consolidation of U.S. *Agriculture, 42*(3), 361–379. https://doi.org/10.1002/aepp.13056

McBride, W. D., & Key, N. (2013). *U.S. hog production from 1992 to 2009: Technology, restructuring, and productivity growth*. USDA, Economic Research Service. http://www.ers.usda.gov/publications/err-economic-research-report/err158

Müller, M. F., Penny, G., Niles, M. T., Ricciardi, V., Chiardelli, D., Davis, K. F., Dell'Angelo, J., D'Odorico, P., Rosa, L., Rulli, M. C., & Mueller, N. D. (2021). Impact of transnational land acquisitions on local foodsecurity and dietary diversity. *PNAS, 118*(4), e2020535118. https://doi.org/10.1073/pnas.2020535118

OECD. (1999). *Review of agricultural policies in Korea*. Organisation for Economic Co-operation and Development (OECD). https://www.oecd.org/korea/40417830.pdf

OECD. (2000). *Review of agricultural policies. Bulgaria 2000*. OECD.

Peterson, R. N., & Brooks, N. L. (1993). *The changing concentration of U.S. Agricultural production during the 20th century*. U.S. Department of Agriculture, Economic Research Service. https://doi.org/10.22004/ag.econ.309686

Statistics Sweden. (several issues). *Jordbruksstatistisk årsbok* (Yearbook of agricultural statistics). Statistiska Centralbyrån (Statistics Sweden).

Toulemonde, M. (2021). Inside the great African land rush. *The Africa Report*. Retrieved from https://www.theafricareport.com/77291/inside-the-great-african-land-rush/

UNCTAD. (2021). *Trade and development report 2021. From recovery to resilience: The development dimension*. UNCTAD. United Nations Publications. https://unctad.org/system/files/official-document/tdr2021_en.pdf

USDA. (2005). *The 20th century transformation of U.S. Agriculture and Farm Policy*. United States Department of Agriculture, Economic Research Service. Retrieved November 11, 2023, from, https://www.ers.usda.gov/webdocs/publications/44197/13566_eib3_1_.pdf

USDA. (several issues a). *Agricultural statistics*. United States Department of Agriculture, National Agricultural Statistics Service. Retrieved from https://usda.library.cornell.edu/concern/publications/j3860694x?locale=en&page=9#release-items

USDA. (several issues b). *Census of Agriculture*. United States Department of Agriculture (USDA). Retrieved from https://www.nass.usda.gov/AgCensus/index.php

von Braun, J., & Lohlein, D. (2003). Policy options to overcome subsistence agriculture in the CEECs. In S. Abele, & K. Frohberg (Eds.), *Subsistence agriculture in Central and Eastern Europe: How to break the vicious circle?* (pp. 46–70). Institute of Agricultural Development in Central and Eastern Europe (IAMO). https://ageconsearch.umn.edu/record/93082/files/sr_vol22.pdf

von Braun, J., & Meinzen-Dick, R. (2009). *"Land grabbing" by foreign investors in developing countries: Risks and opportunities*. International Food Policy Research Institute (IFPRI Policy Brief 13). https://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/14853/filename/14854.pdf

Vranken, L., Tabeau, E., Roebeling, P., & Ciaian, P. (2021). *Agricultural land market regulations in the EU Member States*. Publications Office of the European Union. https://doi.org/10.2760/86127

Walsh, B. (2018). *Chinese overseas agricultural investment and Beijing's dream of a new economic world order*. Future Directions International. https://apo.org.au/sites/default/files/resource-files/2018-05/apo-nid172036.pdf

World Bank. (2018). *ESS5: Land acquisition, restrictions on land use and involuntary resettlement*. Guidance Note for Borrowers. https://documents1.worldbank.org/curated/en/294331530217033360/ESF-Guidance-Note-5-Land-Acquisition-Restrictions-on-Land-Use-and-Involuntary-Resettlement-English.pdf

Zagema, B. (2011). *Land and power: The growing scandal surrounding the new wave of investments in land*. Oxfam International. https://oxfamilibrary.openrepository.com/bitstream/handle/10546/142858/bp151-land-power-rights-acquisitions-220911-en.pdf;jsessionid=53F913DB7045CB36466252D01856C7EA?sequence=32

Zhang, W., Plastina, A., & Sawadgo, W. (2018). *Iowa farmland ownership and tenure survey, 1982–2017: A thirty-fiveyear perspective*. Iowa State University. https://store.extension.iastate.edu/product/6492

CHAPTER 3

The Food Industry

3.1 Introduction

The food industry is involved with the processing, preparation, preservation and distribution of food and beverages. Food companies sometimes both demand products from farmers and sell products to them. Agri-food companies, which mostly supply agriculture with inputs, are also included in the food industry in this context.

In this book, the food industry includes the following companies and groups of companies:

- Companies that process and prepare meat, milk, eggs, fish, vegetables, fruit, potatoes, cereals and sugar beets/cane. These products are mostly supplied directly by farmers
- The beverage industry
- The bakery industry
- The food ingredient industry
- Companies that supply agriculture with inputs such as feed, vitamins, etc.

The food industry accounts for a significant and an increasing share of the added value in the food value chain, so it is an interesting industry.

The explicit focus on the food industry and food companies in this book can always be discussed: Is the food industry so special that it

H. O. Hansen, *Megatrends in Agriculture, Food Industry and Food Markets*, Palgrave Advances in Bioeconomy: Economics and Policies,
https://doi.org/10.1007/978-3-031-58152-6_3

deserves its own field of research? Would it not be more relevant just to transfer research trends, results, experiences, etc., from industries in general to the food companies?

The answer is that the general business models, methodologies and theories can also be applied, to a large extent, to the agri-food companies.

However, a number of structures and market conditions are special in the food industry, which demands a focus on this industry: The food markets and the food companies are subject to unique terms and conditions which differ from the conditions elsewhere.

In terms of the structural conditions, the forms of ownership in the food industry are distinctive in that cooperative ownership is relatively widespread compared to other industries. This is especially true in the parts of the food sector that are most dependent on local agricultural produce, which are close to the agricultural sector in the value chain.

Another special structural condition is the vertical integration, which also plays a relatively important role in the food sector. Furthermore, globalization and barriers to globalization play a particular role for food companies compared to many other companies.

3.2 Consolidation

Consolidation, i.e., the trend toward increasingly fewer companies in the industry, is both significant and rather uniform among countries. Despite a general increase in global food production, a decline in the number of food companies from year to year is a widespread phenomenon.

Consolidation, which is part of continuous structural development, is connected with other processes in the food industry including concentration, growth, mergers and acquisitions (M&As), globalization, etc. When companies merge or grow, consolidation is often the outcome.

Several drivers are behind this structural development and thus also behind the consolidation that has been identified, cf. Hansen (2013).

In a very long-term perspective, it is clear that technological development, improved infrastructure and generally increasing economic welfare are driving the consolidation. A global pattern can be identified in that the structure of the food industry (and other industrial sectors) is most consolidated in the most industrialized and developed countries.

Among the most developed countries, consolidation in the food industry began in the 1930s and 1940s as the examples in Fig. 3.1 illustrate.

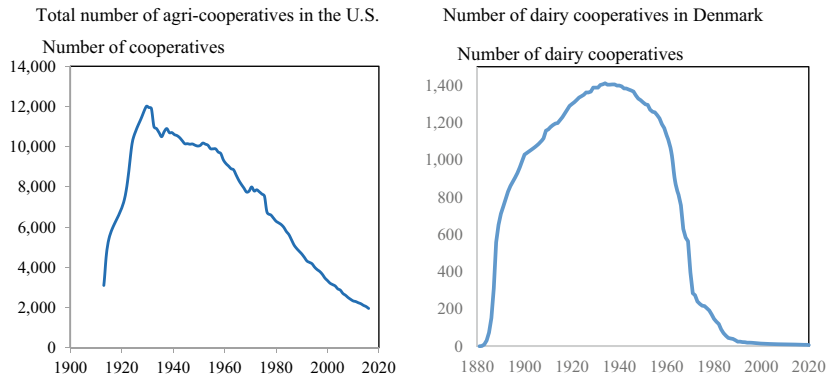


Fig. 3.1 Long-term development of farmer cooperatives: Number of companies (*Sources* Bjørn [1982], Demko [2018], USDA [2015a, 2015b, 2015c] and statistical data from Statistics Denmark, Federation of Danish Cooperatives and Danish Agriculture and Food Council)

The figure presents two examples of long-term development with growth, maturation, saturation and consolidation.

The consolidation since the 1930s and 1940s has been driven by two factors in particular:

- Economies of scale: Larger units could outperform smaller companies by exploiting economies of scale, which lowers unit costs. Technological development was—and still is—a major reason for the continuing economies of scale in the food industry.
- Infrastructure: Local factories or companies close to suppliers and customers were no longer as necessary. It became increasingly possible and advantageous to transport, e.g., milk over longer distances, which meant that small local dairies in villages became redundant.

The scope, process and duration of consolidation vary between sectors. Sectors which were exposed to competition and which were export-oriented with distinct potential for economies of scale were the first to initiate consolidation.

Figure 3.2 presents another example of long-term consolidation in the agri-food industry.

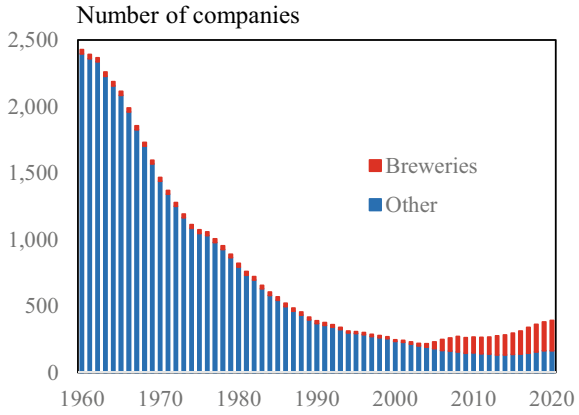


Fig. 3.2 Number of companies in the Danish agri-food industry, 1960–2020 (*Sources* Own data collection, calculation and presentation based on annual reports from companies and business organizations)

The figure illustrates that, in Denmark, the number of companies in the agri-food industry—excluding breweries—has been declining significantly for decades. From 1960 to 2020, the number of food companies fell by more than 90 percent.

The change in the number of breweries is also shown as this industry has exhibited a very different development compared to the other sectors. As can be seen, the number of breweries has been increasing significantly since the beginning of the 2000s, which is in contrast to the general trend in the food industry as a whole.

For many years, structural development in the global brewing sector was characterized by consolidation, concentration, specialization and internationalization: the total number of breweries was decreasing, the large brewing companies were becoming increasingly large and were focusing on beer production and exporting and investing abroad. However, the trend toward fewer breweries reversed at the beginning of this century in step with the emergence of microbreweries (craft breweries).

Figure 3.3 illustrates the number of breweries in Denmark and the USA since the early 1900s, and there is a very uniform development.

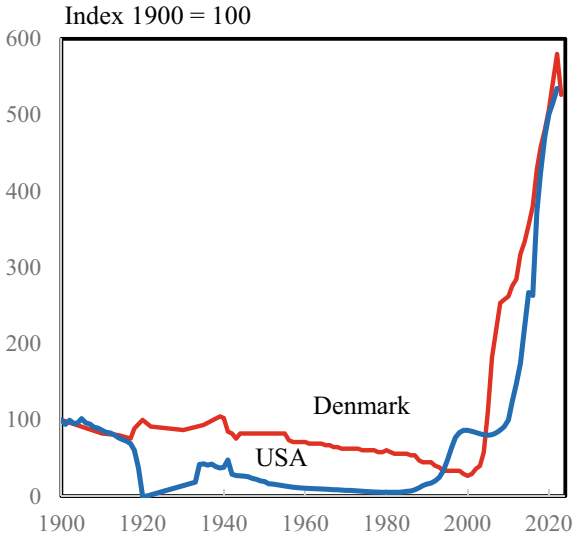


Fig. 3.3 Consolidation of breweries in the USA and Denmark, 1900–2023 (*Sources* Own calculations based on Brewers Association (nd), Tremblay et al. [2005], and statistical data from Danish Brewers' Association)

Microbreweries originally started in the USA and UK in the 1970s, but since then, the concept has spread to most of the world. This "reversed" development in the consolidation of the brewing industry resulting from the boom in microbreweries is a special case which is unlikely to counteract the overall trend as it is unlikely that "micro dairies" or "micro meat companies" would be successful to the same extent: Beer is a differentiable and consumer-oriented product in that its unique characteristics, origin, taste, local identity and innovation are strong parameters in marketing. In contrast, food products such as bread, meat, dairy, etc., do not have the same potential for differentiation.

In the USA, the total number of food companies has decreased on average by approximately 2.5 percent per year in recent decades. However, this change has been more rapid in some sectors than in others. The dairy sector, in particular, has been exposed to significant structural development, while the reduction has been less significant in, e.g., the sugar and flour industries; see Rogers (2001).

Focusing on the total number of food companies in the USA, the downward trend now seems to be stagnating or even reversing, see Fig. 3.4.

The increase in the number of food manufacturing plants and food companies since the early 1990s was mainly due to an influx of small new start-up companies, typically in high growth niche markets and often only with activities for part of the year. These numerous small companies had a negligible influence on the overall picture as they only represented a very small part of the total turnover and activity in the sector.

There are, however, also examples from other countries of new small businesses emerging out of the shadow of large and growing companies. New niches develop, and entrepreneurs start new businesses based on new technology, new markets and the like.

This can thus be interpreted as a sign that the number of companies has a certain lower limit. Large-scale operations, international mergers and acquisitions along with efficiency improvements will, above a certain threshold, create a vacuum that will attract new businesses.

At the same time, it is also an indication that structural development and consolidation may well occur simultaneously with the establishment of new businesses.

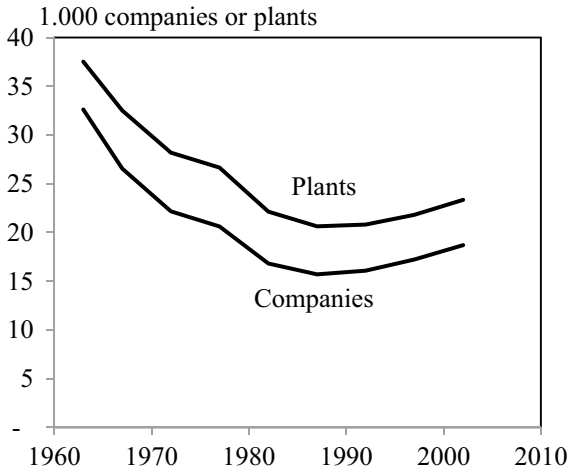


Fig. 3.4 Total number of food businesses in the USA (*Source* Martinez, 2007)

3.3 Size of Companies

During recent decades, the size of food companies around the world has, in general, increased significantly as a result of mergers and acquisitions. This growth in turnover and revenue is remarkable considering the fact that market growth is generally quite low in terms of agriculture, food and beverages.

Growth has been, and is, a consistent strategic goal for many agro-food businesses. Growth in volume and revenue per se is an explicit goal in the strategies of many food companies, which means that there is an internal drive toward ever-growing companies (Hansen, 2013).

Excerpts from the strategies of selected large food companies exemplify this:

- Heineken: We aim to deliver superior and balanced growth (Heineken, n.d.)
- Mondeléz:... we're focused on accelerating growth by investing (Mondeléz, n.d.)
- Nestlé: Our objective is to sustain a mid single-digit organic growth rate... (Nestlé, n.d.)
- Tyson Foods: Tyson Foods is targeting volume growth ahead of the market in every segment (Tyson Foods, 2021).

As an example of growth, Fig. 3.5 presents the change in the average size of dairies in selected countries.

The following drivers are likely to stimulate continued growth and an increase in the size of food companies:

- Growth is an explicit strategic goal of food companies.
- Economies of scale stimulate growth and larger companies.
- Greater size means greater market power in the value chain and thus increased competitiveness.
- Increasing globalization and access to a larger global market benefits the large companies the most.

However, trends and drivers are also pulling the development in a different direction. The question is whether a new era of smaller, locally oriented niche food companies is emerging. An example could be the

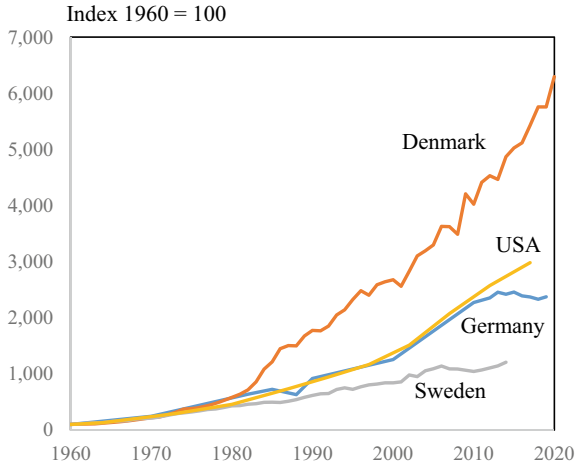


Fig. 3.5 Change in average size of dairies in selected countries (*Note* Calculated as total volume of milk delivered in proportion to the number of dairy companies. *Sources* Wadsworth [2019], USDA [several issues b] and statistical data from Danish Agriculture and Food Council and Danish Dairy Board)

previously mentioned brewing industry, where a large number of micro-breweries have completely changed the structural development calculated in terms of the number of companies and thus also in terms of average size.

Therefore, an even sharper distinction between two types of companies will probably emerge:

- A group of a few large internationally oriented companies with competitive advantages in terms of scale, volume, branding and marketing, efficiency and relatively low prices.
- A group of many small companies that are more locally oriented and specialize in unique and niche products.

Many small businesses will often be start-ups developed by entrepreneurs who will use new ideas or concepts as the platform for a new business. Therefore, the spirit of innovation and entrepreneurship, which seems to have received much greater attention in the past decade, will help to create this sharper distinction and polarization between small and large companies.

3.4 Concentration

In this context, increasing concentration involves large companies obtaining an increasing share of the total production, sales or market. Concentration is defined by the number of companies and their share of all companies.

The level of concentration can have a major impact on markets and market efficiency. A strong market concentration, in which a few companies have a large market share, may lead to imperfect markets, unbalanced market power and a lack of competition.

However, concentration in the form of a few large companies may also be the result of strong competition, where the most competitive companies with the best performance are able to grow. In this way, concentration is the result of competition and not necessarily a restriction or barrier to competition. Concentration is only a problem when the market power gained is abused, thereby harming the market, competitors and, in the long run, also potentially the company itself.

Several studies have analyzed concentration in various industries, countries and periods. Although different definitions, delimitations, methods of calculation, etc., make comparisons difficult, a number of common and general trends can still be identified.

Below, examples of the change in concentration in different countries, food industries and periods are presented. Starting with processing industries close to agriculture, Fig. 3.6 presents the change in concentration in the US livestock slaughter sector, 1980–2015.

The US livestock slaughter industry has witnessed a strong increase in concentration in recent decades. The share of steers and heifers slaughtered by the four largest firms increased from less than 40 percent in 1980 to almost 85 percent in 2015; for cows and bulls, this share grew from around 10 percent to almost 60 percent. Finally, the share of hogs slaughtered by the four largest firms increased from around 35 percent in 1980 to around 65 percent in 2015.

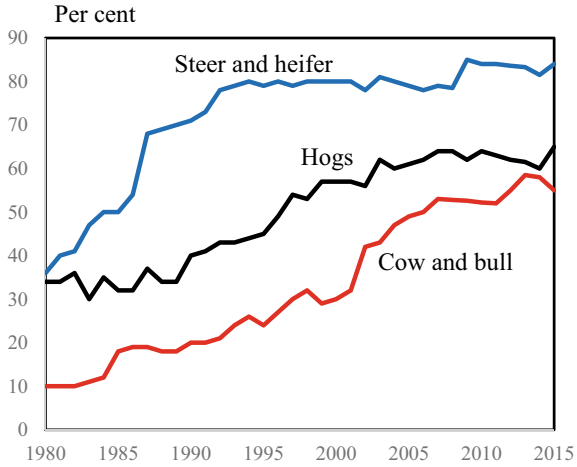


Fig. 3.6 Market concentration in the US livestock slaughter sector, 1980–2015 (*Note* The share of animals slaughtered by the four largest firms. *Source* Own presentation based on Deconinck [2021])

In the brewing industry, a long-term and clear trend toward increasing concentration can also be observed, cf. Fig. 3.7.

As discussed in the section on consolidation, in recent decades, the brewing industry is segmented into macro and micro brewers, respectively. The number of micro brewers has increased significantly, while macro brewers still account for what is by far the largest share of total beer sales.

Figure 3.7 presents the change in concentration for macro brewers. As can be seen, there is a clear increase in concentration over a very long period. The market share of the four largest brewers increased from 44 percent in 1970 to 1998 percent in 2003.

Furthermore, on the global beer market, recent data reveals a significant increase in concentration. In 2013, the top 5 breweries represented more than 50 percent of the global market compared with 32 percent in 2003 (Boesler, 2014). In 2020, the five largest breweries were producing 61 percent of total global production, and the ten largest breweries in the world accounted for 74 percent of the market share in terms of production (BarthHaas, 2022).

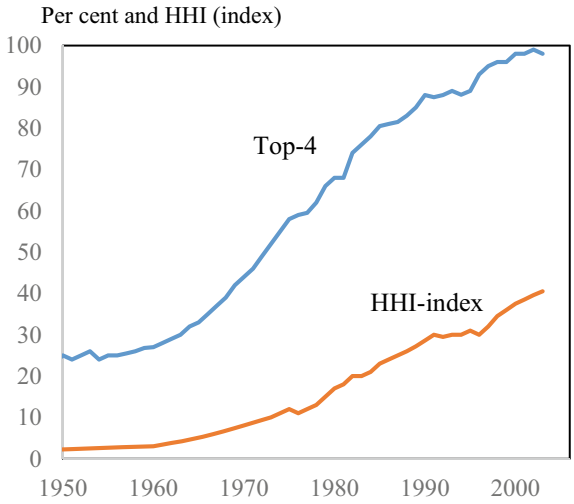


Fig. 3.7 Concentration (Top 4 and HHI-index) for US macro brewers (*Source* Own presentation based on Tremblay et al., 2005])

Turning to Asia, Fig. 3.8 illustrates the change in concentration in Korea.

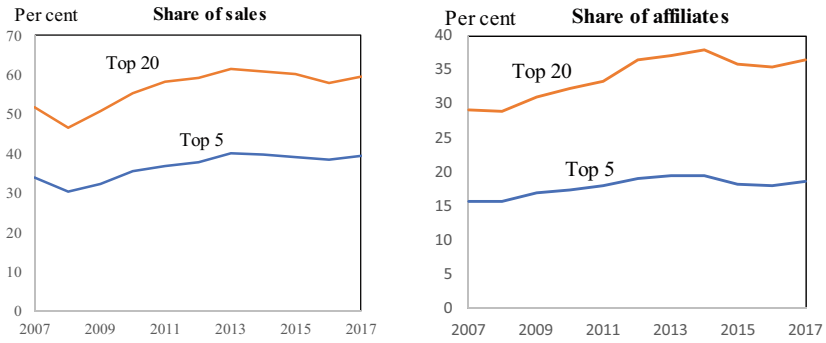


Fig. 3.8 Share of 5 largest and 20 largest chaebols in South Korea: Sales and affiliates (*Note* A chaebol is a large family-owned business conglomerate. Conglomerates account for the lion's share of companies in Korea. *Source* Own presentation based on Wi [2018])

The figure illustrates increasing concentration in South Korea. The sales of the top 20 largest companies (conglomerates) increased from 52 percent in 2007 to 60 percent in 2017 of total sales of the 500 largest companies. Furthermore, the share of affiliates of the biggest conglomerates increased significantly in the period.

In terms of the food and drink industry in South Korea, in recent years, concentration seems to have remained relatively stable, cf. Fig. 3.9.

Concentration in the alcoholic beverage manufacturing and in the non-alcoholic beverage, mineral water and ice manufacturing is quite high, as the biggest company in each sector in 2020 had 41 and 33 percent of the market share, respectively. Concentration is only increasing in alcoholic beverage manufacturing.

Concentration is quite stable in the dairy and animal feed industry. One explanation may be that these industries are quite regional with extensive local networks, which may make further concentration disadvantageous.

In addition, conglomerates account for a significant share of the Korean agri-food industry. Being a conglomerate, economies of scale for a company can be achieved by growth in several industries, while concentration within individual industries is not a necessity.

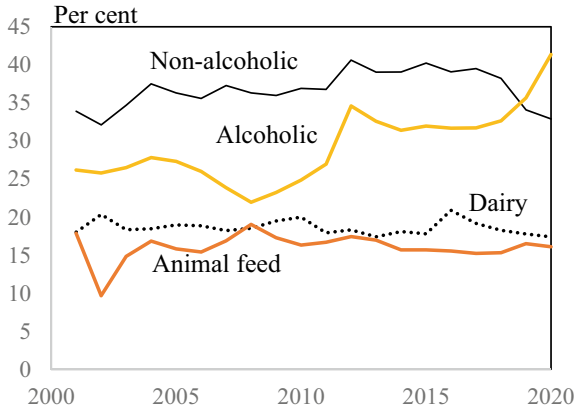


Fig. 3.9 Market shares of the biggest company (Top 1) in South Korea in food and drink industries 2001–2020 (*Source* Own calculations based on information from KOSIS (nd))

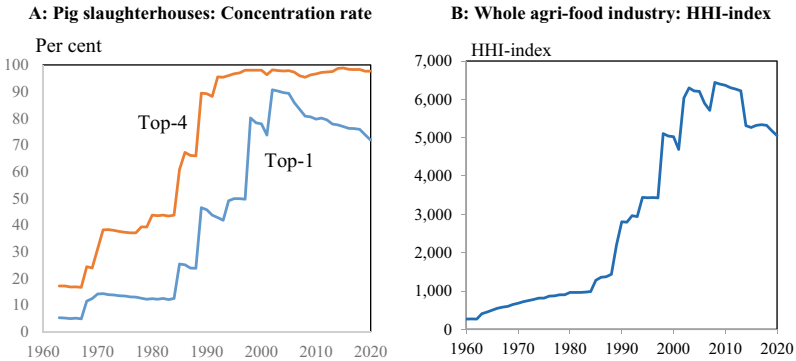


Fig. 3.10 Trend in concentration in the Danish agri-food industry (*Sources* Own calculation and presentation based on annual reports from companies and from industry organizations)

Finally, using Denmark as a European example, significant and increasing concentration can be observed in the agri-food industry, cf. Fig. 3.10.

Figure 3.10 shows a marked increase in concentration for large parts of the period. The concentration and structural development are now almost complete, and will not increase significantly in the future. The reduced concentration in recent years is mainly due to the entry of a German slaughterhouse, which has become the second largest company and has undergone significant expansion.

The Fig. (3.10A) also shows that concentration often decreases immediately after an increase, i.e., after an M&A. This indicates that after an M&A, companies are unable to maintain the new common market share. The lost market share can be explained by problems with integration after an M&A, too strong a focus on mergers and an inadequate focus on the day-to-day management and business development as well as lack of support for M&A from owners, customers or suppliers.

The HHI-index (Fig. 3.10B) is high—and significantly higher than the typical limit for a warning of the potential for a lack of competition. However, the smaller the country or region, the higher the concentration. In a small geographic or demographic region, typically only a few companies will be present. Conversely, in large areas, more companies will

be present and will also be able to grow and create economies of scale, even though the concentration rate is low.

3.5 Specialization and Conglomerates

The structural development of the food industry is not just a matter of size and number. It is also a question of the specialization and diversification of companies. As discussed in the previous chapter, agriculture is developing toward increased specialization driven by economies of scale. The food companies consist of much larger units, so the question is, does the same pressure and tendency for specialization exist in the food industry?

In this context, two types of companies are relevant: One is highly specialized and operates within a single, narrow business area. The core business is an essential part of the business strategy for which the aim is to exploit economies of scale and size within production and on the market. The large market size implies improved bargaining power in terms of both suppliers and customers.

The second type has very different (diversified) business segments called conglomerates, which have undergone a unique historical development and have been exposed to particular driving forces.

The importance of conglomerates varies significantly over time. From the 1950s to the 1970s, many companies followed a conglomerate and diversification strategy. The purpose was, in particular, to diversify the activities into several different business units in order to limit risk. Conglomerates were thus widespread in the 1960s. There was also a significant wave of mergers until about 1970, which was anchored in the creation of several major conglomerates, cf. Fig. 3.11.

The wave of conglomerate mergers was also driven by monopoly legislation and a general distrust of market-dominant corporations.

Since the 1970s, many conglomerates have been split up, and most companies have instead focused on creating competitive advantages within their core business. This restructuring thus created a subsequent wave in mergers for which the core business, focus and growth were the driving forces.

Since the 1990s, there has been a rapid growth in M&As, according to Cho and Chung (2022), but drivers other than conglomerate strategies have been dominant.

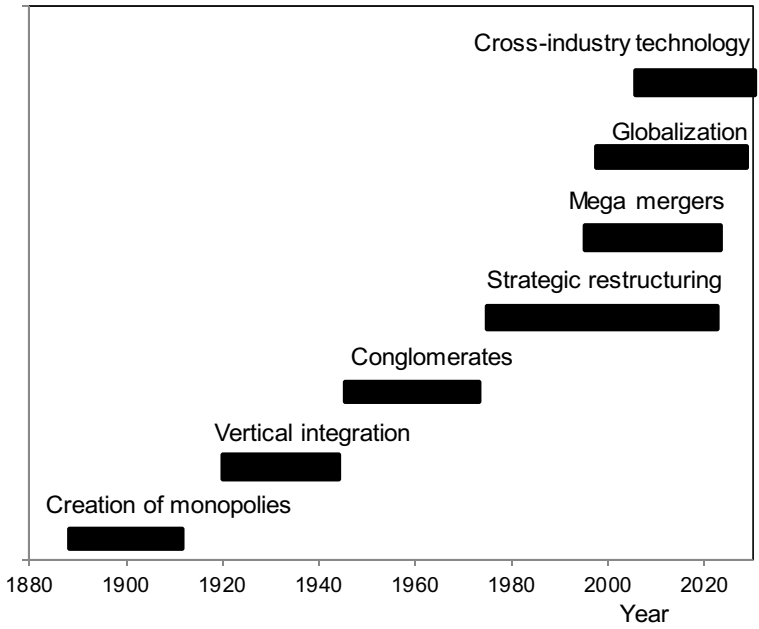


Fig. 3.11 Global waves in mergers since the beginning of the 1900s (*Source* Own presentation based on Cho and Chung [2022], Sisodiya [2004], UNCTAD [several issues])

Today, conglomerates are generally considered to be outdated, and this is generally due to two factors: First, investors do not benefit from the fact that conglomerates are low risk because they can spread risk through diversifying their portfolios. Secondly, conglomerates are considered to have structural and managerial weaknesses.

There is no sharp distinction between specialized companies and conglomerates. The degree of specialization is fluid, and different business units in a conglomerate may well be linked and create synergistic effects. As was the case with cooperatives, the statistical basis is relatively weak when it comes to describing the global trends for conglomerates in the food industry. For this reason, it is useful to assess the underlying driving forces, advantages and disadvantages in order to assess future developments.

A number of possible disadvantages or risks connected with conglomerates can be identified:

- Conglomerates lead to risk diversification, but this does not add value for investors as they can spread their risk by managing their portfolios.
- The conglomerate structure per se is inefficient and unfocused as a company cannot be equally competitive in many business areas at the same time.
- Less profitable and less competitive parts of a conglomerate will attract unnecessary resources, which will prevent very profitable parts from providing the necessary resources and focus in terms of both management and capital.
- Increasing economies of scale force many companies to limit their areas of activity and portfolio in order to achieve the largest market share possible. In order to achieve a sufficiently high market share in an increasingly global market, it has been necessary to focus on and specialize in core areas.
- Finally, the structure, competitiveness and potential profit of conglomerates will often be unclear. Investors may have difficulty assessing the real value due to the complex structure, and perhaps one specialized analyst may not have the ability to review all business areas in a conglomerate. This uncertainty and complexity thus results in poor pricing.

For a number of reasons, companies follow a conglomerate strategy by developing entirely new business areas. Therefore, a conglomerate strategy may encompass a number of opportunities and advantages under the following conditions:

- Moving from Red Ocean to Blue Ocean: If the market is characterized by overcapacity, fierce competition, low growth and profit, and if new competitors have entered the market with unique products or if the company's products are generally technologically obsolete, it may be advantageous to shift focus and develop new business areas. The existing activities—in whole or in part—can continue temporarily and be cash cows for the company.

- If the company has unique general competencies (management, organization, IT, brands, technology, etc.) that can be effectively utilized across business units. Access to big data is a competence and competitive advantage from which conglomerates may benefit. The more data that can be collected, the more uses the company has for it. Consequently, a new generation of conglomerates is data-focused rather than product-focused. Recent examples such as Apply, Amazon and Sony illustrate this cross-industry development.
- Management may be another important competence. Investors will often assess a business case based on the people rather than the project itself. If the management—or a single individual—has managed to implement a project successfully, attracting investors and resources for other projects will be easier. In these cases, the business area is not so decisive—core business or not—because the investors have confidence in the individuals behind the projects.
- If access to internal financing for growth is a very limiting factor, the formation of a conglomerate may be advantageous or necessary. The relative success and importance of conglomerates in Asia can be explained by this factor, cf. Hansen (2018), Vestring and Felenbok (2017). Although such financial drivers behind the development in Asia are now weaker, well-established conglomerates are unlikely to be significantly reduced in Asia.

The main drivers, advantages and disadvantages are now identified. Drivers are structural and thus static. What will be decisive in the future is whether the drivers will favor or limit specialized companies and conglomerates.

In general, the wave of conglomerate mergers that took place in the previous century was driven by factors that probably will not be important in the near future. As long as perfect—or almost perfect—markets exist, conglomerates will in general not be more competitive than specialized companies.

However, new cross-industry technology to drive a new semi-conglomerate trend or wave is likely, although as far as the food industry is concerned, such a driver will not be a game changer if we exclude very downstream activities such as food retail and food service industries.

Food companies that are strictly based on meat, dairy, fish or eggs, are now faced with high market growth in plant-based food. Meat replacement products, vegan food or vegetarian food may not be a segment

within the core business of the companies, and competitive strength may be lacking. Supply chain, processing technology, knowhow, etc., may be quite different in the plant-based food industry. However, the traditional animal food-based companies seem to be increasingly focusing on these plant-based food segments. This change which involves the inclusion of a new and broader business segment means more diversification and, to some extent, a kind of conglomerate strategy.

However, the overall trend for food companies will be to focus on the core business, growth, market shares and specialization as a means to increasing profit.

3.6 Global Mergers and Acquisitions (M&As)

In the intersection between structural development, foreign direct investments, M&As and globalization, a trend is emerging in that global M&As are becoming increasingly important.

Global M&As include the sale of companies in a host economy to foreign multinational enterprises (MNEs), but they do not include the sale of foreign affiliates (already owned by foreign MNEs) to other foreign MNEs. Divestments (the sale of foreign affiliates to domestic firms) are subtracted from the value, so in some years the value of global M&As is negative.

In periods of strong structural development, consolidation and globalization, it is to be expected that global M&As will also grow. As Fig. 3.12 shows, the value of global M&As has increased significantly in recent decades, and mergers in the food industry (food, beverages and tobacco) have developed in much the same way as the manufacturing industry as a whole.

As the figure illustrates, the food industry and total manufacturing industry have followed a similar development over time, which is an indication that it is being driven by the same factors. Financial crises, pandemics and geopolitical instability have reduced both the total number and value of global M&As. In general, more than 30 drivers behind M&As and the growth of food companies have been identified, cf. Hansen (2013).

In the studied period, global M&As in particular increased in the service industries, especially within finance and insurance. Global M&As in the food industry account for 15 percent of global M&As in the

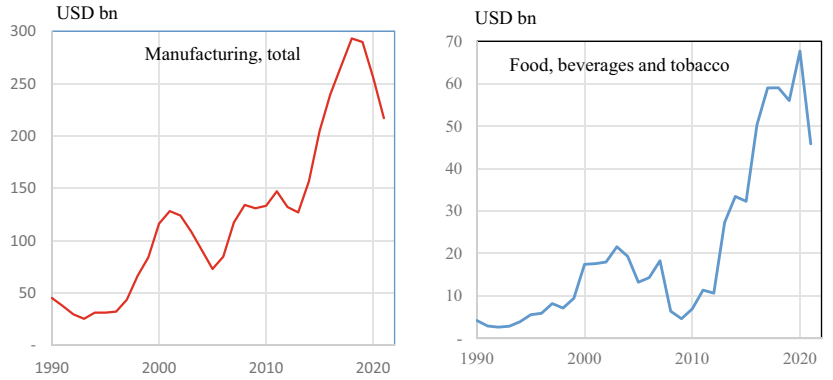


Fig. 3.12 Value of cross-border M&A purchases in "manufacturing, total" and "food, beverages and tobacco", 1990–2021 (*Note* Five-year moving average. *Source* Own presentation based on UNCTAD [2023])

manufacturing industry and 5 percent of global M&As in all industries including service industries. The share has been increasing since 2012.

The relatively high and increasing share of global M&As in the food industry is remarkable considering the fact that the food industry is often rooted locally. However, the beverages and tobacco industry, which is also included, has historically been more globally oriented, and large M&As in these industries can explain the increase in the past decade.

An increase in M&As will probably continue and can be identified as a megatrend, but whether this does in fact transpire will depend on the conditions for globalization including any geopolitical developments. M&As tend to slow down during times of uncertainty or market volatility. However, technological development and improved infrastructure can also become drivers for future global M&As. Furthermore, access to markets, a stable legal framework, etc., are important factors for growth in global M&As.

In a world of economic, political and commercial stability, companies will often seek to grow to take advantage of economies of scale via international expansion. Global M&As can be an attractive way of exploiting these advantages, but because the risks are usually relatively high and such a move would be irreversible, there must be a certain degree of certainty connected with any potential M&A.

3.7 Farmer Cooperatives

Cooperatives play an important role in the food industry in many parts of the world. Cooperatives differ from other companies as the owners and users are one and the same. In the food industry, cooperatives are especially prominent among dairies, slaughterhouses, trading companies and suppliers. Although cooperatives are based on specific principles, and although there are fundamental and structural differences between cooperatives and capital-owned companies, cooperatives are primarily business-oriented companies, where the goal is to create profit in the short and long term for the owners—just like with other types of company. However, cooperatives may face special challenges in the future, e.g., when it comes to the globalization of markets.

Statistical mapping of the global development, significance and performance of farmer-owned cooperatives is lacking. The International Cooperative Alliance (ICA), which represents more than 1 billion cooperative members and 3 million cooperatives worldwide, says that "There is no global-level comprehensive database of cooperative statistics because statistical offices analyze cooperatives differently from country to country. Therefore, it is difficult to get a complete picture" (ICA, n.d.). This fact makes it more difficult to identify megatrends, so additional approaches must be considered.

The assumption is that there are driving forces or conditions that stimulate the establishment of cooperatives. Therefore, in order to understand the performance of farmer-owned cooperatives—historically and in the future—the driving forces behind their formation and development must be identified.

The extent to which cooperatives can survive and grow nationally or internationally depends on the following market conditions which can make it more or less advantageous to establish—or maintain—cooperatives (Hansen, 2020):

1. **No or Only Weak Market Power in Existing Supplier Associations, Etc.**
   Farmers can often achieve a degree of market power by establishing supplier and producer associations, which have bargaining power over their supply and processing companies. In these situations, the benefits of establishing a cooperative are fewer. Conversely, the

absence of such supplier and producer associations increases the incentive to establish farmer-owned cooperatives.

2. **Insufficient Competition Up- or Downstream**
   Fundamentally, cooperatives are created because a group of farmers needs to solve an important market problem. If there is insufficient competition up- or downstream, the market will be imperfect, and the farmers' market power will be adversely affected. Therefore, there is an incentive to establish cooperatives in these industries.

3. **Farmers' Professional, Democratic and Social Skills**
   The establishment, organization and operation of a cooperative implies that the members have the appropriate professional, democratic and social skills. Farmers need to understand and respect the common rules and have the ability to cooperate and recognize mutual benefits.

4. **Delivery Guarantee Can Be Crucial for Farmers**
   When agricultural products are sold on a daily basis, or almost daily, an efficient sales organization and the right to deliver is crucial for the farmers. For dairy farmers, it is important that the milk can be delivered every day, while it is easier for grain producers to, e.g., store grain and spend time evaluating alternative sales opportunities. Therefore, the right to deliver—and thus also the value of being a member of a cooperative—is more important in some industries than in others.

5. **Legislation Promotes Cooperative Ownership**
   Legislation may be a significant driver for the establishment of cooperatives in several areas. In a number of cases, the government supports the formation and development of cooperatives through special support schemes, exemptions or other kinds of legislation.

6. **Financial Structure and Needs**
   The financial situation of cooperatives, including the cooperative's capital needs relative to the number of members, also has an impact on the significance of cooperatives. If processing activities are highly capital intensive, and if there are very few members, the capital requirement per member will be so large that the cooperative model will be unsuitable—especially if there is a start-up phase.

7. **Position in the Vertical Value Chain**
   Usually, farmers will establish cooperatives in industries close to the agricultural production in the vertical value chain. Downstream activities very close to consumers typically have lower cooperative market shares (Hansen, 2013). The reason is probably that the involvement of farmers in cooperatives in industries close to agricultural production often gives those farmers a more direct and transparent advantage.

The drivers can thus be both internal and external in relation to the cooperatives: The cooperative structure in itself may be more or less advantageous in the individual cases. In addition, a number of external factors such as competition, market power and legislation may be key drivers or barriers to the establishment and development of cooperatives.

It is evident that the driving forces behind the formation and development of cooperatives may be more or less present in different countries—and thus the expediency and the prevalence of cooperatives may vary. It also means that a low degree of cooperative organization per se is not negative, as the right drivers and conditions must be present to make cooperatives useful and successful. In other words, cooperative organization is not a goal in itself. It is a means of ensuring a more efficient value chain, and thus improved earnings for the cooperative members, i.e., the farmers.

Cooperatives have a number of advantages and disadvantages in relation to capital-owned companies. This means that cooperatives are not superior in all respects, and the net advantages depend on the specific situations and market conditions. The development of these advantages and disadvantages will also affect the development of the cooperatives—historically and in the future: if a possible disadvantage or a possible problematic issue, e.g., globalization becomes more important, it can weaken the position of the cooperatives. Conversely, an increasing focus on local supply, traceability and short value chains can strengthen cooperatives' market shares.

A number of significant advantages and disadvantages of cooperatives compared to capital-owned companies are identified in Table 3.1.

Table 3.1 emphasizes the fact that substantial advantages and disadvantages are connected to the cooperative model. Cooperatives can thus be advantageous in situations in which the special benefits are important

Table 3.1 Cooperatives: Significant advantages and disadvantages compared to capital-owned companies

Advantages	*Disadvantages*
Strong vertical integration Through cooperative ownership, several links in the value chain can be controlled	**Difficult to attract equity** The potential for attracting external capital is limited
Low transaction costs The supply chain is effective, and supplies between the links are often at no cost to intermediaries or other sales links	**Volume control is difficult** Because of members' delivery rights, cooperatives have limited scope for volume control
Security of supply and demand Both farmers and the cooperative have secure supply and demand	**Conflict of interests and dual role** Members' dual role as both owners and suppliers (or customers) can cause conflicts
Relatively small demand for capital The supply obligation acts as a financial cushion, and thus the need for equity is reduced	**Lack of incentives for long-term investments** Since the cooperative owners basically can not withdraw their share of the value added from the company when they drop out, their economic incentive to leave money in the company for long-term investments and returns can be limited
Division of labor Farmers can focus on the core business —to be farmers—and leave up- and downstream activities to their own cooperatives knowing that all benefits from this belong to and are returned to the farmers/members	**Limited recruitment base to the board** Positions on the board are predominantly reserved for members, which results in a significantly reduced basis for recruitment
Cooperatives are often economically robust The cooperative structure with the obligation to supply, etc., means that it is relatively rare for cooperatives to go bankrupt	**Ties to produce** Cooperatives may have an implicit or explicit tie to the members' own supply of raw produce, which can cause non-optimal commodity composition
Even out market power in the value chain Agricultural production typically comes from many small units which individually have weak market power. By standing together in cooperatives, the bargaining power of these small units is strengthened, and it becomes more equal in relation to the other links in the value chain	**Focus on value chain around members** Cooperatives will, by virtue of their aim to protect the supply and sales of their members, often focus on the links of the value chain which lie closest to the members. Activities further down the value chain closer to consumers may, therefore, be assigned a lower priority, even though they may be economically attractive

Source Own elaboration

and can be utilized. However, there may also be situations in which the disadvantages are too crucial and/or the benefits are less important.

Efficient value chains, including elements such as traceability, security of supply and low food loss and waste, are expected to be of great importance in the future. These factors will be even more important when the pressure on the markets increases and when the climate policy agenda is further prioritized. Such factors will be available and present in cooperatives, and they will thus have a relative competitive advantage in these areas.

Poor access to capital and being tied to members' deliveries are likely to be even more important disadvantages in the future. The demand for capital increases when the structural development in the food industry continues in the direction of increasingly large companies. Increasing globalization can also both increase the need for capital for foreign direct investments and necessitate access to supplies from non-members, which will be detrimental to cooperatives.

Therefore, the potential positive and negative impacts on the cooperatives can influence their future development and there is no clear direction.

As mentioned previously, statistical mapping of the global development in farmer-owned cooperatives is non-existent, which makes it difficult to identify megatrends. However, country-based cases and cross-section figures may be used to identify some megatrends. Below, the focus is specifically on the prevalence and importance of cooperatives, given that it is assumed that a number of megatrends for the food industry also apply to cooperatives.

The European Commission has previously published market shares for agricultural products sold through cooperatives. Data for 10 important products and product groups in the years 1972–1997 are available. More recent statistics have not been published or are not available. Based on these data, Fig. 3.13 presents a calculated weighted average of the market shares of farmer cooperatives in the EU.

The figure shows a fairly clear trend toward increasing market shares for cooperatives in the period shown. However, it should be noted that the extent of cooperative organization varies considerably from product to product—and from country to country—in the EU.

Differences in the cooperatives' market shares and importance between countries in the EU show a relatively clear pattern: Cooperatives have

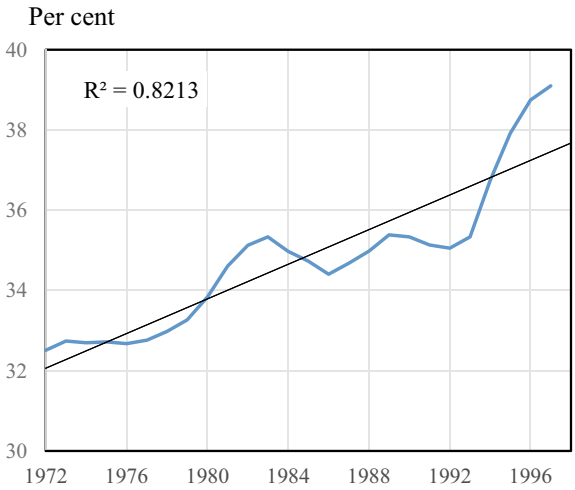


Fig. 3.13 Market shares of farmer cooperatives in the EU 1972–1997 (*Note* Weighted average for 10 agricultural products for the EU countries where data is available. Three-year moving average. *Source* Own calculations and presentation based on European Commission [several issues])

the greatest prevalence in countries with the highest GDP per capita, cf. Fig. 3.14.

The figure shows a relatively clear trend: Cooperatives are less common in the poorest countries, while their significance increases concurrently with economic growth. The figure shows a snapshot based on cross-sectional data, so one must be cautious about drawing very firm conclusions regarding that development over time. However, a dynamic interpretation and even causality can be justified: Often, the establishment of cooperatives requires a certain level of infrastructure, education and organization—conditions which are most prevalent in the most developed countries.

A few studies have analyzed the long-term development in market shares (and, therefore, also the development in competitiveness) of farmer cooperatives, cf. Fig. 3.15.

Figure 3.15 presents long-term market shares for milk in the USA and Denmark and for several agricultural products in Denmark. The figures indicate a long-term increasing trend.

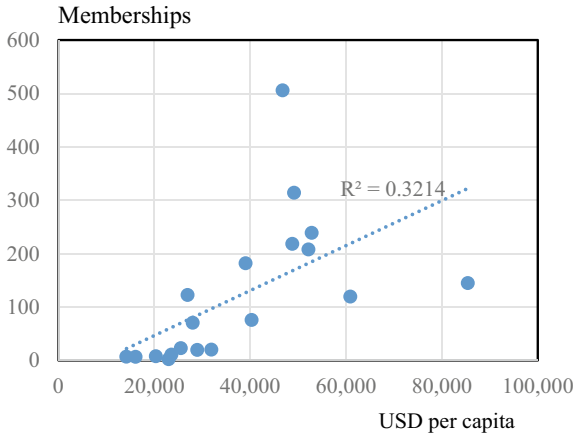


Fig. 3.14 Memberships of farmer cooperatives per farm holding as a function of GDP per capita—among EU countries (2014) (*Note* Multiple memberships. Part-time or hobby farmers can also be members of cooperatives. *Source* Own presentation based on Cogeca [2015] and statistical data from World Bank)

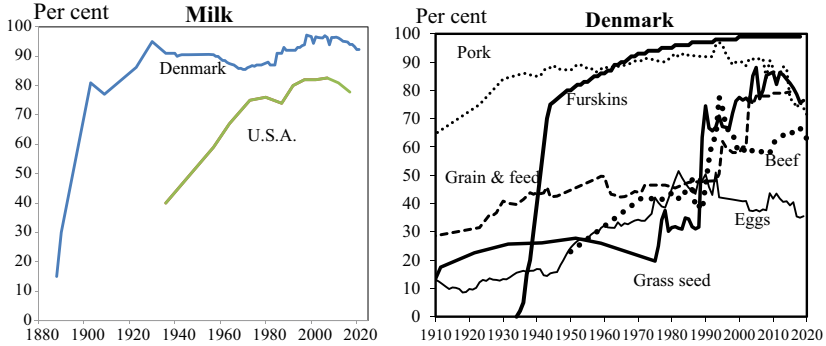


Fig. 3.15 Examples of the development in cooperatives' market shares. Denmark: Share of milk intake by cooperatives. USA: Cooperative member milk volume as a percentage of volume sold to plants and dealers. After 2007: Cooperative share of US total. (*Source* Own presentation and calculations based on annual reports, Wadsworth [2019] and USDA [2005])

Existing farmer cooperatives will often have embedded competitive advantages, which will ensure survival in the future and probably also growth. Cooperatives can grow through increasing market shares (organic growth), M&As and diversification. However, establishing a new major cooperative from scratch may now be much more difficult. Limited access to capital combined with a decreasing number of farmers is making it difficult to attract sufficient capital.

Furthermore, even though cooperatives are often economically robust, there are cases in which cooperatives suffer economically and are outcompeted or acquired by investor-owned companies. In such cases, the market shares of cooperatives may fall significantly and irreversibly.

All things considered, both positive and negative factors will affect the future development of cooperatives, and no clear direction is evident. Cooperatives will also be present in the future due to competitive strengths, but weaknesses, cf. Table 3.1, will also limit future growth.

3.8 Offshoring and Reshoring

Offshoring is the process of relocating domestic business operations (production or services) to a foreign country (usually a developing nation) with the intention of reducing the cost of doing business. The specific reasons for locating operations outside a corporation's home country are lower labor costs, lower tax, more lenient environmental regulations, less stringent labor regulations and close proximity to raw materials.

Reshoring (also sometimes referred to as backshoring, onshoring, rightshoring or inshoring) is the opposite of offshoring. Reshoring means that companies move their production and processing back to the home country, i.e., to the country where the company was first established. So, if a company has moved some or all of its production operations overseas (offshoring), reshoring is the process of bringing some or all of it back again.

Nearshoring means that a company moves its production and manufacturing to another country, but it is close to the home country.

Figure 3.16 shows a simplified illustration of offshoring.

The principle is that part of the value chain is moved abroad. After further processing abroad, the products return to the original value chain. In some cases, the goods are shipped directly from the offshoring country to the final customer.

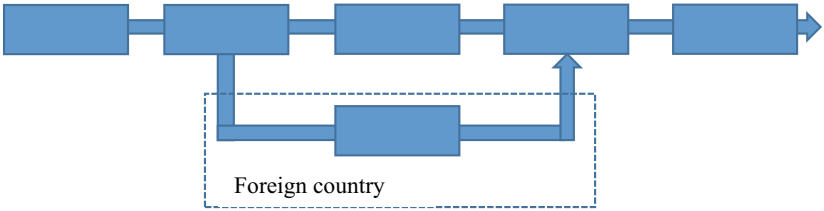


Fig. 3.16 Domestic value chain from farm-to-fork (upper chain) with offshoring (*Source* Own presentation)

The influence of globalization on the agricultural and food sector and on agricultural and food markets is relatively small. This is because, among others, transportation is often complicated and expensive due to low durability, and that political objectives favor domestic production. Nevertheless, there are significant examples of both offshoring and reshoring when it comes to the agri- and food industry:

The labor-intensive part of meat processing has, in some cases, been relocated to low-cost countries. This applies to Europe and other continents, but there are also examples of meat and fish products from Europe undergoing further processing in Asia after which they are either returned to the original producers or sent to the final customer.

The sorting and final processing of intestines (from pigs, cattle and sheep) takes place, to a large extent, in China, which today is an international center for this industry. The raw materials come from both domestic and foreign producers. In this case, relatively low wages, good infrastructure, economies of scale and standardized processing have been important drivers behind the creation of this global intestine cluster in China.

There are also examples of the offshoring of production and processing to be found in the horticulture sector. The production of cuttings is relatively labor intensive and, therefore, parts of this production have been moved from, among other places, Europe to countries in Africa and Asia with low wages and low or no energy costs.

However, according to EY (2015), the industries that are most likely to reshore are those that are capital intensive with complex supply chains and are exposed to rapidly changing consumer markets. The food industry (dairy, meat, bakery, processed foods, etc.) is belongs to the group of industries with the lowest propensity to reshore.

The distinction between offshoring, reshoring, nearshoring, foreign direct investment and international trade is not clear, and there are many borderline cases in which only a small amount of processing or finishing occurs outside the home country. For this reason, it can be difficult to document any statistical trend. However, some studies have identified signs of an increasing degree of reshoring:

For example, Dikler (2021) asserts that, in recent years, reshoring has definitely been increasing in developed countries, but that the effects of reshoring on national economies are still much debated.

The Reshoring Initiative® is a private non-profit organization in the USA that strives to bring manufacturing jobs back to the USA or keep existing jobs in the country. Since January 2010, approximately 250.000 manufacturing jobs have been brought to the USA from offshore. Currently, the inflow of jobs is roughly equal to the outflow, but according to Reshoring Initiative® (n.d.a), there are still approximately four million potentially recoverable jobs offshore. The reversal of the offshoring trend and increase in reshoring is driven by rapidly rising Chinese wages and by companies realizing that producing in or near the market has benefits in terms of the balance sheet, risk and strategy, which often outweigh the higher wage costs.

Based on job announcements, Reshoring Initiative® (n.d.b) estimates job creation, which is used to illustrate the trend in reshoring. While foreign direct investments and reshoring develop almost in parallel over time, reshoring increased sharply in 2020 due to the Covid-19 pandemic, but the trend continued into 2022, cf. Fig. 3.17.

As can be seen, the figure confirms that an increase in reshoring does not necessarily mean that offshoring has been reduced: Offshoring may continue, perhaps at a lower growth rate, but reshoring may increase when it is advantageous. Therefore, the trend is that offshoring is decreasing while the relative importance of reshoring is increasing.

The future importance of reshoring depends on the factors driving the development. If the positive driving forces become more important in the future, reshoring will, in general, increase.

A number of drivers behind the trend toward more reshoring can be identified:

Although offshoring often reduces the labor costs of a food company, several factors make reshoring appealing.

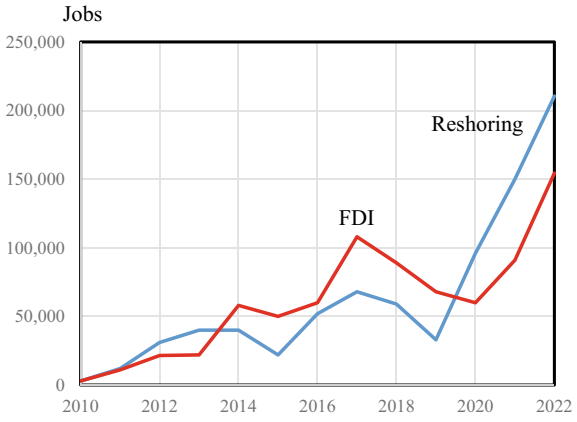


Fig. 3.17 Job announcements per year, reshoring vs. FDI, 2010–2022 (*Source* Own reproduction based on Reshoring Initiative® [n.d.b])

- New robotic technology can replace labor, which means that low labor costs will no longer be such an important competitive parameter. The benefits of offshoring are diminishing while reshoring is becoming more attractive.
- With significant growth and increasing incomes in Asia, in particular, production costs are also increasing, including labor costs, which means that the labor cost gap between developed and less developed countries is narrowing. For some industries, the cost gap has narrowed to such an extent that the benefits of offshoring have more or less disappeared. As an example, Fig. 3.18 shows the change in the average annual wage in China and the USA, 2010–2020.

  Although wage increases in China are much stronger than in the USA, there is still a significant gap in labor costs between the countries. In total, labor costs in China are approx. 25 percent of the level in the USA—and even lower in manufacturing and in agriculture—but the gap is narrowed significantly in recent years (Fig. 3.19).

  The USA and China are relevant examples as both countries are important as offshoring country and host country, respectively. At the same time, studies indicate that China is the country where the USA had the most reshoring activities in the years 2010–2020

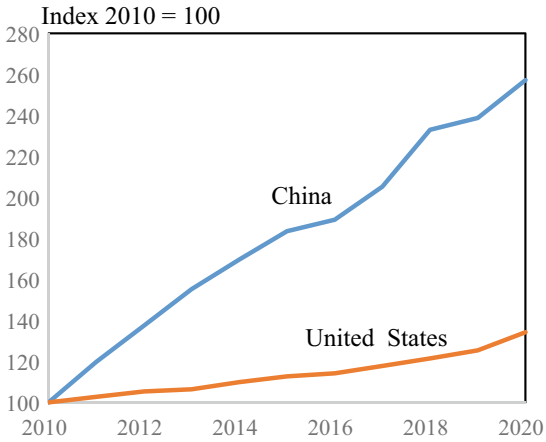


Fig. 3.18 Change in average annual wage in China and the USA (*Source* Own presentation based on statistical data from World Bank)

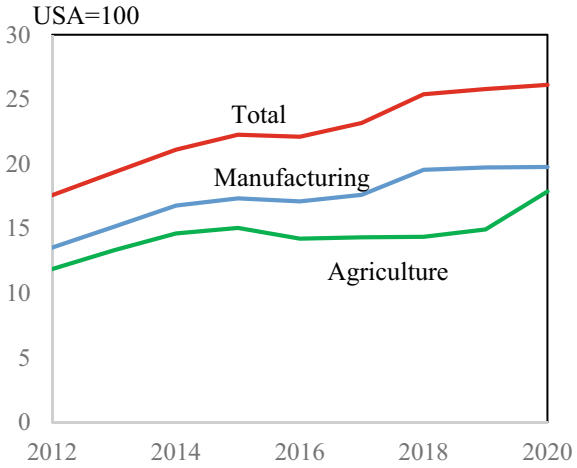


Fig. 3.19 Labor cost gap between China and the USA 2012–2020 in selected industries (*Note* Average monthly earnings per employee—in US Dollars. *Source* Own presentation based on statistical data from ILO)

(Reshoring Initiative®, n.d.c). Although several factors can explain and justify reshoring, the figure indicates that the difference in labor costs is one of the factors behind less offshoring and more reshoring between the USA and China.

- The Covid-19 pandemic exposes the vulnerability of offshoring to remote countries. Although it is likely to be a temporary phenomenon, the pandemic demonstrated that international infrastructure and logistics can be disabled or significantly weakened. At the same time, it also became clear that pandemics are difficult to contain and that new future pandemics are very likely. Therefore, reshoring can help protect supply chains from highly disruptive pandemics in the future.
- Geopolitical uncertainty increases as a result of conflicts between superpowers and the greater role of China and Russia on the international stage. This increasing geopolitical uncertainty implies vulnerability and greater risk for companies with overseas operations. Dikler (2021) refers to political instability as one of several disadvantages connected to offshoring.
- Securing the benefits derived from locating R&D and production together in the host country can be achieved via reshoring. Offshoring often involves splitting up parts of the value chain, whereby development and production activities are separated geographically, which often results in more difficult or weaker coordination between the links in the value chain. In times of more volatile market conditions, weaker coordination and market adaptation can be an increasingly harmful competitive disadvantage.
- Lower transaction costs, leaner workflows, just-in-time systems and strengthened supply chain management are becoming increasingly important in international competition. Reshoring means that most links in the supply chain will be located in the same time zone, which means they will be closer to each other and easier to monitor. At the same time, material standards, quality control issues, etc., will be easier to control.
- An increasing focus on the climate impact of business activities, higher transport costs and increasing demand for traceability in the food sector, in particular, will also drive reshoring. Shorter and more direct value chains can reduce energy consumption and thus the climate impact.

- Offshoring involves a risk of losing intellectual property rights, which seems to be a growing problem. Reshoring—and ultimately insourcing—reduces the risk of losing intellectual property rights.
- Political and economic measures to increase reshoring will also have an effect. Several governments want to boost the domestic economy by pulling jobs, assets and resources back home. Such initiatives strengthen and increase reshoring and limit offshoring. However, this political interest in reshoring also risks leading to a conscious or unconscious overestimation of the economic benefits of reshoring.

3.9 Shareholder and Stakeholder Focus

In business strategies, two different management theories are prevalent: The shareholder approach and the stakeholder approach.

A shareholder is a co-owner of the company, typically an institutional investor or other small or large investors. A member or owner of a cooperative is also a shareholder in this context.

The only aim of the shareholder approach is to maximize profit for the shareholders in the short and/or long run. Shareholder value is the benefit delivered to the owners of a corporation as a result of management leading to an increase in profit and value for the owners.

A stakeholder is any individual, group, institution or party that has an interest in an organization and the outcomes of its actions. Stakeholders have different interests, and companies often face trade-offs when trying to accommodate all of them.

Stakeholders can be classified in many ways: They can be grouped according to different criteria such as internal and external groups, primary and secondary groups as well as groups in order of power and interest.

Important stakeholders may be:

- Employees
- Customers
- Shareholders
- Lenders
- NGOs
- Suppliers
- Communities

- Governments

Stakeholders have an interest in the performance of a company for reasons other than profit maximization. Therefore, stakeholder value is the value delivered to all the company's stakeholders, and it includes the optimum level of return for all stakeholders in an organization, which is a broader concept than in the shareholder approach.

There is an ongoing discussion about whether a shareholder or stakeholder approach is the most common and widespread, and whether the importance of the two models is changing over time. One of the reasons for this discussion is, of course, that it is very difficult—or even impossible—to precisely determine the significance of the two models. However, based on literature studies, discussions, business objectives, etc., trends and waves in the prevalence of the two approaches can be outlined, cf. Fig. 3.20.

After WWII, companies were expected to take national interests into account and help solve socio-economic problems in parallel with the objective of profit maximization.

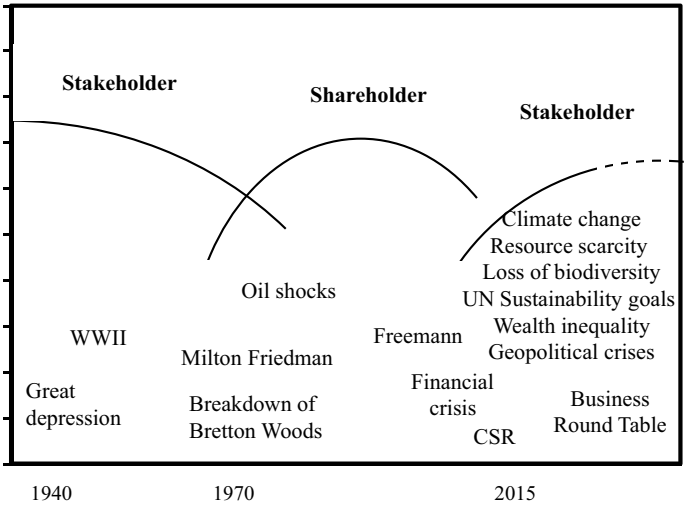


Fig. 3.20 Shareholder and stakeholder focus: Outlined waves and drivers (*Source* Own presentation)

However, the economic shocks of the 1970s, the breakdown of Bretton Woods (an international monetary agreement), oil crises, inflation, etc., created an unstable environment. Therefore, the shareholder approach became dominant, and Milton Friedman—the American economist, who was awarded the Nobel Memorial Prize in Economics in 1976 was an outspoken supporter of the shareholder value model. He argued that the role of corporations is to maximize profit and to serve the owners of the company. Any interest in social responsibility, such as environmental protection or improved workers' rights, should not be pursued at the expense of the company (Friedman, 1970).

The shareholder model dominated for many years as a way of increasing competitiveness. Furthermore, the global spread of the academic disciplines of economics contributed to its dominance (Bottenberg et al., 2017).

However, the financial crisis that started in 2008 raised questions about the validity of the shareholder model as well as the legitimacy of the institutions that drove the development. Companies were accused of abusing their power, and a misalignment between corporate and societal goals created mistrust in the banking and financial sector, cf. Mukunda (2014).

Also, grassroots movements began to encourage companies to think about their triple bottom line, profit, people and the planet (Marquis, 2019). Companies were asked to take into account people and the planet along with their profits.

The new stakeholder approach was also supported by Professor F. E. Freeman, who was among the first to describe the theory, see for example Freeman (2010).

The desire to think about more than just the shareholder is a trend that has been growing since the 2008 financial crisis.

Not only the financial crisis but also several other factors have driven and strengthened the stakeholder approach. The Covid-19 pandemic and geopolitical tensions have probably also motivated business leaders to place more emphasis on the stakeholder approach. As shown in Fig. 3.20, the climate crisis, the UN sustainability goals, resource scarcity, etc., have also contributed to changing the agenda.

A significant milestone in a new stakeholder wave emerged in 2019, when the CEOs of nearly 200 companies announced that shareholder value was no longer their main objective. For the past 20 years, the Business Roundtable, a non-profit organization consisting of the CEOs of US companies has had the view that maximizing shareholder value should

be the principal goal of a corporation. However, in August 2019, The Business Roundtable updated its statement to reflect the belief that there was a "fundamental commitment to all of our stakeholders", cf. Business Roundtable (2019).

Assuming that this is a new long-term wave and not just a short-term bubble, a dominant stakeholder approach will set a new framework for the behavior and development of food businesses.

References

BarthHaas. (2022). *BarthHaas Report 2021/2022*. https://www.barthhaas.com/resources/barthhaas-report

Bjørn, C. (1982). *Dansk Mejeribrug: 1882–2000*. De danske Mejeriers Fællesorganisation.

Boesler, M. (2014). How the global beer industry has consolidated over the last 10 years in two charts. *Business Insider*. https://www.businessinsider.com/global-beer-industry-consolidation-2014-2?r=US&IR=T

Bottenberg, K., Tuschke, A., & Flickinger, M. (2017). Corporate governance between shareholder and stakeholder orientation: Lessons from Germany. *Journal of Management Inquiry, 26*(2), 165–180. https://doi.org/10.1177/1056492616672942

Business Roundtable. (2019). *Corporate governance: Business roundtable redefines the purpose of a corporation to promote 'An economy that serves all Americans'*. Business Roundtable. https://www.businessroundtable.org/business-roundtable-redefines-the-purpose-of-a-corporation-to-promote-an-economy-that-serves-all-americans

Cho, S., & Chung, C. Y. (2022). Review of the literature on merger waves. *Journal of Risk and Financial Management, 15*(10), 432. https://doi.org/10.3390/jrfm15100432

Cogeca. (2015). *Development of agricultural cooperatives in the EU 2014*. European agri-cooperatives (Cogeca). https://www.europarl.europa.eu/meetdocs/2014_2019/documents/agri/dv/copa-cogecareport_/copa-cogecareport_en.pdf

Deconinck, K. (2021). *Concentration and market power in the food chain*. OECD Publishing. https://doi.org/10.1787/3151e4ca-en

Demko, I. (2018). *Trends of U.S. agricultural cooperatives (1913–2016)*. CFAES Center for Cooperatives.

Dikler, J. (2021). Reshoring: An overview, recent trends, and predictions for the future. *KIEP Research Paper, World Economy Brief, 11*(35). https://doi.org/10.2139/ssrn.3916557

EY. (2015). *Reshoring manufacturing—Time to seize the opportunity*. Ernst & Young LLP. https://www.criticaleye.com/inspiring/insights-servfile.cfm?id=4282

Freeman, R. (2010). Stratgic management—A stakeholder approach. *Cambridge University Press*. https://doi.org/10.1017/CBO9781139192675

Friedman, M. (1970). The social responsibility of business is to increase its profits. *New York Times Magazine* (pp. 122–126).

Hansen, H. O. (2013). *Food economics: Industry and markets*. Routledge.

Hansen, H. O. (2020). Danish farmer cooperatives: Development, importance and lessons. *Cooperativismo & Desarrollo, 29*(119), 1–34. https://doi.org/10.16925/2382-4220.2021.01.03

Hansen, H. O. (2018). *Strategic challenges and solutions in agro and food companies*. Samfundslitteratur.

Heineken. (n.d.). *Our Strategy—Welcome to EverGreen*. https://www.theheinekencompany.com/our-company/our-strategy

ICA. (n.d.). *Facts and figures*. Retrieved february 2, 2024, from International Cooperative Alliance: https://www.ica.coop/en/cooperatives/facts-and-figures

Marquis, C. (2019). *The business roundtable CEOs have spoken. Here's how they can act*. https://socapglobal.com/2019/09/the-business-roundtable-ceos-have-spoken-heres-how-they-can-act/

Martinez, S. W. (2007). *The U.S. food marketing system: Recent developments, 1997–2006*. United States Deptartment of Agriculture, Economic Research Service. https://www.ers.usda.gov/publications/pub-details/?pubid=45821

Mondeléz. (n.d.). *Growth & strategy*. https://www.mondelezinternational.com/: https://www.mondelezinternational.com/About-Us/Who-We-Are/Growth-Strategy

Mukunda, G. (2014). The price of wall street's power. *Harward Business Review, 92*(6), 70–78.

Nestlé. (n.d.). *Our business strategy*. https://www.nestle.com/about/strategy

Reshoring Initiative®. (n.d.a). *Presentations*. https://www.reshorenow.org/presentations/

Reshoring Initiative®. (n.d.b). *Reshoring Initiative® 2022 Data Report*. Reshoring Initiative®. https://reshorenow.org/content/pdf/2022_Data_Report.pdf

Reshoring Initiative®. (n.d.c). *Reshoring Initiative® 2020 Data Report*. https://reshorenow.org/content/pdf/RI_2020_Data_Report.pdf

Rogers, R. T. (2001). Structural change in U.S. food manufacturing, 1958–1997. *Agribusiness, 17*(1), pp. 3–32. https://doi.org/10.1002/1520-6297(200124)17:1<3::AID-AGR1001>3.0.CO;2-1

Sisodiya, A. S. (2004). *Mergers and demergers: Concepts and cases*. ICFAI University Press.

Tremblay, V. J., Iwasaki, N., & Tremblay, C. H. (2005). The dynamics of industry concentration for U.S. micro and macro brewers. *Review of Industrial Organization, 26*, 307–324. https://doi.org/10.1007/s11151-004-8114-9

Tyson Foods. (2021). *Tyson foods: Outpacing a growing, global protein market*. https://www.tysonfoods.com/news/news-releases/2021/12/tyson-foods-outpacing-growing-global-protein-market

UNCTAD. (2023). *World Investment Report: Annex Tables*. https://worldinvestmentreport.unctad.org/annex-tables/

USDA. (2005). *Cooperatives in the Dairy Industry*. United States Department of Agriculture. Retrieved from https://www.rd.usda.gov/files/cir1-16.pdf

USDA. (2015a). *Farmer, rancher, and fishery cooperative historical statistics, 1913–1950*. United States Department of Agriculture, Rural Development Cooperative Programs. https://www.rd.usda.gov/sites/default/files/cir1-26-part-i-stats-1913-1950_0.pdf

USDA. (2015b). *Farmer, rancher, and fishery cooperative historical statistics, 1951–1999*. United States Department of Agriculture, Rural Development Cooperative Programs. https://www.rd.usda.gov/sites/default/files/cir1-26-part-ii-stats-1951-1999_0.pdf

USDA. (2015c). *Farmer, rancher, and fishery cooperative historical statistics, 2000–2012*. United States Department of Agriculture, Rural Development Cooperative Programs. https://www.rd.usda.gov/sites/default/files/cir1-26-part-iii-stats-2000-2012.pdf

Vestring, T., & Felenbok, J.-P. (2017, January 18). *How Conglomerates in Southeast Asia can live long and prosper*. Bain & Company. https://www.bain.com/insights/how-conglomerates-in-southeast-asia-can-live-long-prosper/

Wadsworth, J. J. (2019). *Marketing operations of dairy cooperatives: 2017*. Washington DC: United States Department of Agriculture. Retrieved from https://www.rd.usda.gov/files/publications/RR234MarketingOperationsofDairyCooperatives2017.pdf

Wi, P. Y. (2018). *The dynamic change analysis and implications of Korea's top 500 companies (1998–2017)*. ERRI (Economic Reform Research Institute).

CHAPTER 4

Food Value Chains

4.1 Introduction

Value chains in the agricultural and food industry are important as they connect the links from farm to table. Since the food value chain often involves living organisms or perishable products, efficiency is essential.

The concept of the food value chain is not clearly defined. In the following, the food value chain is defined as *the network of stakeholders involved in supplying, producing, processing, and selling the food from farm to table*.

The from farm to table concept will normally include these essential links in the value chain:

- Supply of inputs to agriculture and the entire value chain including feed, machinery, equipment, capital, R&D, etc.
- Agriculture (farms)
- Processing and refinement
- Wholesale
- Retail and food service
- Consumers

The food value chain is thus a vertical axis. Outside this axis, but in a well-defined sphere, other stakeholders are located including the public authorities, NGOs, etc. Sometimes, several stakeholders outside

H. O. Hansen, *Megatrends in Agriculture, Food Industry and Food Markets*, Palgrave Advances in Bioeconomy: Economics and Policies,
https://doi.org/10.1007/978-3-031-58152-6_4

the vertical value chain are also included, but then it is more of an industrial cluster, which is a broader and slightly different concept than a value chain.

The concepts of value chain and megatrends are connected. Value chains develop and change—often influenced by or as a consequence of megatrends:

- The balance of market and bargaining power in the value chain shifts.
- The controlling and dominant parts of the value chain move vertically (The integrator or the dominant part of the value chain may move from, e.g., farmers to industry).
- The forms of integration in the value chain develop and change.
- The value chains are becoming globalized, and global value chains are becoming more important.
- A significant structural development in the value chain is taking place but at varying speeds and extents in the links.
- Both constant megatrends and cyclical processes (waves) can be identified.

The vertical integration in the food value chains means that the links are coordinated and made more efficient.

The integration or coordination can be either backward or forward.

Backward integration is typical when a food industry is involved in the supplying industries, including agricultural production. There are several examples of food companies entering into long-term production contracts with farmers, whereby the food companies set the conditions for agricultural production. There are also several examples of food companies buying farms around the world in order to ensure deliveries of agricultural raw materials.

If integration takes place with a business unit further down the value chain (closer to the consumer), it is called forward integration. Forward integration by the agricultural industry into the food-processing industry via farmer cooperatives and producer organizations is very widespread. The important drivers behind this development are stronger bargaining power and lower transaction costs.

Forward integration is also called downstream integration, and backward integration is called upstream integration. The opposite of vertical

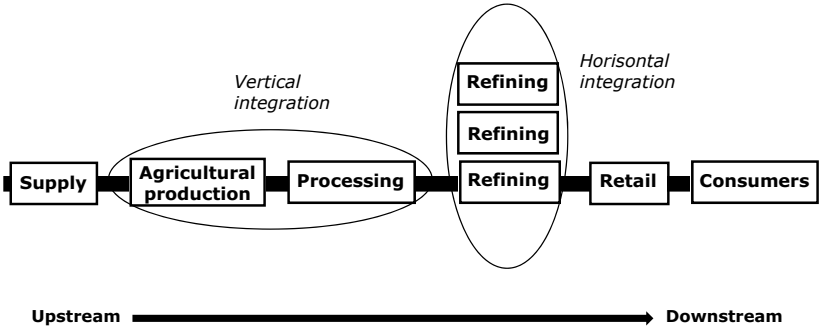


Fig. 4.1 Examples of vertical and horizontal integration in the agricultural and food value chain (*Source* Own production)

integration is horizontal integration, which includes coordination, acquisitions, mergers or alliances at the same stage of the value chain.

Figure 4.1 illustrates a relatively simple value chain in the agricultural and food sectors with examples of vertical and horizontal integration. A value chain can be expanded with many more links, flows and connections.

Vertical integration means that a company obtains more control over its value chain. The degree of control varies between cases and ranges from short-term sales contracts to full and integrated ownership, cf. Fig. 4.2.

The ranking is not unambiguous and to a certain extent arbitrary as, e.g., alliances and long-term sales and production contracts may have a very high degree of integration depending on the specific conditions in the contract.

Similarly, the degree of vertical integration in cooperatives varies significantly between cases.

4.2 Integrators in the Value Chain

As discussed in Sect. 4.1, the controlling and dominant parts of the value chain move vertically. This shift in power manifests itself in the fact that the dominant or integral parts of the value chain can move from, e.g., farmers to processing companies. It is difficult to show empirically which

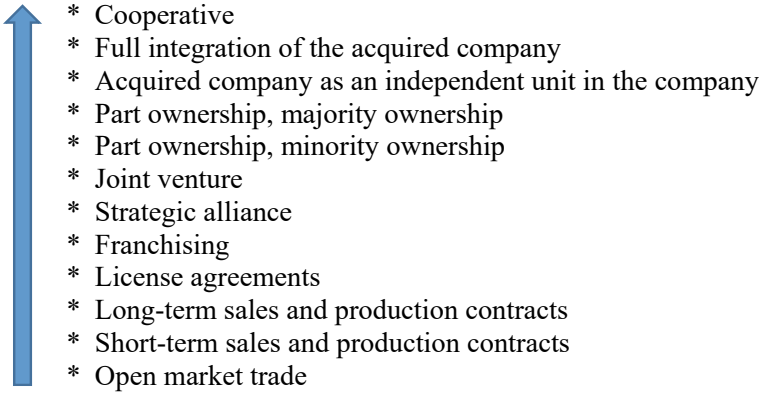


Fig. 4.2 Types and levels of vertical integration (*Source* Own production)

link is the most integral in a value chain, but cases and estimates of economic performance can be used to indicate a development.

Figure 4.3 shows four value chains with different integrated parts.

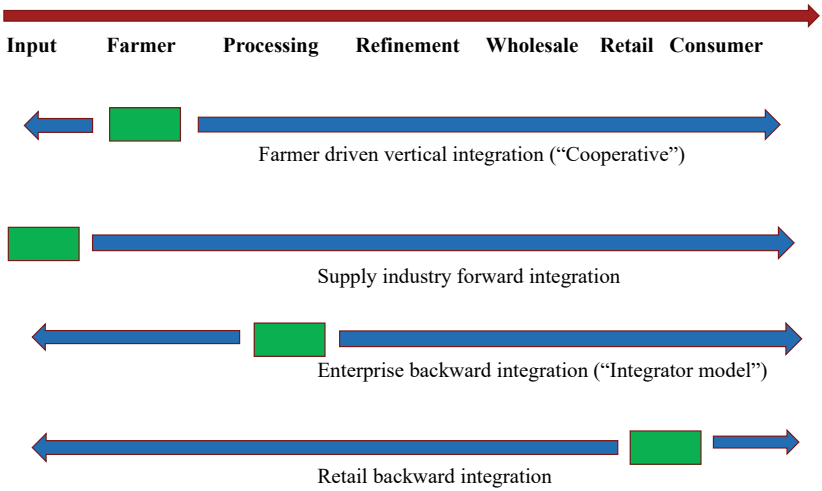


Fig. 4.3 Vertical integration with different links that control the integration (*Source* Own presentation)

The figure shows value chains (from farm to table) as well as the leading integrators and drivers behind the integration.

The first value chain in Fig. 4.3 is a "traditional" farmer-driven cooperative in which farmers move both forward and backward in the food value chain. As discussed in Sect. 3.7, this form of value chain ownership has worked for many decades, and it appears to continue to be economically, marketwise and organizationally justified.

The next value chain is called supply industry forward integration. Several examples show that large supply companies, particularly within the feed supply industry, are moving forward in the value chain. The supply companies integrate forward into agricultural production via contracts and concept breeding and integrate into processing and refinement of agricultural goods. This is often driven by the fact that mark-ups increase as a company moves downstream toward the consumer link, especially compared to a trading company that buys and sells commodities.

The third value chain, enterprise backward integration, has received more attention recently because ownership, coordination and integration in the value chain is increasingly taking place at the processing and/or refinement stage, i.e., the "integrator model". In this model, the processing link (typically a slaughterhouse or dairy) is the central integrator in the value chain. The integrator moves backward in the value chain by, e.g., purchasing farms, offering contract production to the farmers, purchasing production inputs (animals, buildings, machines), financing inputs (feed, etc.), deciding production methods, ensuring farm-to-table coordination and traceability, etc.

Spain is often highlighted as a country with widespread use of the integrator model in the pig sector. The Spanish pig sector is thus organized significantly differently than it is in the rest of the EU. In Catalonia, 63 percent of all farms are in integrated value chains—some value chains are from feed to slaughter, while others only include feed and pig production (Eurostat, 2016; ter Beek, 2017).

Interest in the Spanish integrator model is due to the fact that in recent decades Spain in particular has experienced marked progress in the pig industry in the form of strong growth in both the production and export of pork. Today Spain is among the EU's largest producers and exporters of pork, and the integrator model is considered to be a significant explanation for the success.

It seems that the most important reasons (drivers) for the positive development in the Spanish pig industry are:

- Industry concentration: Economies of scale and market power have made large entities more competitive throughout the value chain.
- Financial crisis: The small farms were not sufficiently competitive and, therefore, suppliers integrated forward to farmers in the value chain sometimes to secure the debts owed to them by farmers
- Increasing food security: Vertical integration became more necessary to control and strengthen food security.

In recent decades, the integrator model has become increasingly widespread in parallel with the emergence of more efficient feed factories. The integrator model is today considered a pioneer in the Spanish pig sector.

The fourth and final value chain, retail backward integration, is discussed more in detail in Sect. 4.9.

4.3 Open Markets

As discussed in Sect. 4.1, open market trade involves the least vertical integration in the value chain. However, several factors will support or stimulate greater vertical integration and less open market trade including:

- Lower transaction costs
- Improved traceability
- Improved security of supply and demand and thus improved capacity utilization
- Greater price predictability
- Reduced risk of the spread of infectious livestock diseases

The tendency toward less open market trade can be observed in several examples. Figure 4.4 illustrates the development of the American market for hogs during a period of significant change in market integration.

Long-term marketing contracts between large packers and large hog producer-integrators have replaced open market transactions. From 1970 to 1980, around 98 percent of hogs were received by packers from open markets, but after 1980, the share decreased significantly.

In 2009, 8.1 percent of all hogs were sold on open markets (spot markets), while 26 percent were owned and slaughtered by the same packer (Grimes & Plain, 2009).

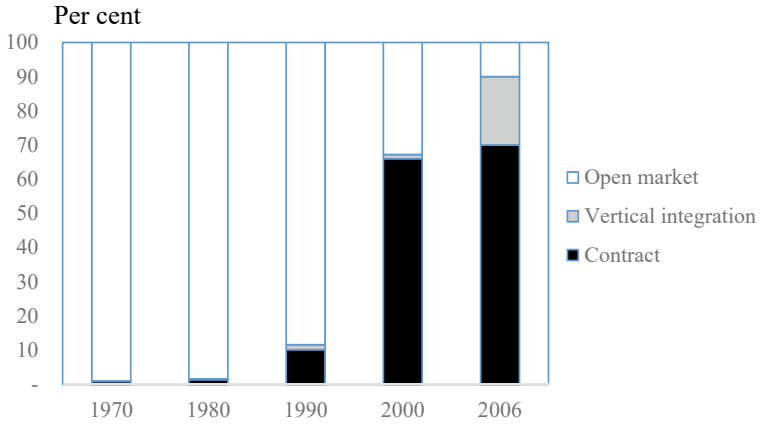


Fig. 4.4 Share of hogs delivered for processing via long-term contracts and vertical integration (*Source* Own presentation based on Martinez [1999, 2007a, 2007b])

Figure 4.5, which presents the share of open market sales of cattle and the share of cooperative cattle slaughters in Denmark, reveals a similar pattern.

The figures clearly illustrate that the role of open markets has been steadily declining and is now insignificant, while farmer-owned cooperatives have been experiencing an increase in market share.

4.4 Retail Market Power

Food companies and retail companies are two major players in the value chain—in the farm-to-table chain. In recent decades, the trend has been for the retail companies to become increasingly large, global and concentrated, and the retail industry has thereby gained greater market power. To a certain extent, this development has come at the expense of the food companies, which have not experienced the same rate of development.

A comparison of the power of balance between the large international food industry companies and the large retail chains thus suggests that a shift in power has taken place.

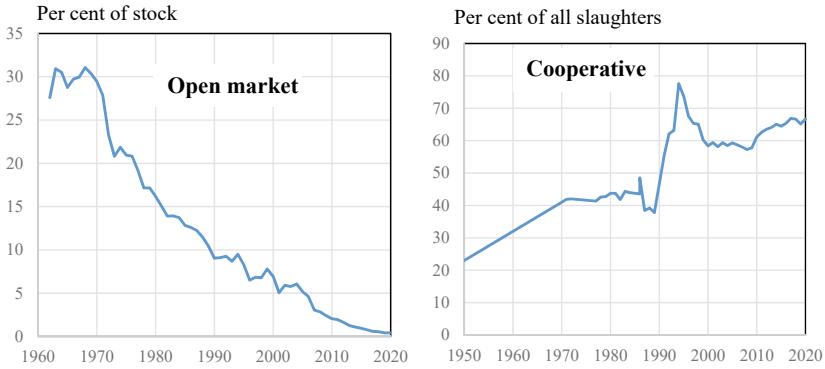


Fig. 4.5 Share of open market sales of cattle and share of cooperative cattle slaughters in Denmark (*Note* The share of open market: Annual sales on open markets as a share of total stocks of cattle. Cooperative: Intake (number) of cattle to farmer-owned cooperative slaughterhouses as a share of total intake. *Source* Own calculations based on statistical data from Danish Agriculture & Food Council and Statistics Denmark)

Firstly, Fig. 4.6 illustrates the change in the distribution of power in the food value chain from the period before the Second World War, through the 1990s and up to the present.

In the period before World War II, the wholesalers had the strongest position and power because they controlled the information about consumer demand, qualitative and quantitative needs and the logistics of the grocery suppliers. The retail trade industry consisted of many small independent shops which were poorly organized. The role of retail was primarily to distribute the manufacturers' goods, which included very few branded products.

After the Second World War, the food companies took over the role of wholesalers and became distributors directly supplying the store chain, thereby bypassing the wholesale link. By improving the efficiency of their marketing, food producers could avoid the expensive wholesale link. At the same time, manufacturers managed to build consumer preferences through increased demand for processed products.

In the 1990s, the balance of power shifted in favor of the retail trade. The important factors were the retail industry's close proximity to consumers, advantages connected to the introduction of private labels and

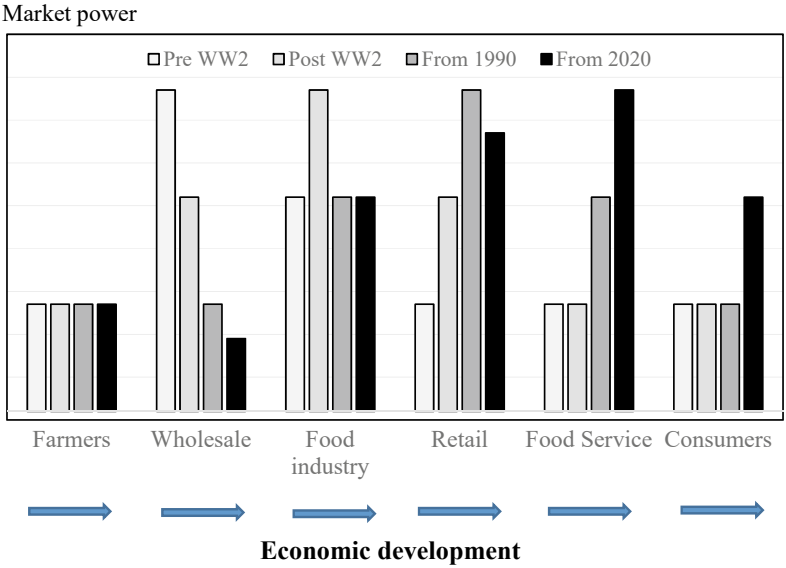


Fig. 4.6 Market power in the food value chain—schematic diagram illustrating the change in the power structure (*Note* The arrows show for each link in the value chain the development from before WW2. Market power is illustrated schematically and qualitatively. *Source* Own presentation)

information technology and increasing concentration and internationalization. These factors together meant that the retail industry became a dominant link in the chain from farm to table. In particular, the information about the customers and the market, which the retail chains have due to their position in the value chain, is considered a significant source of market power, cf. for example Grievink et al. (2003).

Also in the 1990s, food service in the form of catering, restaurants, takeaway, ready meals, canteens, etc., gained in importance as a result of changing consumer habits and increasing welfare and purchasing power. A declining proportion of food was bought in supermarkets, but the retail trade was able to protect their power through either growth and structural development or by developing in-store food services.

Since the beginning of the 1990s, further shifts which have further strengthened the position and market strength of the retail industry vs. the food companies have taken place.

The revenue of the five largest retail companies has grown significantly and is now greater than the revenue of the five largest food companies. Indeed, today it is almost twice as large, cf. Fig. 4.7.

Size is an important competitive parameter: Increasing size leads to economies of scale and greater bargaining power and thus increased competitiveness.

As well as the increasing size of the retail companies, their use of private labels, backward integration and globalization helped the retail industry strengthen its market power and shift the balance of power in its favor.

Looking forward, there are some unanswered questions: Who will have the central role in the future online food service market? Will the retail trade, the hotel and restaurant segment or the food industry play an important role, or will Amazon, Alibaba or the like become the preferred supplier?

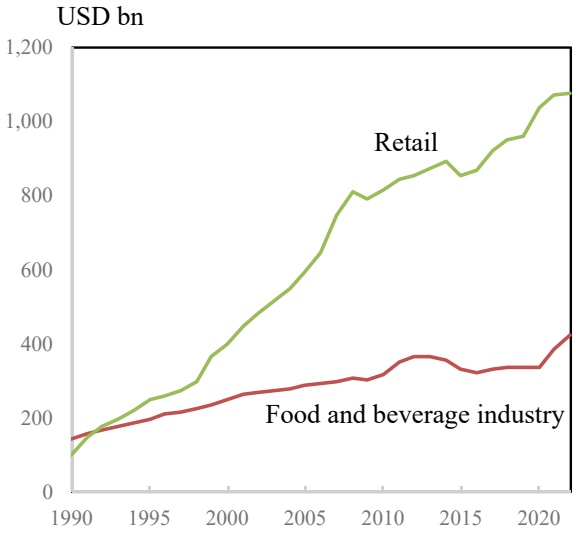


Fig. 4.7 Total revenue of five largest retail companies and food companies (*Source* Own presentation based on Deloitte [several issues], Grievink [2003] and annual reports from companies and own calculations)

4.5 Brands and Private Labels

As discussed in the previous section, market power in the value chain is changing. In many cases, the industry is gaining more bargaining power over its suppliers, which is often the food industry. Increased use of private labels is both a means of strengthening retail's market power and a very visible manifestation of this change in the balance of power.

Firstly, it is necessary to define the two concepts, private labels and brands:

> *Private labels* (also known as store brands, own labels or distributor-owned brands) are the supermarkets' own brands, which bear the chain's name, or a name owned by the chain. The producer's name does not appear or, if it does, it is very discrete. For producers of private labels, marketing costs are low, which means they can offer the products at a price that is lower than the price of a brand name equivalent. Often, the quality is not the highest, although there is a general tendency for the gap between the quality and price of brands and private labels to narrow. The retail industry hopes to build loyalty to their chain by offering private labels.
> *Brands* are company labels which retain their identity throughout the process to the ultimate end user. These are often a little more expensive than other products and the company is mainly responsible for marketing and promotion. Brands often require significant investment in marketing in order to maintain the higher market price. Normally, brands are connected with higher quality.

Calculating market shares for private labels is often complicated: Which product groups should be included in the market analysis? Is the selected narrow product group representative of the entire segment? Studies have shown that fresh milk and frozen food typically have large market shares, while other product groups are more dominated by brands.

Despite uncertainties connected with calculation, estimates of the market shares have been made. Several studies conclude that private labels in Fast-Moving Consumer Goods (FMCGs) are increasing:

Gielens et al. (2023) note that in recent decades, private labels have become mainstream in most consumer packaged goods markets. This trend has been observed in many categories, countries and retail industries. The results of their survey show increasing market shares of private

labels in all countries. The increases in percentage and in percentage points are greatest in countries with the smallest market shares of private labels.

Bunte et al. (2011) also note that the market share of private labels has grown steadily in recent decades. For example, in the EU, private labels account for 23 percent of the groceries market.

Rabobank (2012) estimated that the market share of private labels in the years 1999–2010 increased from 20 to 31 percent and predicted that it would continue to increase to more than 50 percent by 2025.

Dobson and Chakraborty (2015) refer to several studies and conclude that, globally, the market share of private labels has been increasing over time and represents around 15 percent of FMCG sales.

At the global level, the market share of private labels varies considerably between countries. In general, the market share increases with increasing economic development, cf. Fig. 4.8.

The figures illustrate a relatively unambiguous and clear correlation. However, the growth in private labels does not only depend on the economic level: The concentration of the retail trade—and thus also market poweris decisive. Therefore, there is also a strong correlation between retail concentration and market shares for private labels, cf. Hansen (2005).

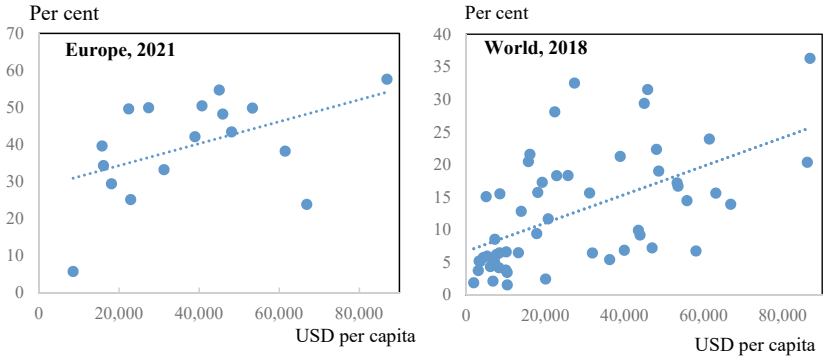


Fig. 4.8 Market share of private labels in EU countries and in the world—as a function of GDP per capita (*Sources* Own presentation based on Gielens et al. [2023], PLMA [2022], and statistical data from World Bank)

Cultural differences and consumer trust in brands may also be important explanations for differences in private label market shares between countries. However, the trend toward an increasing market share for private labels, especially in countries which only have a few private labels, is relatively certain.

The driving forces behind the growth in private labels are as follows, cf. Hansen (2005), Martec (n.d.), Noormann and Tillmanns (2017).

- Strong retail chains create more private labels. The balance of power between retail chains and food companies is crucial, as retail chains have an interest in private labels, while food companies are primarily interested in strong branded products. However, some food companies which strategically focus on producing private labels for the retail chains have an interest in more private labels.
- Retail concentration. In a market with a few large and thus strong retail chains, private labels typically enjoy relatively large market shares.
- Economic development. A clear correlation between a country's level of economic development (GDP per capita) and the private label share of the market has been identified. Economic development is probably a proxy, which describes the historical and structural change in a society, including changes in the retail trade.
- Consumer trust and loyalty toward branded goods. Marketing is a driving force in that it can strengthen both consumer trust and loyalty.
- Cultural differences: The demand for private labels and/or branded goods may depend on age/generation.
- Differences in product segments: Private labels typically have larger market shares in niche markets such as health products, while branded goods have a relatively large market share in segments that consumers are familiar with such as snack foods, soft drinks, etc.
- Discount wave: Private labels appear primarily in the discount segment, and with increasing discounts, private labels increase their market shares.
- Price gap between private labels and branded products.
- The expansion of private labels in the premium segment increases the product range and thus also the market share.

These drivers may have different impacts and they may be interdependent. For example, a highly concentrated structure in the retail industry will often mean strong retail chains and strong market power.

4.6 Retail Industry: Concentration

Changes in concentration in the value chain can affect market power and, therefore, competitive conditions upstream and downstream. Concentration in the retail industry has had a significant impact on the food industry in several areas. Examples illustrate that structural developments have occurred in the food industry in order to match the increasingly large retail chains (Hansen, 2005). Dobson (2002) believes that the increasing concentration of the retail sector has been a major reason for the structural change in the food industry in the form of fewer and larger companies and the lack of investment in new methods and products in the food industry.

Quantifying the extent of concentration in the food retail industry is complicated for several reasons:

- Concentration is calculated based on information about market shares, which is often considered confidential information by the companies. Access to data can, therefore, be difficult and its quality may be questionable.
- The retail industry may include many different product segments. In general, food will be an important part of the range, but other product groups and own production may contribute to the total turnover and the total market. New online and non-store companies are also part of the market, and they must also be included when market shares are calculated.
- A significant change among the largest retail chains is currently taking place. This means that several companies must be followed and must be included in the ongoing collection of financial key figures, cf. Table 4.1.

As can be seen in Table 4.1, more than half of the companies on the top 10 list in 2021 are new compared to 2001.

In parallel with a major replacement of the largest companies in the international retail industry, a significant increase in concentration

Table 4.1 World top 10 retail companies, 2001 and 2021

	2001		*2021*
1	Wal-Mart	1	Wal-Mart
2	Carrefour	2	Amazon
3	Ahold	3	Costco
4	Home Depot	4	Schwarz Group
5	Kroger	5	Home Depot
6	Metro	6	Kroger
7	Target	7	J.D.com
8	Albertson's	8	Walgreens
9	Kmart	9	Aldi
10	Sears	10	Target

Note Ranked by annual revenue. All retail formats are included
Source Own presentation based on Deloitte (several issues) and the companies' annual reports

has taken place. Figure 4.9 presents some examples of the increasing concentration in the retail industry in selected geographically diverse countries.

The figure demonstrates a very clear trend toward increasing concentration in countries on five different continents during the period.

Generally, the retail industry is most concentrated in the most developed countries (Dobson, 2002), so continued increasing concentration will probably take place in the retail industry in line with economic development.

Among the large globally oriented retail companies, increasing concentration is evident: At any given time, the 10 largest retail companies' share of the turnover of the 250 largest retail companies has been increasing in recent decades, cf. Fig. 4.10.

In 2021, the 10 largest retail companies' share of the total retail revenue of the Top 250 had increased to 34 percent, compared to 29 percent in 2004.

Especially in recent decades, concentration has been increasing in the USA. The increase is largely due to several large mergers among the retail companies.

Among grocery stores in the USA, the 4 largest grocery companies' share increased from 17 percent in 1992 to 42 percent in 2016, cf. Fig. 4.11.

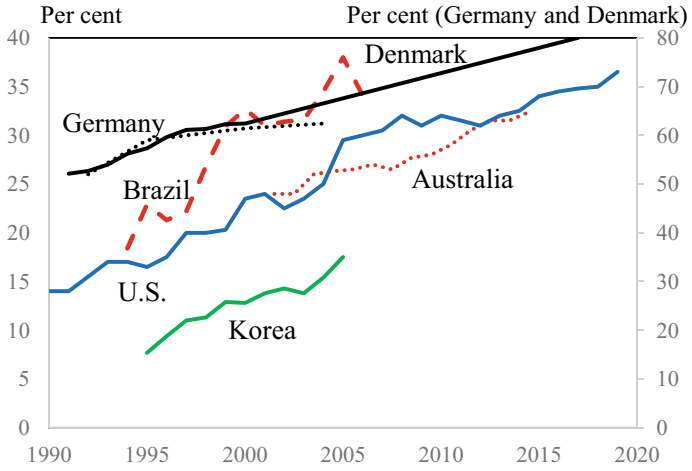


Fig. 4.9 Development in concentration in the retail industry in selected countries (*Note* USA: Top 4 firms' share of US food retail sales. Brazil: Concentration rate (CR3) in the Brazilian retail sector. Korea: National CR4 of Conventional Supermarket Sector. Australia: Top 4 firms' share of retail sales. Germany: Market Share of the top 5 leading companies in German food retailing. Denmark: Top 2 firms' share of retail sales. *Sources* Hambur and La Cava [2018], Herrmann et al. [2009], Kim [2009], Retail Institute Scandinavia [several issues], and statistical data from USDA)

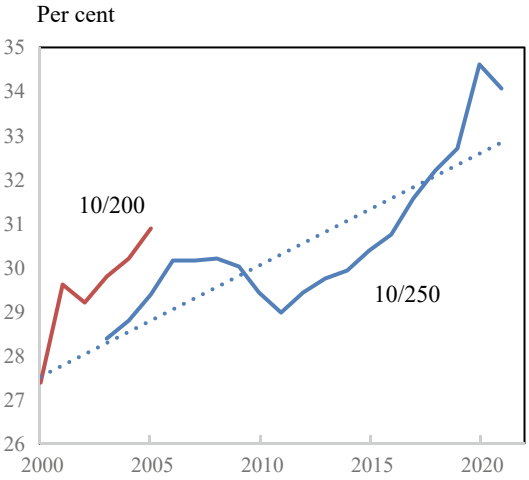


Fig. 4.10 Concentration of global retail industry, 2000–2021 (*Note* Annual revenue of largest 10 retail companies of 200 and 250 largest companies. Trend line for 2004–2019 is included. *Source* Own presentation based on Deloitte [several issues])

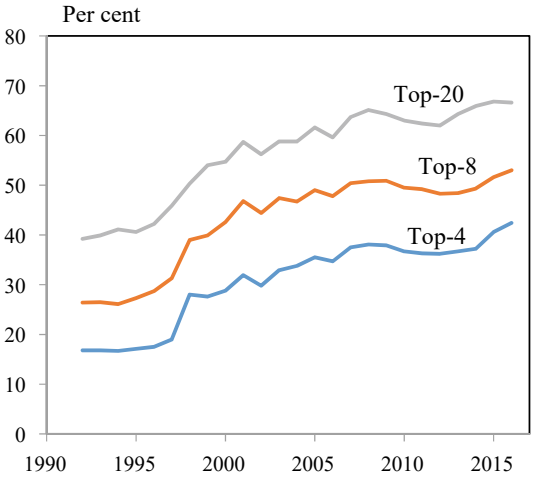


Fig. 4.11 Share of sales for the top 4, 8, and 20 grocery stores in the USA, 1992–2016 (*Source* Rudd, 2019)

The level of concentration in the USA seems to have stabilized at a rather constant high level. Competition law and limited economies of scale are likely explanations for this development. Other countries with less concentration and a lower level of economic development will, however, probably experience a continued increase in retail concentration.

In these countries, significant economies of scale are still likely to be available. In addition, the retail industry and the food industry will continuously seek to strengthen their market power vis-à-vis each other through growth and also increased concentration. The food industry has, to some extent, been forced to follow the same development to preserve the balance of power. In the real world, this means that mergers and investments are often motivated by a need to match the ever-larger and more global retail chains—and vice versa.

The differences in concentration levels among the EU countries can largely be explained by two factors: the size of the countries (negatively correlated) and the countries' level of development (positive). To illustrate this correlation, Fig. 4.12 shows that the concentration is highest in the economically most developed EU countries.

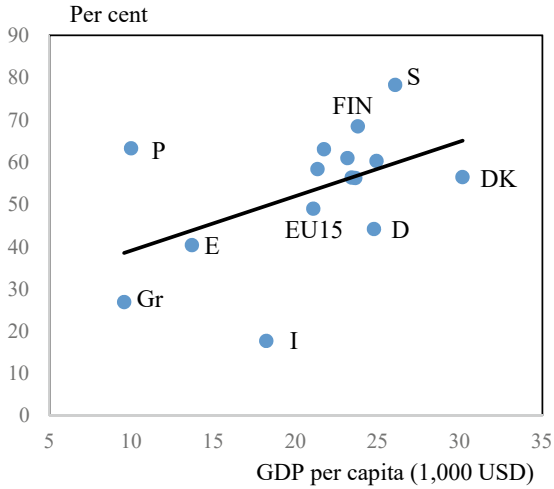


Fig. 4.12 GDP per capita and retail concentration (CR5) in European countries (1999) (Own presentation based on Dobson [2002] and statistical data from World Bank)

4.7 Retail: Globalization

The structure of the retail industry is undergoing continuous change on several dimensions. One of the most significant global trends in recent decades is increasing globalization: Since the early 1990s, the general trend in the retail industry has been an increasing focus on sales outside the domestic market. The increase in foreign sales among the large retail companies has been significant (see Fig. 4.13).

The figure shows a relatively clear increase in international activities. The development has been significant in recent decades; however, stagnation seems to have been reached in recent years.

While Fig. 4.13 shows the long-term internationalization for selected large retail companies, Figs. 4.14 and 4.15 show other average key figures for the 250 largest retail companies in the world.

Figure 4.15 shows that 20–25 percent of the turnover of the large retail companies comes from foreign operations. After strong growth at the beginning of the 2000s, the level is now almost constant or even slightly decreasing.

Almost the same development can be observed when it comes to the number of countries where companies have retail operations—another measure of internationalization. Here, too, strong growth at the

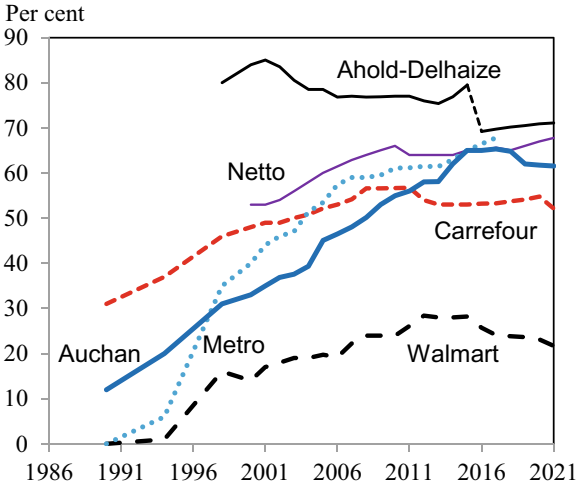
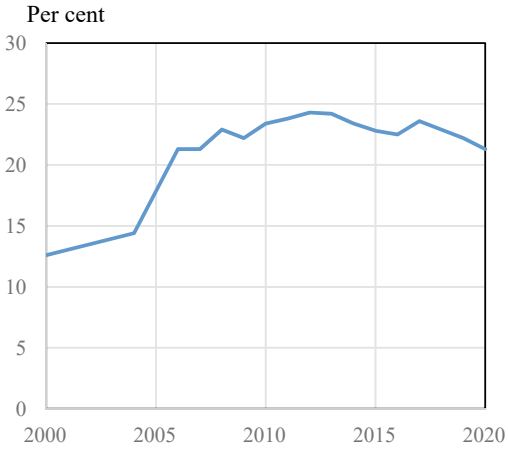


Fig. 4.13 Sales outside the domestic market for selected retail companies (percent) (*Note* Netto: Retail area in foreign countries. *Sources* Own presentation based on the companies' annual reports)

Fig. 4.14 Top 250 retailers: Share of retail revenue from foreign operations (*Source* Own presentation based on Deloitte [several issues])



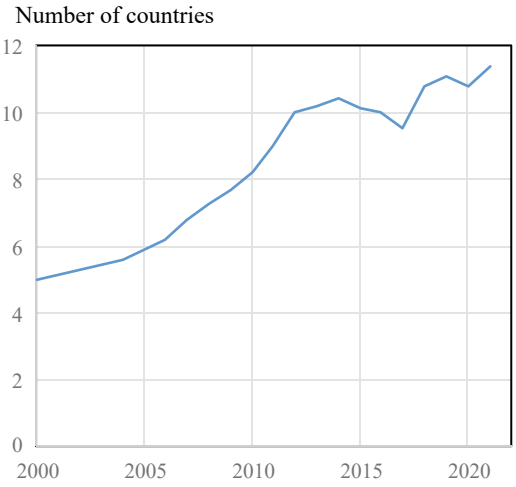


Fig. 4.15 Top 250 retailers: Average number of countries where companies have retail operations (*Source* Own presentation based on Deloitte [several issues])

beginning of the 2000s was a dominant trend, but subsequently, the development has been almost constant.

The slowdown in internationalization is most evident among the very large retailers, cf. Fig. 4.16.

The figure shows the development of the 10 largest retailers in the world. As can be seen, their foreign activities have declined in relative importance—calculated as the number of countries with foreign activities and foreign turnover. In contrast, their share of the 250 largest retailers' revenue has increased. The trend has changed to less globalization and more domestic growth.

Several possible explanations for this development can be identified. The economic benefits of globalization have probably been overestimated, and short-term profit goals have probably been more important than growth goals and long-term profit goals. Gains from economies of scale via expansion abroad have an upper limit, and the marginal benefits may be small compared to the disadvantages in the form of geographical distance, cultural differences, preferences for local providers, logistical problems, international management, etc.

In order to understand, explain and predict the globalization of the retail industry, the driving forces that drive and have driven the development must be identified.

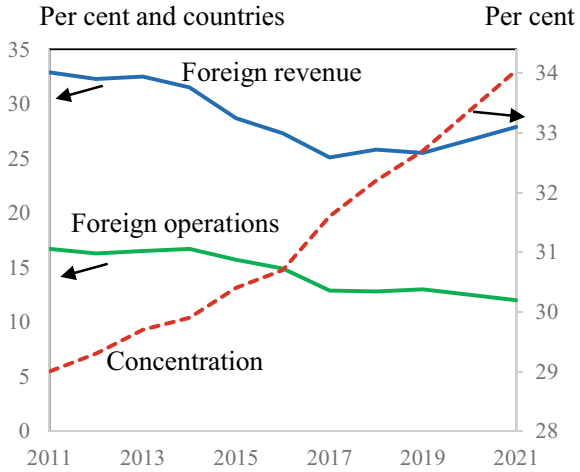


Fig. 4.16 Top 10 retailers: Globalization and concentration (*Notes* Foreign revenue: Share of retail revenue from foreign operations (percent). Foreign operations: Average number of countries where companies have retail operations. Concentration: Top 10 share of Top 250 retail revenue. *Source* Own presentation based on Deloitte [several issues])

The overall long-term and implicit goal for retail internationalization is assumed to be economic performance, i.e., profit and earnings. In order to achieve this goal, companies typically decide on a number of sub-goals, instruments or drivers that contribute to achieving the goal. Internationalization is not considered a final goal, but rather a sub-goal or a tool to meet an overall goal.

A number of studies have identified a large number of motives and drivers behind the internationalization of the retail industry that has taken place in recent decades, cf., e.g., Evans et al. (2008) and Deloitte (several issues). The motives are proactive, reactive, internal and external drivers, cf. Hansen (2013). The most important motives and drivers are as follows:

- Saturation of the domestic market
- Reduction in economic, political and other risks
- Access to market growth
- Utilizing economies of scale

- Increasing market power
- New opportunities for increased sales and scale efficiencies
- First mover advantage (emerging markets)
- Entering a new market with an underdeveloped retail sector
- Entering a new market with increasing purchasing power of consumers
- Access to new international supply channels
- Exploitation of core competencies

4.8 Waves in the Food Retail Trade

Substantial structural changes downstream in the value chain are also evident—changes in parallel with economic development and following clear megatrends. Four waves or trends can be identified, and the development can be outlined as presented in Fig. 4.17.

The first wave is a trend toward increasingly fewer specialized food shops such as butchers, bakers, fishmongers, etc. The local open markets and the so-called wet markets are also becoming less important.

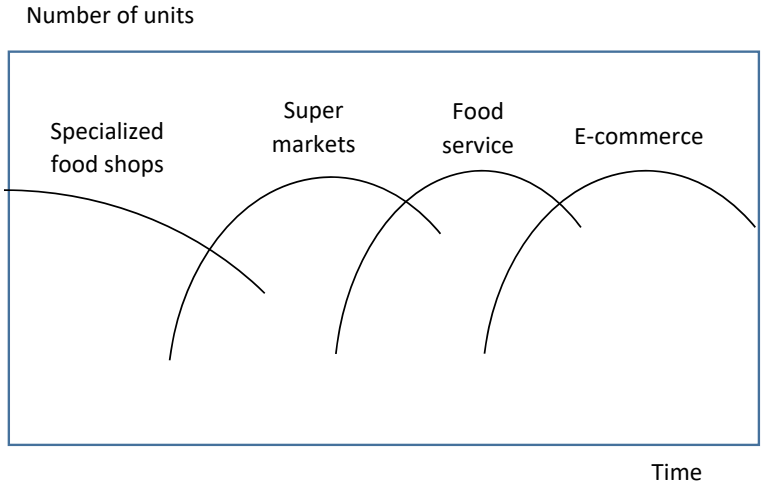


Fig. 4.17 Changes in food retail (*Source* Own presentation)

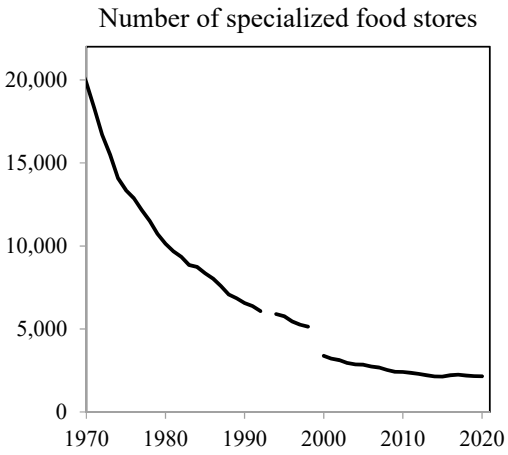


Fig. 4.18 Number of specialized food stores in Denmark 1969–2021 (*Note* Lack of data continuity in 1992–1993 and 1998–1999. The specialized food stores include, among other things, retail sale of bread, cheese, meat, fish, vegetables, sandwiches, etc. *Source* Own presentation based on statistical data from Statistics Denmark)

Figure 4.18 presents some examples of the decreasing role of specialized food stores.

In the second wave, the supermarkets become dominant. The function and market shares of the specialized food stores are, to a certain extent, taken over by the supermarkets. Infrastructure, cold chains and distribution are developed, and this part of the value chain is made more efficient.

In the third wave, supermarkets come under pressure from the expanding food service sector. Food service here includes restaurants, canteens, fast food and takeaway. An increasing proportion of food demand is directed toward meals, while food has a decreasing share of total demand.

Many supermarkets are trying to solve this problem of a declining consumer market by establishing food service units inside the supermarkets. In this way, customers can buy both food and meals in the same place. However, the number of establishments in food services is increasing, while the number of establishments in retailing is decreasing or is more constant. Data from the USA illustrates these different trends, cf. Fig. 4.19.

Figure 4.19 shows the increasing number of establishments in food service since the 1960s.

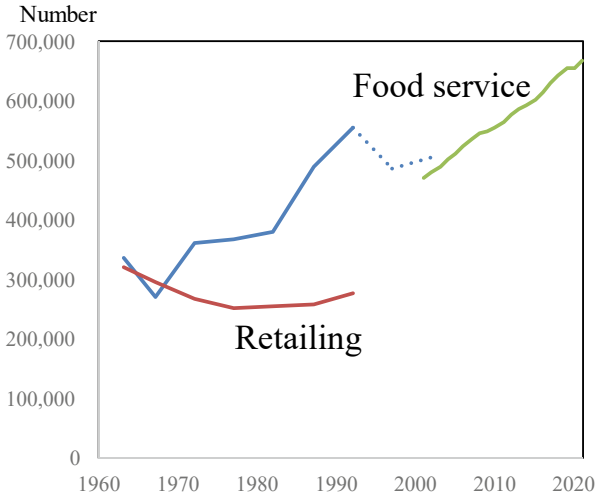


Fig. 4.19 Number of establishments in retailing and food services and drinking places in the USA (*Note* Number of Establishments in Private NAICS 722. Food services and drinking places for all establishment sizes in U.S. Total. *Source* Own presentation based on Martinez [2007a, b], Harris et al. [2002] and statistical data from U.S. Bureau of Labor Statistics)

In the fourth wave, e-commerce will increasingly replace a large proportion of both trade and distribution when it comes to food and meals. Both the retail industry and the food service industry as physical shopping locations will decline in importance. Ready meals will be ordered online. E-commerce will also replace a significant part of the wholesale trade that the agricultural and food sectors depend on.

4.9 Retail Backward Integration

In Sect. 4.2, a fourth and increasingly common value chain was outlined, i.e., retail backward integration. The acquisition of food companies by the retail industry is an example of backward vertical integration. It is obvious that the retail industry is considering whether they should only sell or whether they should also produce or at least become more involved with production.

This section discusses trends whereby the retail industry acquires their direct or indirect suppliers including food companies and farms. The less binding and most reversible forms of integration, cooperation between retail and food industry, is discussed in more detail in Sect. 4.10.

In the past, the retail industry has engaged in backward integration by acquiring or establishing food companies and/or suppliers. Historically, it often took place when the market was imperfect, and when supplies could not be guaranteed from an open market.

In the 1950s and 1960s, there were several cases of backward integration of the retail industry. Retail companies acquired or established, e.g., dairies and milk bottling plants. Right up until 1980, the American grocery industry owned 18 percent of these milk bottling plants, cf. Blayney and Manchester (2000). The purpose of this backward integration was to control the supply. Subsequently, the trend changed completely, and there was a significant number of divestments; a trend that also moved to Europe.

The motives and the background for backward vertical integration by the retail industry have varied over time:

Through the nineteenth *century*, retail chains typically acquired manufacturing companies to achieve growth and larger volume to exploit economies of scale.

In the *middle of the twentieth century*, the motive was to ensure the supply of critical deliveries. Reduced transaction costs were also a common motive at this time.

At the *end of the twentieth century*, competition between the retail chains increased, and at the same time, access to supplies became more available through more perfect markets and increasing internationalization. To a large extent, retail chains followed a strategy based on the core business, internationalization, exploitation of economies of scale, and market strength. The retail chains focused their resources on horizontal integration through mergers and acquisitions, while many of their previous production companies were divested. Backward vertical integration was thereby reduced during this time.

A new and future phase may include a renewed focus on backward acquisitions driven by the availability of unique supplies for private labels, and increasing differentiation of product supply as important competitive parameters, among others. Increased bargaining power toward an increasingly consolidated food industry will drive this new potential phase.

Furthermore, requirements for full traceability and full control over the value chain to achieve high food safety, compliance with own stricter Corporate Social Responsibility (CSR) standards may also make it necessary for retail companies to integrate backward. Weak links in the value chain can destroy the supermarkets' reputation and consumer trust. Direct ownership of suppliers may, therefore, be a necessity.

The various phases are outlined in Fig. 4.20.

The different motives and phases are partly due to changing market conditions and new technology, as well as changing "strategic recommendations": In some periods, the recommendation is to outsource and ensure the greatest possible flexibility regarding deliveries. In other periods, the recommendation is to insource and establish own production facilities through acquisitions, and thus ensuring full control over supplies becomes a strategic core competency. In this way, interest in vertical integration develops in waves.

As supply chains become more global and complex, the retail industry needs to ensure a secure supply of products (including raw materials) and product quality and safety to avoid labor-related reputational risks such as child labor or other forms of unfair working conditions in categories such as fruit and vegetables. Vertical integration creates this transparency and control, so that retailers always know where their food is coming from and the conditions under which it has been produced.

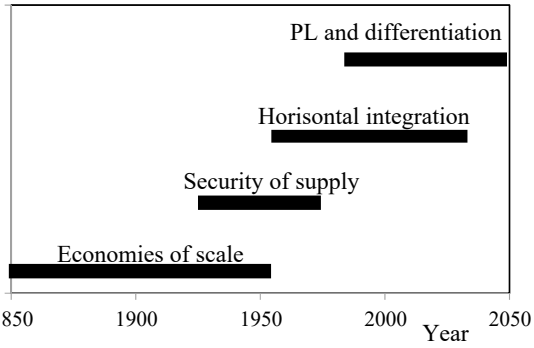


Fig. 4.20 Different drivers behind backward vertical integration of the retail industry in selected time periods (*Note* PL = Private Labels. *Source* Own production)

4.10 Collaboration Between Food and Retail Industry

As discussed in Sect. 4.1, vertical integration in value chains can occur in several ways, and the degree of integration may vary widely. One form of vertical integration is collaboration between the food and retail industries—and this form of integration seems to be changing over time.

The willingness of the retail industry to collaborate and enter into partnerships with their suppliers—primarily the food industry—varies from time to time. The retail industry may regard the food companies as either strategic partners and collaborators or as independent suppliers and providers.

In some periods and under special conditions, entering into strategic cooperation with the food industry may be advantageous for the retail companies. Such cooperation may be with a selected group of companies, and it may include product development, production of private labels, marketing, category management, etc.

At other times, retail companies may want greater independence from suppliers. Cooperation and alliances with a few selected strategic food companies are being replaced by trading with a larger group of food companies, where the retail companies have greater control, freedom of choice, and independence in terms of supplies. The decisive factor is that the retail chains avoid being locked into one particular supplier for a long time.

The willingness of the retail industry to cooperate with their suppliers, which is almost impossible to quantify, is outlined in Fig. 4.21.

It is difficult—if not impossible—to substantiate this varying willingness to cooperate through empirical studies. Collaboration may be more or less formalized, and the degree of collaboration may also vary widely, which makes it difficult to quantify and compare the willingness from time to time. However, food business managers experience this varying interest and willingness from the retail industry—their customers—but the relationship between the food retail trade and the food industry is often confidential or takes the form of discrete knowledge.

A collaboration may include more than just long-term sales contracts. Production and marketing may also be a part of formalized collaboration. Several examples of long-term collaboration between food companies and retail chains reveal the way in which a product's design, concept, etc., are developed and decided jointly.

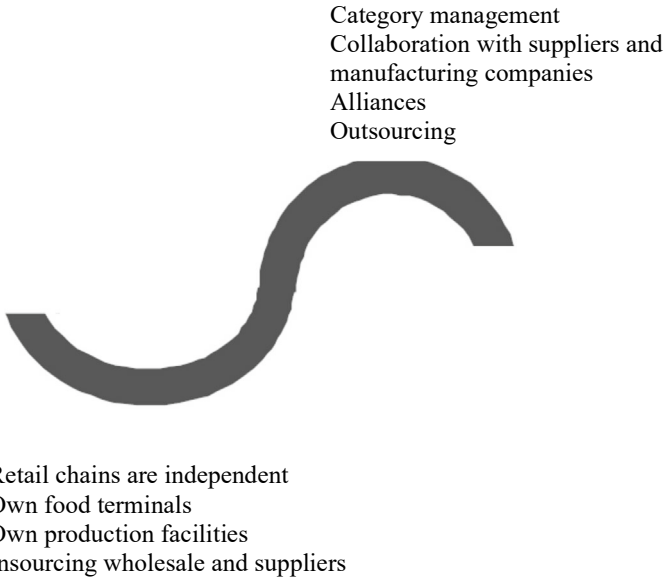


Fig. 4.21 The willingness of the retail industry to cooperate with their suppliers (*Source* Own production)

Cooperation may be based on the retail company's very near contact with consumers, which provides valuable knowledge about demand. On the other hand, food companies have unique knowledge regarding production conditions. This combination of market and product competence can thus be combined and used for mutual benefit.

The retail chain receives a unique product, possibly in the form of its own brand (private label), which may improve its image and recognition in the eyes of consumers and strengthen its competitive profile relative to competitors. At the same time, the food company gains market access and ensures sales for a certain time.

Although a company has to invest in product development as part of private label cooperation, the investment would have been much greater, and riskier, if the company had not been able to share the cost with the retail partner.

Collaboration between a producer and a retail chain leads to the emergence of an interdependent relationship, which can be both a strength and

a weakness. The strength lies in the fact that it is possible for the partners to exploit each other's competences, while the weakness is that it is possible for one of the partners, in the long term, to abuse the agreement to the detriment of the other. If the retail chain terminates the cooperation, the company will lose significant sales and perhaps also considerable investments in innovation of the product.

Various drivers have an effect on collaboration in different ways, and the drivers are unlikely to remain constant. The willingness to collaborate will probably continue to change in waves, depending on the current conditions, market development and the strategies of food retail companies.

4.11 Share of Retail Food Price

The food value chain is changing in several ways. One of the changes is that the primary links in the value chain (upstream) are receiving a declining share of the price and the value that is created in the final link close to the consumers (downstream).

All links in the value chain including farmers, the food industry, wholesale and retail industry and the state (collecting taxes and levies) receive a share of the final sales value of the food product. The share varies from product to product and between industries, while the size of the share also changes over time.

In this context, the final sales value of the food is sometimes called "the food dollar". "The farmers' share of retail food price" is the share (percent) of the final retail (or consumer) price that can be traced back to the selling price of the farmers' production. The size of the farmers' share in the process from farm-to-fork is illustrated schematically in Fig. 4.22.

The figure illustrates that while the farmer's share has reduced, other links in the value chain get a larger share of the value the further downstream the goods move forward toward the consumers. In Fig. 4.22, the farmer's share drops from 100 percent when the products leave the farm gate to approx. 20 percent when consumers buy the food in the retail store. A similar development and pattern are seen in almost all developed countries.

However, the distribution of the added value downstream is very different from product to product. The reason is that the degree of processing and the price of the agricultural raw materials vary considerably.

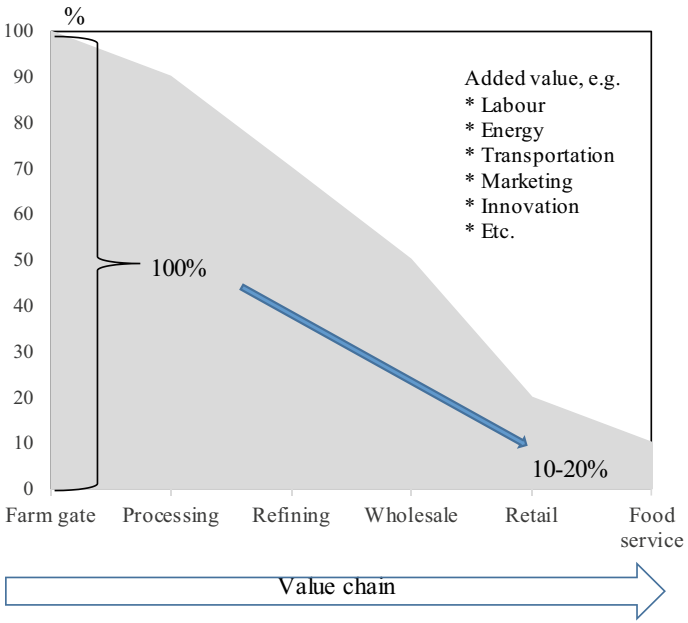


Fig. 4.22 Farmers' share of food retail value (*Source* Own production)

While the share of the retail food price for the individual links in the value chain differs between products, the development over time is relatively clear. Also, the change in the farmer's share of the retail value, which is often discussed, is quite clear: the farmer's share is falling, which is, to a large extent, a global phenomenon, cf. Fig. 4.23.

Figure 4.23 shows that the development has been very similar in agriculture in Denmark, Germany, the UK and the USA. The same trend is probably also present in other developed countries, but only a few studies with a long time series have been published.

The trend in the farmers' shares of retail value in the USA can be traced back 100 years. At the beginning of the twentieth century, the share of retail value was around 50 percent.

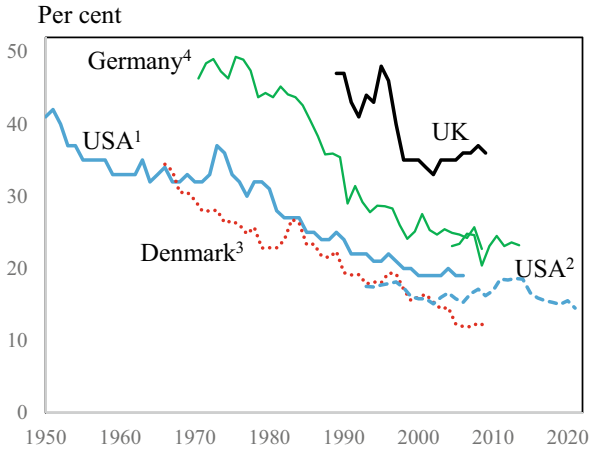


Fig. 4.23 Long-term change in farmers' share of retail value. (1) Calculations based on Input–Output analyses, 1950–2006. (2) Previous calculations based on price series, correction factors, etc. 1993–2021. (3) Calculations based on Input–Output analyses, 1966–2013 (*Sources* USDA [several issues a], Wendt and Peter [2014], NFU [2010], and calculations based on statistical data from Statistics Denmark and USDA Economic Research Service)

The variation between the countries can be explained by differences in:

- Taxes and levies (including VAT).
- The product groups included in the analysis.
- Data, product definition, method calculation, etc.

The trend toward a decreasing share of the consumer value for the farmers is also apparent from cross-section data, which can be used to compare the share with the countries' level of economic development. A clear correlation can be observed, cf. Figure 4.24.

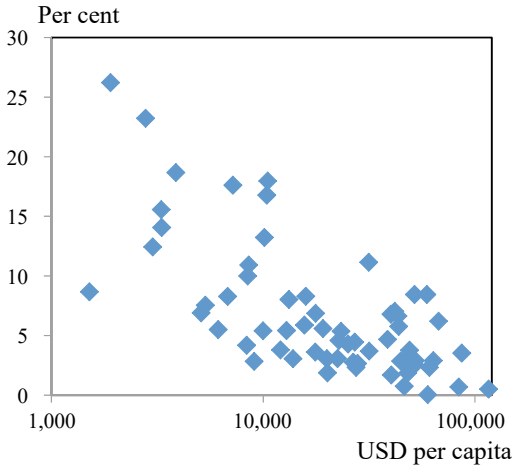


Fig. 4.24 Farmers' share of food and accommodations away from home (faafh) as a function of the countries' economic development (2015) (*Source* Own presentation based on Yi et al. [2021] and statistical data from World Bank)

The figure illustrates a clear trend in which the farmers' share declines with increasing economic welfare.

For several reasons, the farmer will often face a decreasing share of the retail value:

Firstly, with increasing economic welfare and growth in a society, the amount of processing and value that is added to the food also increases. An increasing focus on convenience, eating out, food service, takeaways, etc., will further strengthen this trend.

With increasing added value and processing, the cost of labor product development, innovation and preparation, etc., will also rise, while the share of agricultural raw materials will fall. The result is a decreasing share of the retail value for farmers. The decreasing share is due to the fact that the total "cake" is getting bigger, and that the farmer's relative share is simply getting smaller.

If a food company invests in innovation, processing and market development, and the investment turns out to be profitable, the investment will result in increased earnings. However, as a result, farmers and the agricultural products will also receive a decreasing share of the retail value because innovation costs, etc., will increase. In this case, the farmer's share of the retail value will fall, but the farmer's earnings will increase because the increasing earnings will belong to the owners if it is a farmer-owned cooperative.

Secondly, farmers' declining share of the retail value can also be explained by the increasing division of labor between farmers and the food industry. The clear trend in the Western World is for the food industry to take over a significant part of the agricultural activities in the agro-industrial complex (Sect. 5.8).

Even though the food industry takes over part of the employment and added value from the farmers and agriculture during economic development, it will still experience a relative decrease in economic significance during increasing economic welfare. The obvious explanation is that the increased value added and marketing in the food industry cannot offset the negative effect of the low growth in demand.

Third, as a consequence of both increasing productivity and the agricultural treadmill, agricultural sales prices will rise more slowly than the price of other products in the economy, on average. In the long term, the prices of both agricultural and food products will increase at a slower rate than inflation, and the terms of trade will fall. When the price of—and thus also the value of—agricultural raw materials rises less than the price of other products and services, the farmer's share of the retail value will also fall—all other things being equal.

4.12 Global Value Chains

Global value chains (GVC), i.e., value chains that break up the production process across countries, have been increasing in importance for a number of years. This also applies to global food value chains for which a significant global trend is dominant. Global value chains refer to the international sharing of production, whereby production is divided into activities and tasks that are carried out in different countries. Firms specialize in a specific task and do not produce the whole product.

However, the term global value chain has not been unambiguously defined, and several definitions exist:

> *A global value chain or GVC consists of a series of stages involved in producing a product or service that is sold to consumers, with each stage adding value, and with at least two stages being produced in different countries. A firm participates in a GVC if it produces at least one stage in a GVC.* (Antràs, 2020)

> *Global value chains (GVCs) are the cross-border networks that bring a product or service from conception to market*. (Xing et al., 2021)

The OECD asserts that a value chain is global when "*the different stages of the production process are located across different countries*" (OECD, n.d).

UNIDO (2015) lists potential activities and defines a GVC as "*the full range of activities (design, production, marketing, distribution and support to the final consumer, etc.) that are divided among multiple firms and workers across geographic spaces to bring a product from its conception to its end use and beyond*".

Figure 4.25 presents a GVC in its simplest form.

Country A produces an intermediate product for further processing, and it is exported to country B. Country B uses the intermediate product as an input to production. The final product is exported, or it is sold on the domestic market.

The example in Fig. 4.25 involves only two countries and one product. In the real world, there are extensive networks between many countries with many flows of intermediate products crossing borders.

GVC is part of globalization, but it differs from international trade and foreign direct investment because the production takes place in at least two countries and is part of a coherent value chain. International trade and foreign direct investment can be part of a GVC, but the value chain and multi-country production must also apply.

A number of studies conclude that GVCs have been increasing in importance and are gaining an increasing share of total world trade:

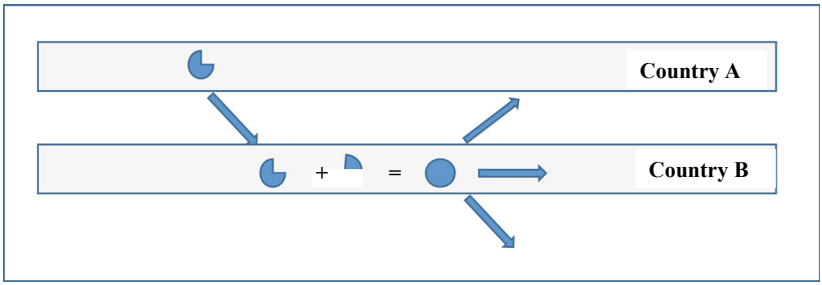


Fig. 4.25 A simple GVC involving two countries (*Source* Own presentation)

According to World Bank (2020), the magnitude and importance of GVCs grew particularly rapidly from 1990 until the financial crisis of 2008. This was driven by technological advances and lower trade barriers, which led manufacturers to internationalize production processes, cf. Fig. 4.26.

Xing et al. (2021) confirm the increase in GVCs from the 1990s to around the global financial crisis of 2008–2009. In the following years, the development stagnated. In general, GVCs increased in importance, but less than the world trade total, so GVC's share declined. Increasing political and economic risk connected to participating in long global value chains played a role, and climate policy may also have made local supply and demand more attractive.

Indeed, in the late 2010s, the world was exposed to significant geopolitical risks and climate change, and also the Covid-19 pandemic in 2020. Figure 4.27 illustrates the long-term development of GVCs.

As can be seen, there was a significant increase until the financial crisis, which was followed by a period of stagnation and then a significant decrease during the Covid-19 pandemic.

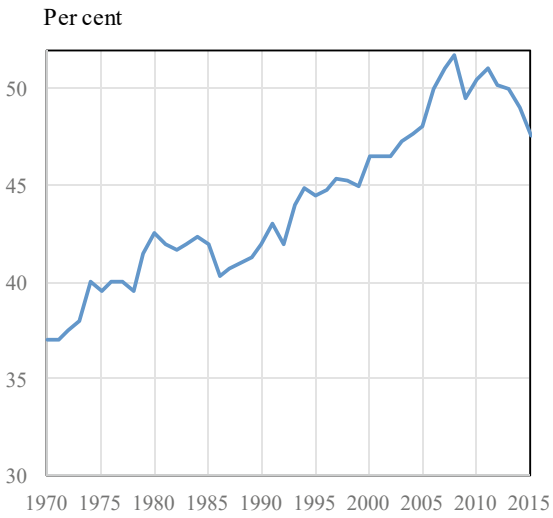


Fig. 4.26 GVC share of global trade, 1970–2015 (*Source* Own reproduction from World Bank [2020])

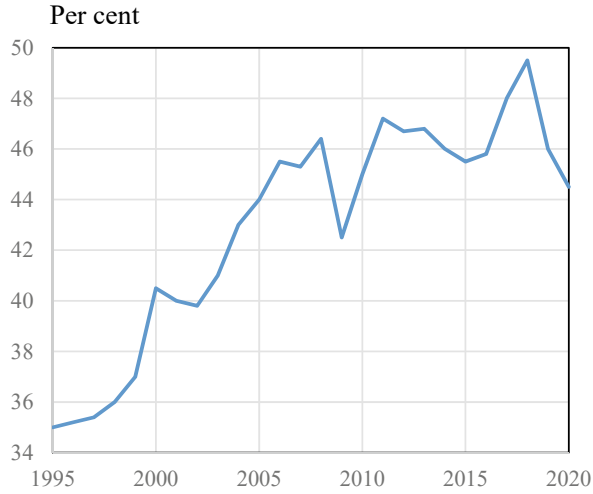


Fig. 4.27 Global value chain participation rates, 1995–2020 (*Note* Trade based. *Source* Own reproduction from Xing et al. [2021])

A third study by Cigna et al. (2022) and published by the European Central Bank uses two methods to illustrate the development in the participation in global value chain, cf. Fig. 4.28.

The figure confirms the conclusion derived from the two previous figures. Figure 4.27 also shows a significant increase in 2021, although the data for 2021 only cover the first seven months of the year. In addition, international trade flows were greatly affected by the Covid-19 pandemic, which means it is too early to assess whether a new trend is emerging—also because of subsequent geopolitical uncertainties.

Another study on international trade in intermediate goods, which is a proxy for or part of GVCs, concludes that intermediate goods accounted for 50 percent of total trade for the second quarter of 2022; a ratio that has remained constant during the last decade (WTO, n.d.a). This indicates that the development seen over the last decade is rather stable and constant.

However, a constant ratio does not mean no change. Previously, the trend was driven by access to low labor costs. Now, GVCs are becoming more knowledge-intensive and reliant on highly skilled labor.

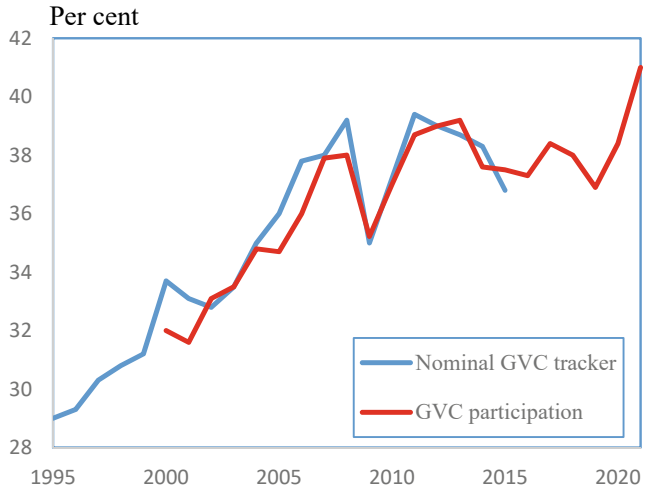


Fig. 4.28 Participation in global value chains, 1995–2021 (*Note* GVC tracker based on selected data on trade in intermediate goods. *Source* Own reproduction from Cigna et al. [2022])

Focusing on GVCs in agriculture and the food industries, an expansion and increasing trend has also been identified, although no long-term time series data have been presented to support or document the trend. The OECD (2020) points out that agricultural trade is being increasingly organized within GVCs with the production of food increasingly occurring across countries while inputs sourced from around the world are being used. A rising share of exports from one country is being re-exported by another, after having been used as intermediates for further processing. Therefore, agro-food production from one country can cross borders multiple times through direct or indirect export (as an ingredient in processed food).

The extent of involvement in GVCs can be estimated by calculating the share of total exports that is exported and imported intermediates, which results in a share of around 20 percent. In 2014, on average, 20 percent of all agro-food exports were re-exported by the first importing country. However, OECD (2020) also underlines that most agro-food trade does not cross multiple borders, and that food production and consumption often remain largely local.

As discussed in Sect. 7.2, the international diversion of resources within agriculture and the food industry—and thereby also GVCs—is quite modest. OECD (2020) emphasizes that, unlike in the manufacturing sector, in the agri-food sector, domestic value chains are dominant and dynamic, and while GVCs are important, they are secondary. Short shelf life, self-sufficiency goals, globally available resources, low transportability, etc., are highlighted as the main reasons.

Analyzing the drivers behind GVCs is important in order to determine the potential durability of the current megatrends to which they belong: if the drivers are stable, it is likely that the megatrends will also be stable. However, it is difficult to distinguish the drivers behind GVCs from those behind international trade, foreign direct investment, global offshoring and globalization as the same drivers support many different globalization trends. Nevertheless, it is possible to list several drivers, cf. OECD (2020), Amador and Cabral (2016), World Bank (2020), Hansen (2005):

- Liberalization of international trade.
- Liberalization of international capital markets.
- Reduced transportation costs.
- Faster, better and cheaper means of communication at the global level.
- The end of the Cold War and Russia and former soviet republics' integration into the world economy.
- East Asia's and specifically China's move to a market economy and rapidly increasing participation in international trade and the economy.
- Differences in production costs, productivity and the availability of inputs among countries.
- Business stability including economic growth and the geopolitical situation.
- Tariff escalation. Some countries want to support domestic employment by having a low import tariff on raw materials and a high one on processed goods, which makes GVCs more attractive.

When it comes to assessing future development, the starting point is that GVCs have created and been part of a very significant megatrend in recent decades. However, geopolitical uncertainty and not least the Covid-19 pandemic dampened the development and led to the relative decline in

importance of GVCs in international trade. Several factors, both internal and external, are decisive for the development in the future:

On the one hand, the economic and commercial advantages of GVCs may mean that GVCs will continue to be extremely important and perhaps even increase in importance. Most countries will be able to further exploit international specialization together with value chains across national borders to their advantage. Therefore, GVCs will continue to encompass obvious rational economic benefits.

On the other hand, geopolitical uncertainty may increase risk and uncertainty, making GVCs less attractive. GVCs involve and presuppose international trade and a greater or lesser degree of cooperation and coordination across national borders, and geopolitical uncertainty can be or can create a barrier. Countries can put restrictions on GVCs even though it may hurt them economically in order to deliberately hurt other countries economically.

Many countries will also seek to steer their business development away from a focus on the production of raw material or intermediates in order to move downstream and capture a larger share of the added value in the value chain. This will also limit GVCs because the foreign production of intermediates is insourced in the country.

Finally, climate policy measures may discourage geographically long value chains. The climate impact of transportation may slow the increase in the number of GVCs regardless of whether it is justified.

Overall, the potential for continued economic benefits of GVCs is clear, but external and geopolitical conditions are likely to limit the rate of increase, so a continued moderate stable trend is likely.

References

Amador, J., & Cabral, S. (2016). Global value chains: A survey of drivers and measures. *Journal of Economic Surveys, 30*(2), 278–301. https://doi.org/10.1111/joes.12097

Antràs, P. (2020). Conceptual aspects of global value chains. *The World Bank Economic Review, 34*(3), 551–574. https://doi.org/10.1093/wber/lhaa006

Blayney, D. P., & Manchester, A. C. (2000). Large companies active in changing dairy industry. *Food Review, 23*(2), 8–13. https://doi.org/10.22004/ag.econ.205539

Bunte, F., van Galen, M., de Winter, M., Dobson, P., Bergès-Sennou, F., Monier-Dilhan, S., Juhász, A., Moro, D., Sckokai, P., Soregaroli, C., Van der Meulen, B. M. J., Szajkowska, A., & Enterprise and Industry. (2011). *The impact*

of private labels on the competitiveness of the European food supply chain. Publications Office of the European Union.https://doi.org/10.2769/11911

Cigna, S., Gunnella, V., & Quaglietti, L. (2022). *Global value chains: Measurement, trends and drivers*. European Central Bank (ECB).https://doi.org/10.2866/33149

Deloitte. (several issues). *Global powers of retailing*. Deloitte Global. https://www2.deloitte.com/global/en/pages/consumer-business/articles/global-powers-of-retailing.html

Dobson, P. W. (2002). *Retailer buyer power in european markets: Lessons from grocery supply*. Loughborough University.

Dobson, P. W., & Chakraborty, R. (2015). Assessing brand and private label competition. *European Competition Law Review, 36*, 76–81.

Eurostat. (2016). *Agriculture, forestry and fishery statistics: 2016 edition*. Publications Office of the European Union. https://doi.org/10.2785/917017

Evans, J., Bridson, K., Byrom, J., & Medway, D. (2008). Revisiting retail internationalisation: Drivers, impediments and business strategy. *International Journal of Retail & Distribution Management, 36*(4), 260–280. https://doi.org/10.1108/09590550810862679

Gielens, K., Dekimpe, M. G., Mukherjee, A., & Tuli, K. (2023). The future of private-label markets: A global convergence approach. *International Journal of Research in Marketing, 40*(1), 248–267. https://doi.org/10.1016/j.ijresmar.2022.07.006

Grievink, J.-W. (2003). *The changing face of the global food supply chain*. Presentation OECD Conference The Hague 6 February 2003.

Grievink, J.-W., Josten, L., & Valk, C. (2003). Power resides where the information is unique: Interview with Wout Dekker, Nutreco. In J.-W. Grievink, L. Josten, & C. Valk (Eds.), *State of the art in food: The changing face of the worldwide food industry* (pp. 308–314). Cap Gemini Ernst & Young and Reed Elsevier.

Grimes, G., & Plain, R. (2009). *U.S. Hog marketing contract study: January 2009*. University of Missouri. Retrieved from http://agebb.missouri.edu/mkt/vertstud09.pdf

Hambur, J., & La Cava, G. (2018). *Business concentration and mark-ups in the retail trade sector*. Reserve Bank of Australia. https://www.rba.gov.au/publications/bulletin/2018/dec/business-concentration-and-mark-ups-in-the-retail-trade-sector.html

Hansen, H. O. (2005). *Vækst i Fødevareindustrien: Vækst, fusioner, strukturudvikling, globalisering og koncentration i det agroindustrielle kompleks i Danmark og globalt*. Handelshøjskolens Forlag.

Hansen, H. O. (2013). *Food economics: Industry and markets*. Routledge.

Harris, J., Kaufman, P. R., Martinez, S. W., & Price, C. (2002). *The U.S. food marketing system, 2002 competition, coordination, and technological innovations into the 21st century.* USDA (Agricultural Economic Report No. 811). https://doi.org/10.22004/ag.econ.34001

Herrmann, R., Möser, A., & Weber, S. A. (2009). *Grocery retailing in Germany: Situation, development and pricing strategies.* Zentrum für internationale Entwicklungs- und Umweltforschung der Justus-Liebig-Universität Gießen (Discussion Paper, No. 41). https://www.econstor.eu/bitstream/10419/39806/1/593466845.pdf

Kim, D. H. (2009). The case of Korea. In K. W. Stiegert & D. H. Kim (Eds.), *Structural changes in food retailing: Six country case studies* (pp. 77–103). Food System Research Group. https://ageconsearch.umn.edu/record/60676/files/_food_retailingchapter5.pdf

Martec. (n.d.). *What is driving the growth of private label brands?* Retrieved February 5, 2024, from https://martecgroup.com/private-label-growth/

Martinez, S. W. (1999). *Vertical coordination in the pork and broiler industries. Implications for pork and chicken products.* USDA, Economic Research Service (Report No. 777).

Martinez, S. W. (2007a). *The U.S. food marketing system: Recent developments, 1997–2006.* United States Deptartment of Agriculture, Economic Research Service. https://www.ers.usda.gov/publications/pub-details/?pubid=45821

Martinez, S. W. (2007b). *The U.S. food marketing system: Recent developments, 1997–2006.* United States Department of Agriculture, Economic Research Service. https://doi.org/10.22004/ag.econ.55962

NFU. (2010). *NFU Briefing: Food price inflation update and impact on retail prices.* Retrieved from commercialfarmers.co.uk https://www.commercialfarmers.co.uk/wp-content/uploads/2016/09/Food-inflation-analysis-November-2010.pdf

Noormann, P., & Tillmanns, S. (2017). Drivers of private-label purchase behavior across quality tiers and product categories. *Journal of Business Economics, 87*, 359–395. https://doi.org/10.1007/s11573-016-0837-1

OECD. (2020). *Global value chains in agriculture and food: A synthesis of OECD analysis*. OECD Publishing. https://doi.org/10.1787/6e3993fa-en

OECD. (n.d.). *Global value chains*. Retrieved February 9, 2024, from OECD https://www.oecd.org/industry/global-value-chains/

PLMA. (2022). *PLMA's 2022 international private label yearbook*. PLMA International Council. Retrieved from Industry News https://www.retaildetail.eu/news/food/switzerland-is-private-label-champion-belgium-in-second-place/

Rabobank. (2012). *Producing both brands and private label.* Rabobank.

Retail Institute Scandinavia. (several issues). *Dansk dagligvarehandel.* Retail Institute Scandinavia.

Rudd, J. (2019). Checking out productivity in grocery stores. *Beyond the Numbers, 8*(15). https://www.bls.gov/opub/btn/volume-8/checking-out-productivity-in-grocery-stores.htm

ter Beek, V. (2017). *Spain hasn't seen the end of its growth yet*. Retrieved from Pig Progress: https://www.pigprogress.net/World-of-Pigs1/Articles/2017/7/Spain-hasnt-seen-the-end-of-its-growth-yet-163772E/

UNIDO. (2015). *Global value chains and development: UNIDO's support towards inclusive and sustainable industrial development*. United Nations Industrial Development Organization (UNIDO). https://www.unido.org/sites/default/files/2016-03/GVC_REPORT_FINAL_0.PDF

USDA. (several issues). *Agricultural statistics*. United States Department of Agriculture, National Agricultural Statistics Service. Retrieved from https://usda.library.cornell.edu/concern/publications/j3860694x?locale=en&page=9#release-items

Wendt, H., & Peter, G. (2014). *Gestiegene Erzeugerpreise für tierische Erzeugnisse treiben den Erzeugeranteil nach oben*. Thünen-Institut für Marktanalyse. https://literatur.thuenen.de/digbib_extern/dn054226.pdf

World Bank. (2020). *World development report 2020: Trading for development in the age of global value chains*. World Bank. https://doi.org/10.1596/978-1-4648-1457-0

WTO. (n.d.). *Information note on trade in intermediate goods: Second quarter 2022*. Retrieved from World Trade Organization, Economic Research and Statistics Division https://www.wto.org/english/res_e/statis_e/miwi_e/info_note_2022q2_e.pdf

Xing, Y., Gentile, E., & Dollar, D. (2021). *Global value chain development report 2021. Beyond production*. Asian Development Bank et al. https://doi.org/10.22617/TCS210400-2

Yi, J., Meemken, E.-M., Mazariegos-Anastassiou, V., Liu, J., Kim, E., Gómez, M. I., Canning, P., & Barrett, C. B. (2021). Post-farmgate food value chains make up most of consumer food expenditures globally. *Nature Food, 2*(6), 417–425. https://doi.org/10.1038/s43016-021-00279-9

CHAPTER 5

The Position of Agriculture

5.1 Introduction

The economic, political and social significance of agriculture reduces in line with increasing economic development. The diminishing significance of agriculture is taking place all over the world, and the position and role of agriculture in society is changing and it is following relatively stable megatrends created by consistent drivers.

Other industries are not exhibiting the same development as agriculture. This is because agriculture is exposed to specific political and market conditions, which play a decisive role.

As people's basic needs for food are met, they seek to meet needs that are further up Maslow's pyramid of needs. The environment, animal welfare, biodiversity, landscaping, origin, sustainability, etc., come increasingly into focus. The role of farmers as producers and suppliers of food diminishes, which means that the economic position of farmers changes, and a number of negative externalities created by agriculture becomes more important.

Not only is agriculture's role as a producer of food changing, but also farmers' political power and influence is changing.

The change in the position of agriculture is driven by a series of different internal and external conditions some of which are predetermined, while others can be influenced by the individual countries.

H. O. Hansen, *Megatrends in Agriculture, Food Industry and Food Markets*, Palgrave Advances in Bioeconomy: Economics and Policies,
https://doi.org/10.1007/978-3-031-58152-6_5

The major drivers behind the weaker position of agriculture, which may be interconnected, are briefly described below.

An important explanation for the weaker position of agriculture is that agricultural and food products generally have a low-income demand elasticity. This means that a given increase in income leads to a relatively small increase in demand. In other words: People can only eat their fill once, so an increase in income will not result in a large quantitative increase in the consumption of food. The relatively limited growth in demand will, therefore, also limit the growth in supply.

Another explanation is that increase in productivity is relatively substantial in agriculture. This means that a constant amount of agricultural produce can be produced with fewer resources, or that an increase in production can be achieved without a corresponding increase in the use of resources. Inputs such as labor are often removed as a result of productivity growth.

The agricultural industry consists of many small units—farms—which typically grow and become increasingly large. Exploiting economies of scale drives this development, which also releases resources such as labor for other sectors.

Productivity growth and the exploitation of economies of scale also contribute to lower costs per unit and thus also contribute to falling real prices for agricultural products. This means that—all other things being equal—the value of agricultural production falls.

Finally, an increasing division of labor is taking place between the primary agricultural industry and the agricultural supply and processing industry.

Whereas farmers previously accounted for a large part of direct sales to consumers, farms and agriculture are now more specialized and focus on agricultural production. As a result, part of the added value has moved from farms and agriculture to the processing industry such as dairies and meat companies, which are not defined or characterized as agricultural industries.

Overall, the development is characterized by resources being transferred from agriculture into other sectors, which means that agriculture is becoming less important. The transfer of resources is created by both pull and push effects: During economic growth, other sectors will demand labor and other resources from the agricultural sector. Excess labor in agriculture occurs as a result of mechanization, so labor in particular is pushed out of agriculture into other sectors.

5.2 The Significance of Agriculture

Agriculture and the up- and downstream industries change significantly in a country during economic development. The change is often very predictable and some clear global tendencies and megatrends can be identified.

Figure 5.1 illustrates the long-term decreasing significance of agriculture in two countries, the USA and Denmark.

As can be seen the figure presents a relatively similar trend in the two countries over a very long period. In recent decades, the development has been become asymptotic with the X-axis. The three food crises that have occurred since 2007 with sharply rising prices for short periods of time have resulted in increasing export value both nominally and relatively.

Korea, which is an example of a country that has experienced very rapid industrialization, has witnessed a sharp decline in the significance of agriculture in recent decades, cf. Fig. 5.2.

The agricultural labor force's share of the total labor force declined from 60 percent in the mid-1960s to 13 percent in the mid-1990s, which confirms the very rapid change and adaptation in agriculture and in the whole of Korean society.

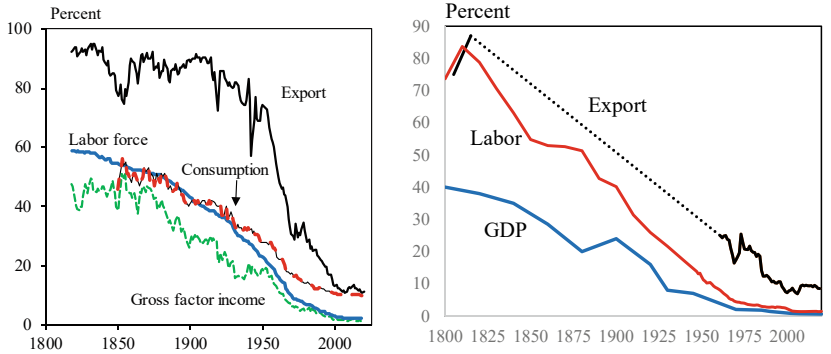


Fig. 5.1 Long-term change in the economic significance of agriculture: Denmark and the USA (*Sources* Own presentation based on Hansen [1983], Landbrugsraadet [several issues], Henriksen and Ølgaard [1969], Grigg [1992], Grubbs [n.d.], USDA [several issues], Lebergott [1966], and statistical data from FAO, Statistics Denmark, and World Bank)

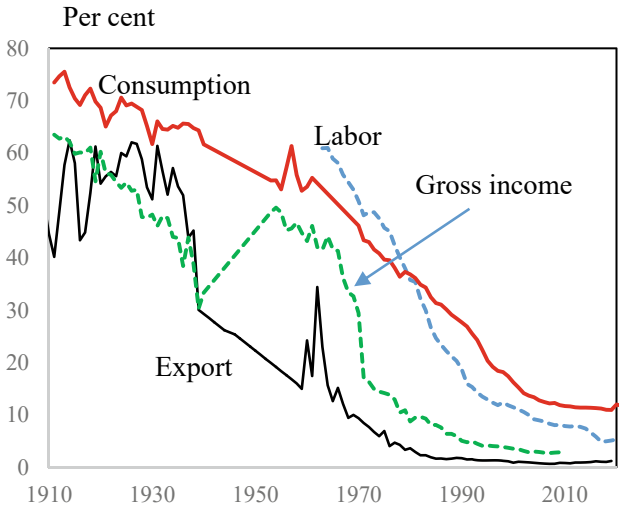


Fig. 5.2 Long-term change in the economic significance of agriculture in South Korea (*Note* Data from around the Second World War until the end of the Korean War are both uncertain and atypical of the long-term development, which is why detailed figures for these years are to some extent omitted. *Sources* Own presentation based on Kim [2018] and statistical data from FAO, Korean Statistical Information Service and World Bank)

The decreasing significance of agriculture in a country may have a number of economic, market-related and policy implications:

- In a low-growth sector, the utilization of economies of scale and the benefits of productivity growth may be limited as the potential for increasing production is less.
- In a low-growth sector, excess capacity can occur more easily, which will often reduce earnings.
- The pressure for mergers and consolidation will increase as the companies' potential for growth in the form of organic market growth is less. For this reason, growth through mergers and acquisitions becomes a more appropriate or attractive option.
- The opportunities for attracting capital to companies in low-growth sectors are often limited. Investors often prefer industries or companies with strong growth potential.

- The political attention on the sector diminishes as its economic contribution declines.

5.3 Share of Production

Agriculture's share of a country's total production and added value is a fairly clear and precise expression of agriculture's economic importance and position in a society.

Agriculture's share of total production in a country is falling, which is a very significant megatrend. The development appears to be relatively unaffected by economic cycles, food crises, structural changes or other internal or external influences. This megatrend can be identified through both time series analysis (the development over a long period of time in various selected countries) and cross-sectional analysis (snapshots of the situation in many countries). Both types of examples of megatrends are presented below.

Long time series of agriculture's share of total production are rare and often subject to a certain degree of uncertainty. Such time series require data on the value added in agriculture and in society as a whole, which can be very difficult to obtain many decades back in history. Despite these uncertainties, clear megatrends that show that agriculture's share of total production in a country is declining can be identified, cf. Fig. 5.3.

The figure shows long time series for four selected countries where relatively consistent data has been available.

The figure shows clear trends over time, and the share of agriculture for the four countries reduced over the entire period, so that it now amounts to just a few percent. The uniform trend, but different rate of change, also shows that while the natural conditions including access to resources for agriculture may differ between countries, the same driving forces are at play everywhere, which results in the same development in the long term.

When focusing on a slightly shorter time horizon and on regions rather than countries, a clear trend can still be identified with regard to agriculture's share of total production, cf. Fig. 5.4.

The figure shows that even with a relatively short time horizon (from the beginning of the 1960s) and with aggregated figures for regions and for the whole world, a clear trend in the form of a decrease in agriculture's share of the total production value can be observed.

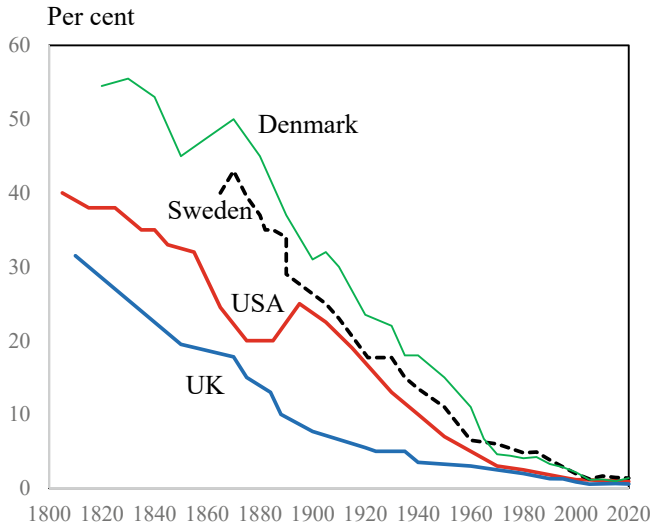


Fig. 5.3 The long-term decline in agriculture's share of total GDP in selected countries (*Note* Delimitations and definitions are not consistent over time. In recent decades: Including fishing, forestry. *Sources* Own presentation based on Grigg [1992] and statistical data from World Bank)

As previously mentioned, agriculture's declining share of total production over time and in line with economic development can also be illustrated by cross-sectional data, which show agriculture's share of total production as a function of the countries' income measured in GDP per capita. In this way, an international pattern regarding the importance of agriculture emerges.

Figure 5.5 clearly illustrates the international pattern with regard to agriculture's declining share of production and value creation with increasing economic welfare.

For each country, the figure shows the correlation between the country's level of economic development (GDP/capita shown on a logarithmic scale) and agriculture's gross factor income in relation to the countries' total gross factor income. Every point represents one country. As can be seen, despite large differences in the countries' resources, etc., there is a clear tendency for agriculture to become less important with economic growth.

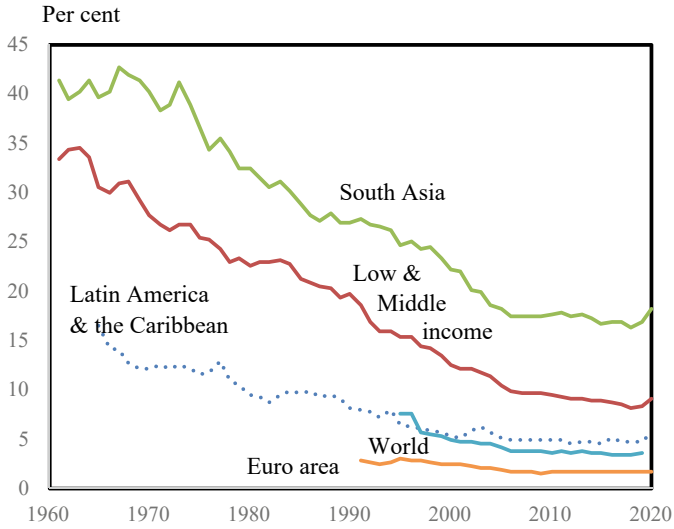
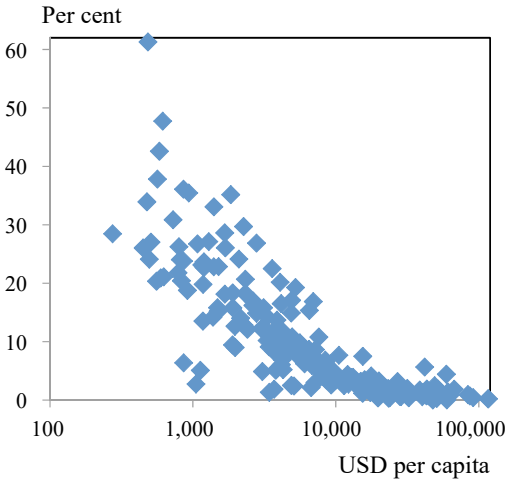


Fig. 5.4 Agriculture's share of total GDP for selected regions (*Note* Including fishing and forestry. *Sources* Own presentation based on statistical data from World Bank)

Fig. 5.5 Agriculture's share of the countries' gross factor income as a function of GDP per capita (*Note* Added value is calculated for 2020 or for the last year with available data. GDP per capita is for 2020. *Source* Own calculations based on statistical data from World Bank)



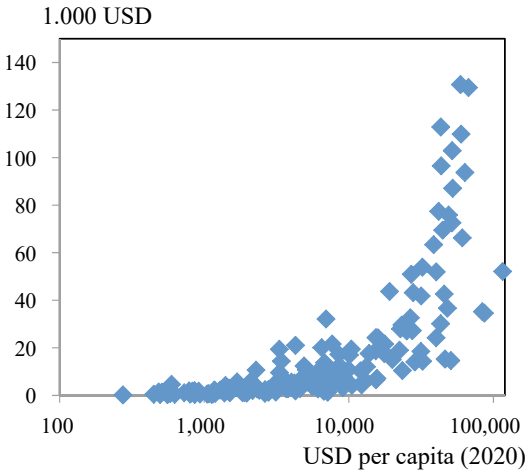


Fig. 5.6 Added value per agricultural work force unit as a function of GDP per capita (*Note* Added value is calculated for 2020 or for the last year with available data. GDP per capita is for 2020. *Source* Own calculations based on statistical data from World Bank)

However, it is noteworthy that the migration of labor occurs so rapidly that the added value in relation to the remaining agricultural workforce increases sharply in line with economic development. This correlation between added value per work force unit and the level of economic development is shown in Fig. 5.6.

5.4 Share of Employment

Technological development and the mechanization of agriculture together with limited demand growth lead to a surplus of labor in agriculture, which results in the emigration of labor from agriculture to other sectors. Since technology develops gradually and its implementation on individual farms is also slow, the process is long-lasting and constant.

Agriculture's share of total employment will decline relatively smoothly without any significant fluctuations between time periods. This long-term reduction in agriculture's share of total employment can be seen in Fig. 5.7.

The figure illustrates a continuous reduction in agriculture's share of employment since the beginning of the twentieth century. On the one hand, the development has released labor for better and more attractive utilization in other sectors—often at a higher value and thus higher

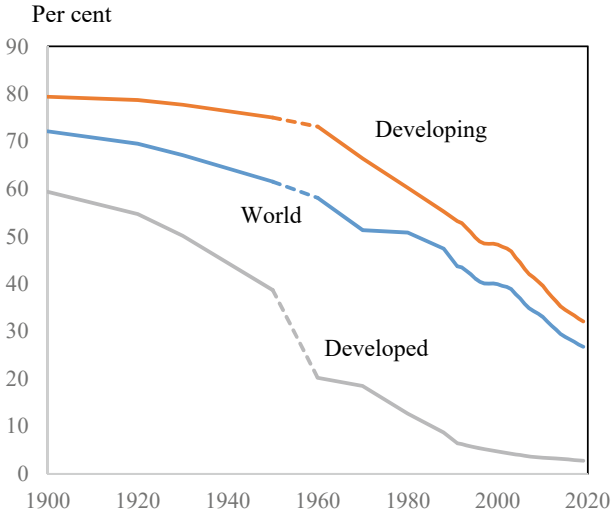


Fig. 5.7 Agricultural labor force (as a share of total labor force) for groups of countries, 1900–2050. From 1991: Developing countries = Low and middle income. From 1991: Developed countries = High-income countries (*Source* Own presentation based on Grigg [1992] and statistical data from FAO and World Bank)

remuneration. The result is a favorable pull effect created by other industries which have lacked manpower. On the other hand, a push effect has pushed excess labor out of agriculture but without any immediate alternative employment in other industries. In this way, the change has had both positive and negative effects.

Figure 5.7 clearly shows differences in the extent of the share of agricultural employment between developed and developing countries. The trend is almost identical, but the employment rate is much lower in the developed countries. This pattern is illustrated more clearly in Fig. 5.8.

As shown in Fig. 5.8 there is a very clear correlation between economic welfare and agriculture's share of employment.

Employment in agriculture and in rural areas is correlated and exhibits broadly the same development. As rural development increasingly receives political attention and becomes an integrated part of agricultural policy,

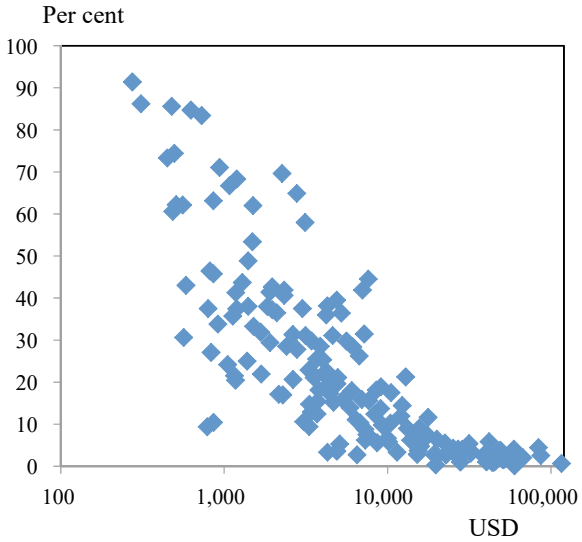


Fig. 5.8 Agriculture's share of the countries' employment in agriculture (as a percentage of total employment) as a function of GDP per capita (2020) (*Note* 2020 or latest year with available information. *Source* Author's calculations based on statistical data from World Bank)

employment and economic activity in these areas outside the cities is important.

Currently, over half of the world's population lives in cities, whereas the rural population is decreasing relatively on all continents. According to the FAO, this development is expected to continue in the coming years (see Fig. 5.9).

In 1950, 70 percent of the world's population lived in rural areas and 30 percent lived in urban areas. However, by 2050, the opposite is expected to be the case. The population in rural areas will also decline in nominal numbers. In Europe, the population of rural areas will have declined by almost 40 percent by 2050.

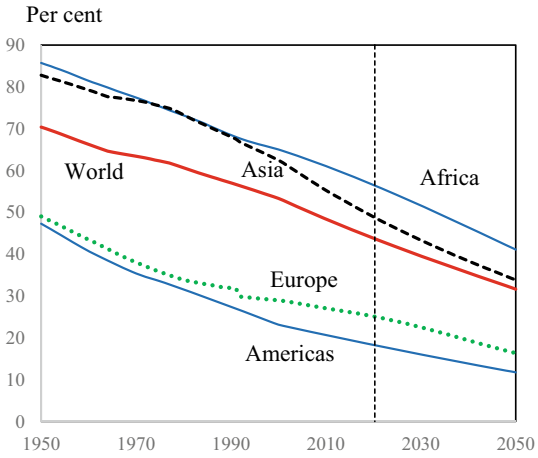


Fig. 5.9 Percentage of the population living in rural areas, 1961–2021, and projected to 2050 (*Note* The projection 2022–2050 is conducted by UN/FAO. *Source* Statistical data from FAO)

5.5 Share of Export

Less developed countries are often characterized by the fact that agriculture is a very important business and is one of their comparative advantages, industrialization has not yet been completed, and agricultural goods, therefore, account for a significant share of the countries' exports. With increasing economic growth and industrialization, branches of industry other than agriculture are being developed, which also results in increasing exports.

Figure 5.10 illustrates this development for selected regions, the whole world and selected countries for the years 1961–2021.

Because exports are derived from production, the significance of agricultural and food exports also declines with increasing economic growth. There is a definite pattern in that the poorest countries generally are very dependent on agricultural exports, but this dependency lessens as welfare increases (see Fig. 5.11).

The pattern is somewhat obscured by the fact that some of the poorest developing countries export very little due to overpopulation and food shortages. Correspondingly, there are poor countries which export relatively large quantities of raw materials such as metals, oil, etc., and relatively small quantities of agricultural products.

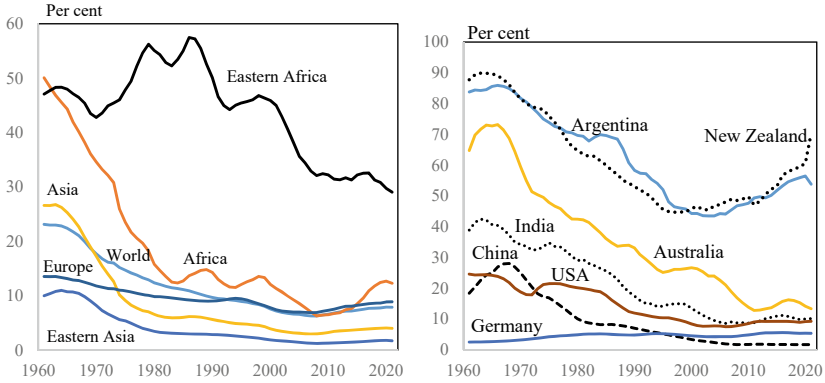


Fig. 5.10 Agricultural exports as a share of total exports for selected regions and countries, 1961–2021 (*Note* 5-year moving average. *Source* Own calculations based on statistical data from FAO)

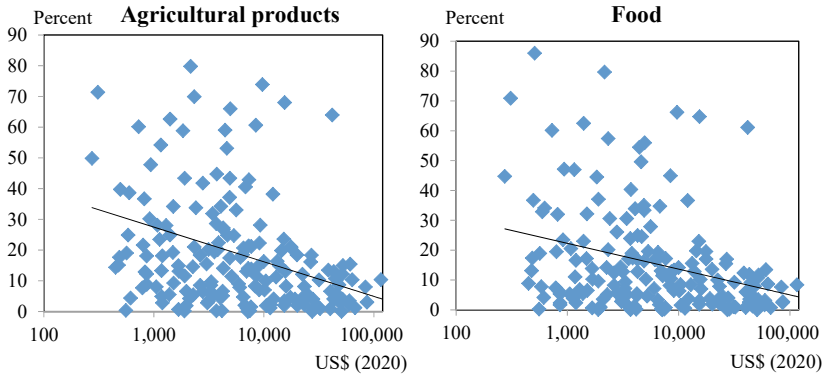


Fig. 5.11 Exports of agricultural products and food as a percentage of total exports—as a function of GDP per capita (2020) (*Source* Own calculations based on statistical data from FAO and World Bank)

There are also atypical countries, e.g., Denmark and New Zealand, which have a very large agricultural export despite being highly developed countries.

The relatively good correlation between per capita GDP and the relative importance of agricultural exports is remarkable considering that

parameters other than just economic growth affect the size of food exports. A country's basic comparative advantage, agricultural policy, etc., will also, to a large degree, affect the size of food exports.

On the other hand, economic growth seems to create new competitive strengths outside the food sector, thereby reducing the agricultural sector's role in trade.

The decreasing importance of food exports with increasing economic growth is only related to total exports. Thus, total food exports per capita increase in line with economic development (see Fig. 5.12).

As Fig. 5.12 shows, food exports increase as countries become more developed. This occurs despite the fact that agricultural and food production become less important over the same period.

When looking at the trend in net exports (exports minus imports) of agricultural products in the economic development process, it should be emphasized that there is no clear picture. As can be seen in Fig. 5.13, net exports seem to either decrease or increase with increasing GDP per capita.

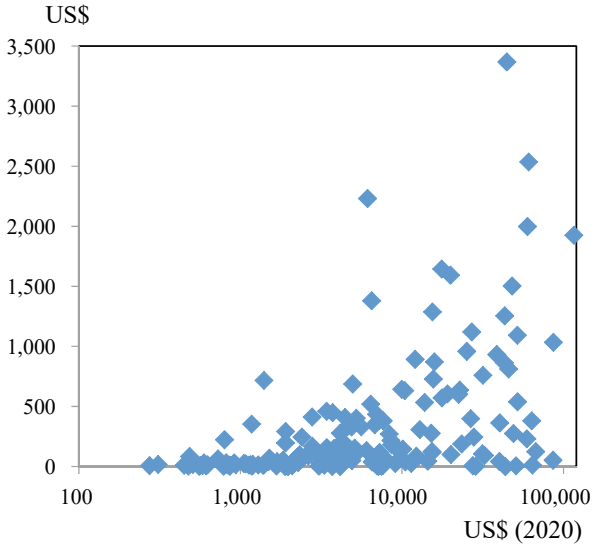


Fig. 5.12 Per capita food exports during economic growth (2020) (*Source* Own calculations based on statistical data from FAO and World Bank)

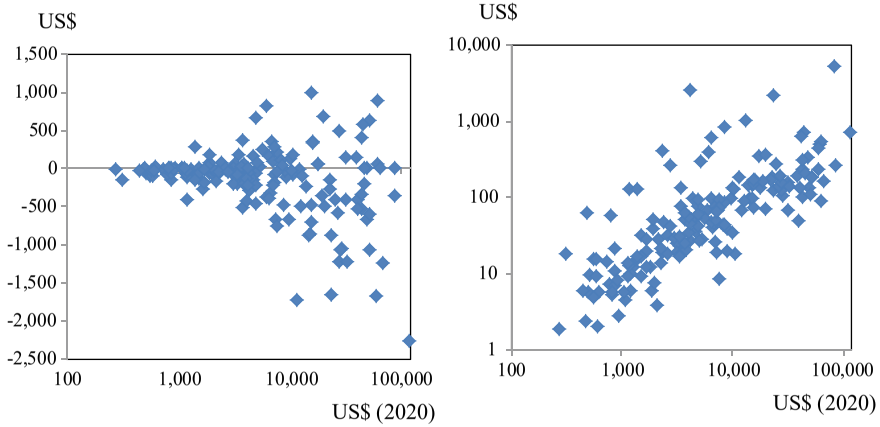


Fig. 5.13 Per capita net exports of and total international trade (exports + imports) in agricultural products as a function of GDP per capita (2020) (*Note* A few outliers have been omitted. *Source* Own calculations based on statistical data from FAO and World Bank)

As can be seen in Fig. 5.13, most developing countries have a very small net export of agricultural products. However, the countries will increasingly become either net exporters or net importers of food products as the economy grows. In total, imports + exports of agricultural products increase significantly with increasing income. Thus, greater international specialization occurs during economic growth, whereby the countries adjust to a division of labor in relation to their comparative advantage.

The clear correlation between economic growth and international food trade highlights two relationships. Firstly, economic assistance for underdeveloped countries will, ceteris paribus, create new producers and consumers in the global market. Secondly, it seems that economic growth is a necessary precondition for participation in international food trade and specialization.

5.6 Share of Import

Countries' dependence on agricultural and food imports is also changing. In general, international trade in agricultural and food is accounting for a decreasing share of total trade as trade in industrial goods, cars, computers, machinery and, not least, services is increasing much more rapidly.

Furthermore, all countries have the basic resources necessary for domestic agricultural production. Therefore, agricultural production is a dominant industry in countries that are poorly developed in terms of technology, and thus food imports are small.

Additionally, many countries do not want to be overly dependent on food imports. A certain degree of self-sufficiency in food is—or has been—part of the agricultural policy of many countries. This goal also helps to reduce food imports. The liberalization of agricultural policy in recent years has weakened the potential to limit imports, although special exceptions have been applicable in cases in which a country's import dependence has increased too much (Safeguard measures).

The share of food of total imports does not vary to the same extent as was the case with agricultural exports. Very few countries' food imports account for more than 30 percent of total imports.

The relationship between the countries' economic development and the relative importance of food imports can be seen in Fig. 5.14.

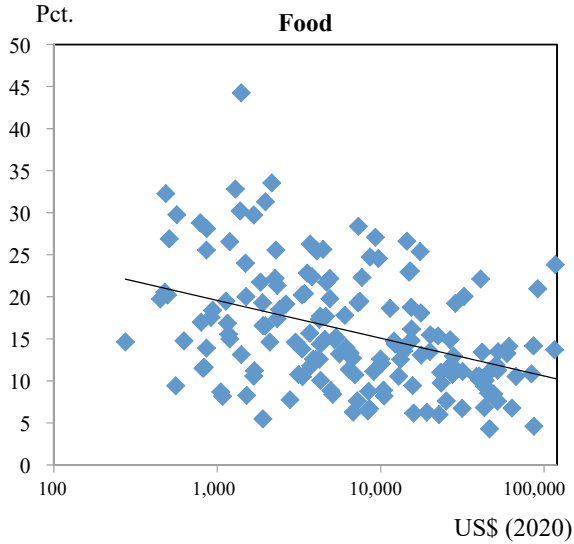


Fig. 5.14 Food import's share of total merchandise imports during economic development (2020) (*Source* Own calculations based on statistical data from World Bank)

Time series data show a similar trend: The countries' food imports have accounted for a much smaller share of total merchandise imports in recent decades, cf. Fig. 5.15.

The figure shows a clear downward trend in that the least developed countries still depend relatively heavily on food imports.

The countries' relatively limited dependence on food imports, which is a result of the goals of food security and a reasonable degree of self-sufficiency, is illustrated with an example in Fig. 5.16. The figure shows the countries' degree of self-sufficiency for poultry meat and the countries' share of the world's total consumption of poultry meat.

The figure shows that countries that are 95–105 percent self-sufficient in poultry meat account for more than 50 percent of global poultry meat consumption. A very low proportion of total consumption comes from countries with a self-sufficiency level of less than 75 percent.

In conclusion, the relative importance of food imports decreases over time due to several factors and driving forces:

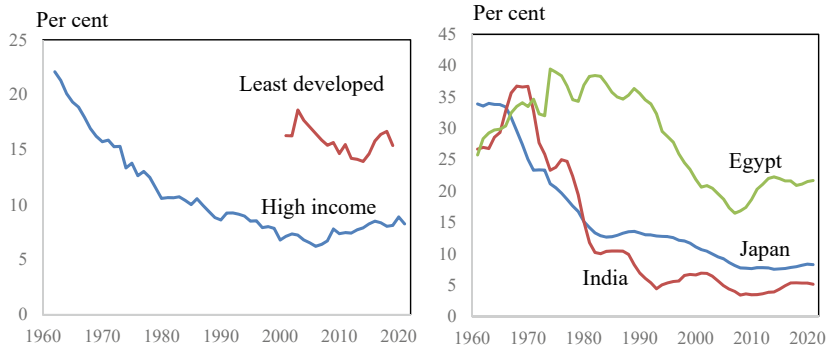


Fig. 5.15 Food import's share of total merchandise imports for least developed countries, high-income countries and selected countries (*Note* Individual countries: Five-year moving average. *Source* Own calculations based on statistical data from FAO and World Bank)

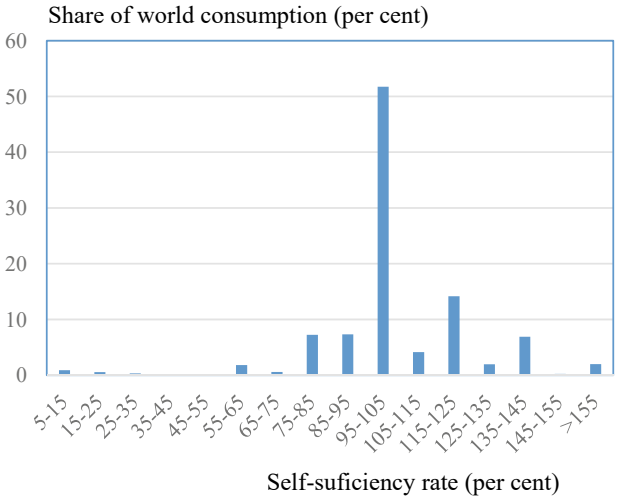


Fig. 5.16 Global consumption of poultry meat from countries with varying levels of self-sufficiency (2020) (*Source* Own calculations based on statistical data from FAO)

- All countries have the resources to produce their own food, which limits the need for imports.
- The production and consumption of agricultural and food products increases at a slower rate than they do for other products during economic growth.
- Many countries want a certain degree of self-sufficiency in food, so they limit imports through agricultural and trade policy measures.

These fundamental drivers are likely to continue to apply in the future, and thus the megatrends will continue.

5.7 Share of Consumption

The demand for and consumption of agricultural and food products is an important parameter for the development and position of agriculture and the food industry.

Firstly, demand for agricultural and food products differs from the demand for other products. Food is a basic necessity, which we need to consume daily, and which cannot be replaced.

Secondly, the extent of the demand, its composition and development is crucial for future agricultural production. The value chain is now from fork to farm, so farmers have to adapt to a greater extent to market and consumer demand.

Thirdly, food is an essential consumer good. Therefore, it receives a great deal of attention in developed and developing countries with food security and food safety being very high on the economic and political agenda.

Fourthly—and the central point of this chapter—food accounts for a steadily decreasing share of total consumption. In line with increasing economic welfare and purchasing power, the demand for, in particular, durable consumer goods, services, holiday travel, cars, housing, etc., increases. In contrast, the consumption of food is more constant, as you "can't eat your fill more than once". Consumption is changing toward more processed and more expensive food, but the increase in value is modest and the increase in quantity is even smaller. In addition, food prices often rise at a slower rate than the general inflation in society, which also means that the value of food consumption will decrease compared to total consumption.

Engel's law and Engel's curve are essential for explaining food demand and its decreasing share of total consumption. Engel's law states that as income rises, the proportion of income spent on food falls, even if actual expenditure on food rises. Engel's law was proposed by the German statistician, Ernst Engel (1821–1896).

This law does not suggest that the amount of money which is spent on food decreases with increasing income, but that the percentage of income spent on food increases more slowly than the percentage increase in income. In other words, the income elasticity of demand for food is between 0 and 1.

Engel's law can be illustrated by Engel's curve, which shows the relationship between the level of income and the level of food consumption.

There are two types of Engel's curve. The first illustrates that absolute demand for and expenditure on food varies with income. In this case, one expects demand to increase at a decreasing rate as income rises. The second type illustrates that the proportion of household income (relative demand) spent on food varies with income. In this case, one expects demand to decrease as income rises.

Engel's law and Engel's curve can be illustrated in several ways depending on which axis, data and parameters are used. Figures 5.17, 5.18, and 5.19 present examples of the correlation between income and food demand using either cross-sectional or time series data.

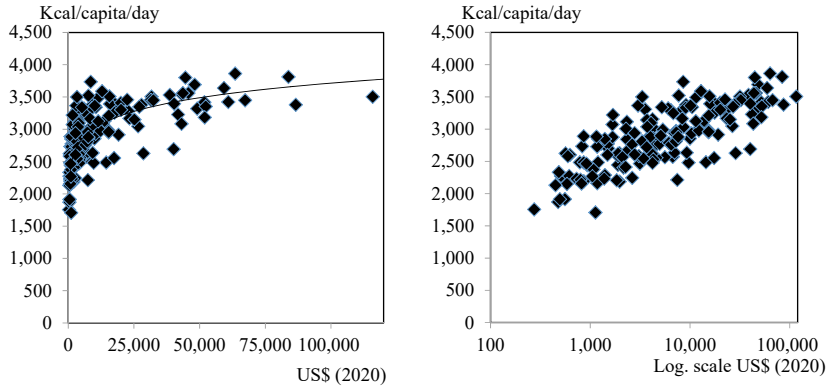


Fig. 5.17 Food consumption and level of economic development (2019) (*Source* Own presentation based on statistical data from FAO and World Bank)

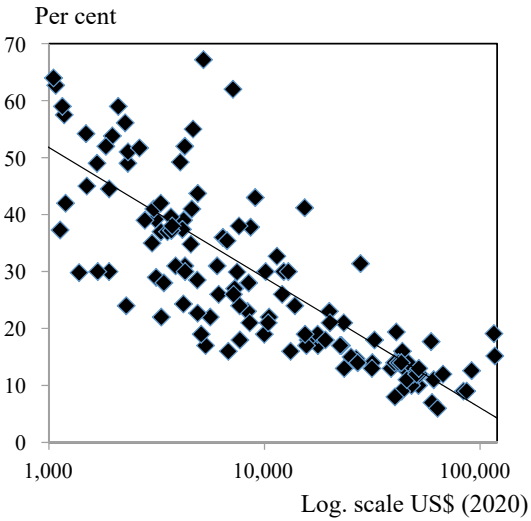


Fig. 5.18 Food's share of total consumption and level of economic development (2021 or most recent year with available data) (*Note* Definitions are not identical in the sources used. *Sources* Author's presentation based on Seale and Regmi [2006] and statistical data from FAO, USDA, and World Bank)

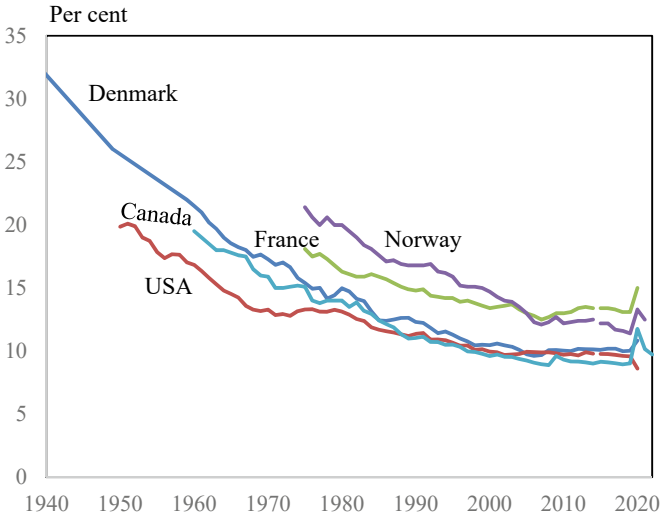


Fig. 5.19 Food's share of total consumption in selected countries (*Sources* Own presentation based on statistical data from Eurostat, Statistics Canada, Statistics Denmark, and USDA)

Figure 5.17 shows that food consumption—measured as daily food supply in calories—tends to increase with increasing income but at a decreasing rate, and that it is almost constant for high-income countries.

Figure 5.18 demonstrates that food's share of the total consumption decreases significantly as income increases. On a logarithmic scale, the trend is very clear and decreasing—using cross-sectional data for almost all countries in the world—developing and developed.

Figures 5.17 and 5.18 show Engel's law very clearly: As countries start to grow economically, demand for food increases, but food's relative share of total consumption decreases simultaneously.

Figure 5.19, which is based on time series data, shows that the role of food decreases as income increases. Countries such as the US, Canada and France have witnessed a significant and constant decrease in food's share of total consumption for several decades during which massive economic growth occurred.

Differences in calculation methods and definitions between the countries mean that the graph must primarily be used to illustrate a declining long-term trend in all countries.

5.8 Food Industry vs. Agriculture

Increasing specialization in the agro-industrial sector occurs in line with economic growth in a society.

In a developing country, a significant part of the supply and processing activity takes place in primary agriculture, i.e., on the farms. In line with economic growth, a greater division of labor occurs, so that supply and processing industries take over a significant portion of the food processing that previously was performed on the farms or in the households. This trend is likely to continue in the form of a global megatrend.

As can be seen in Fig. 5.20, there is a clear tendency for the food industry to acquire an increasing percentage of the value added in the agro-industrial complex.

Therefore, this development will also contribute to reducing primary agriculture's relative importance during economic growth. Agriculture is increasingly becoming a sub-supplier to the food industry and other related industries in or outside a food cluster.

When agricultural production and food processing take place in two different sectors, a strong and coherent value chain as well as an efficient

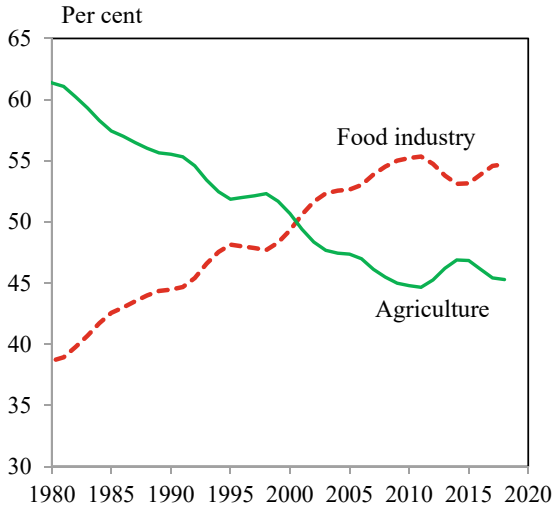


Fig. 5.20 Distribution of value added in parts of the food sector in OECD countries (*Note* Weighted average of 29 OECD countries. *Source* Own calculations based on statistical data from OECD and World Bank)

market for their products are important. Structural development in order to strengthen vertical integration is crucial.

Therefore, the development of the food industry is affected by, on the one hand, generally weak growth in demand for food, and on the other hand, increasing added value and food processing.

5.9 The Significance of the Food Industry

Although the food industry absorbs a proportion of the employment and value added from primary agriculture during economic growth, it seems that it also becomes less important as economic welfare increases. This is because the increased processing in the food industry cannot compensate for the negative effect of the low growth in demand.

The relationship between economic growth and the significance of the food industry can be seen in Fig. 5.21, which shows that food typically comprises up to 60–70 percent of the total value added in the industry in the poorest developing countries, while it typically comprises 5–25 percent in countries with the highest incomes.

A relatively clear megatrend can be observed: The food industry has a declining share of the total manufacturing industry during economic growth.

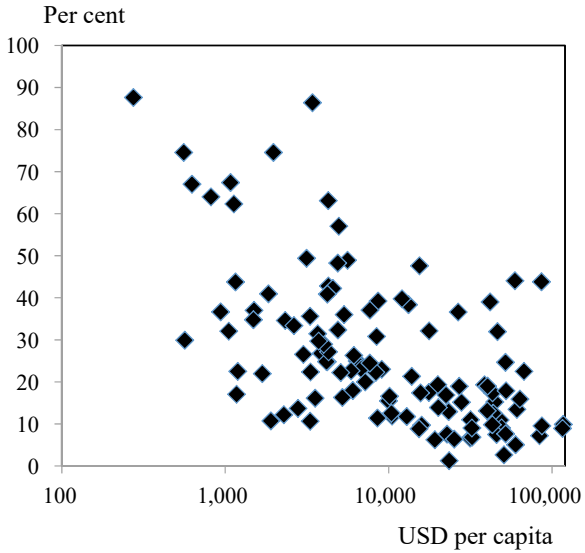


Fig. 5.21 The food industry's share of total value added in manufacturing during economic growth (2018) (*Note* Food, beverages and tobacco [% of value added in manufacturing]. *Source* Own calculations based on statistical data from World Bank)

The declining importance of the food industry is mainly due to low growth in demand along with a dependency on local and national markets. For many years, the food industry's raw materials and consumers have been preferentially local. In line with increasing liberalization and globalization, the food industry is becoming less reliant on local raw materials, so the connection with national agriculture can be expected to become weaker in the future. At the same time, more international sales will also mean that the food industry will no longer be so limited by low growth in demand, as growth can be achieved in the international markets.

Finally, it is also significant that raw materials from agriculture are playing an increasingly minor role in the food industry's production and value creation. Innovation, processing, refinement, marketing, logistics, etc., are comprising an increasing portion of the costs compared to

the cost of raw goods. Therefore, the food industry is becoming less dependent on agricultural production.

References

Grigg, D. (1992). Agriculture in the world economy: An historical geography of decline. *Geography, 77*(3), 210–222. http://www.jstor.org/stable/40572192

Grubbs, T. J. (n.d.). History of agriculture timeline for 1800–1900. https://www.timetoast.com/timelines/history-of-agriculture-timeline-1800-1900

Hansen, S. (1983). *Økonomisk vækst i Danmark. Bind II: 1914–1983* (3rd ed.). Københavns Universitets Økonomiske Institut.

Henriksen, O. B., & Ølgaard, A. (1969). *Danmarks Udenrigshandel 1874–1958*. Københavns Universitets Økonomiske Institut.

Kim, N.-N. (2018). *Korean long-term statistics 1*. Seoul National University Press Cultural Center.

Landbrugsraadet. (several issues). *Landbrugseksporten (The agricultural export)*. Landbrugsraadet (Danish Agricultural Council).

Lebergott, S. (1966). Labor force and employment, 1800–1960. In D. S. Brady (Eds.), *Output, employment, and productivity in the United States after 1800* (pp. 117–204). National Bureau of Economic Research. https://www.nber.org/system/files/chapters/c1567/c1567.pdf

Seale, J. L., Jr., & Regmi, A. (2006). Modeling international consumption patterns. *Review of Income and Wealth, 52*(4), 603–624. https://doi.org/10.1111/j.1475-4991.2006.00204.x

USDA. (several issues). *Agricultural statistics*. United States Department of Agriculture, National Agricultural Statistics Service. Retrieved from https://usda.library.cornell.edu/concern/publications/j3860694x?locale=en&page=9#release-items

CHAPTER 6

Agricultural and Trade Policy

6.1 Introduction

Agricultural and trade policy plays and will probably continue to play a major role in the agricultural sector in the future. A significant proportion of the value of agricultural production is due to agricultural support—but there are large differences between countries and products. Furthermore, agricultural and trade policy also changes over time as both the goal and instruments of support change. At the same time, several drivers that will determine the development in the future can be identified.

Agricultural and trade policy encompasses both goals and tools: The overall political goals relate to, e.g., the development of the agricultural sector, agriculture's contribution to the economy, agriculture's connection with environmental and rural development, etc. Once the goals have been determined, the instruments that will ensure that they are achieved and, at the same time, will not create unnecessary negative side effects and externalities in relation to trading partners, international agreements, the environment, climate, rural areas, etc., must be selected. The instruments may take the form of financial incentives, taxes, quotas, legal conditions, etc.

Agricultural policy and trade policy are often linked because trade policy in the form of import regulations, export support, import quotas, etc., is used to achieve the agricultural policy goals. If one of the goals of agricultural policy is to increase domestic production and secure a

H. O. Hansen, *Megatrends in Agriculture, Food Industry and Food Markets*, Palgrave Advances in Bioeconomy: Economics and Policies,
https://doi.org/10.1007/978-3-031-58152-6_6

greater degree of self-sufficiency, farmers can be guaranteed higher prices by limiting imports and thus also limiting the supply on the domestic market.

Agricultural policy objectives change over time: when some objectives have been met, other objectives become more important. At the same time, both internal and external—national and international—conditions will create new demands and goals. In a less developed country, it is initially important to secure the food supply, stable deliveries and thus often a high degree of self-sufficiency. In a more developed and industrialized country, there will be a greater focus on protecting the environment, nature and encouraging rural development, which affects and creates other agricultural policy goals.

In general, agricultural policy involves several goals. Some goals may be contradictory, while others may be achieved by the same instruments. Often, both the goals and market trends will be interconnected. For example, if a country wants to limit emigration from agriculture to support rural development and at the same time wants to increase self-sufficiency, both goals can be achieved through financial incentives for farmers. Higher sales prices, improved training and advisory services, direct production support, etc., are tools that can be used to achieve these goals.

When a country moves further up Maslow's pyramid of needs, several goals including the goals of agricultural policy will automatically change. In the same way, the instruments used will change.

Agricultural support may take many different forms, and its effects and consequences are driven by the overall goals that are set. In terms of agricultural support, some relatively clear global trends can be identified. However, the trends may vary between countries, which can largely be explained by differences in the countries' level of development and the competitiveness and supply of the agricultural sectors.

6.2 The Goals of Agricultural Policy

The goals and targets of agricultural policy set the direction in which agriculture and the agricultural industry should develop in the future.

The goals will typically determine the future structure and competitiveness of agriculture and how the sector will contribute to the social economy and environmental and rural development, etc.

Several common features of the goals of agricultural policy in developed countries have been identified. In general, agricultural policy in developed countries aims to improve:

- Income in agriculture.
- The income distribution among farmers.
- Agricultural productivity.
- Efficiency of the processing and marketing chain.
- Supply and price stability.
- Rural development.
- The environment.
- Export, employment, production, added value, etc.

Many different types of instruments can be used to achieve the given goals, and it is a very complicated relationship: Some instruments can be used to achieve several goals, while others may contribute to the achievement of some goals, while at the same time hampering the achievement of others. Finally, important differences in terms of financing, impact on production and trade, transparency etc., can be observed.

In recent decades, international agricultural policy has moved toward greater liberalization and free trade and less support and regulation. This trend will continue in the future and its effects will vary between countries and industries.

While several decades ago, the goal of international agricultural policy was to increase production, productivity and competitiveness, more recently, there has been a shift toward a greater focus on sustainability, the environment, climate adaptation, the bioeconomy, etc. This trend may reduce the attractiveness of investing in agriculture and it may also lead to fragmentation and polarization, where agriculture becomes based on two different basic ideas, either business or nature.

Agricultural policy appears to develop in waves in line with socio-economic development, agricultural development and increasing economic prosperity. Some agricultural policy goals may be met, but changes in society may mean that new more urgent goals emerge. The various focal points of agricultural policy since the middle of the twentieth century are outlined in Fig. 6.1.

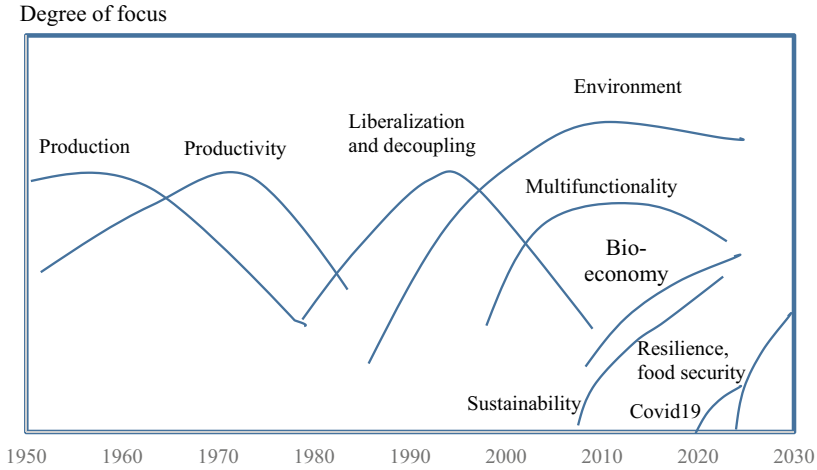


Fig. 6.1 Focal points during the long-term development of agricultural policy in the Western World (*Source* Own production)

Figure 6.1 is a schematic representation of the most important focal areas based on a qualitative assessment of the agricultural policy agenda in the Western World.

Clearly, the duration, extent and importance of the waves cannot be determined unambiguously and it is not possible to quantify them in many cases. However, the implications of the agricultural policy objectives can be determined. For example, agricultural support fell significantly during and after the liberalization wave.

The change in the agricultural policy objectives highlights that an increasing emphasis is being placed on non-economic objectives. Production, productivity, and competitiveness are no longer the most important driving forces behind agricultural policy in the Western World.

Production was a major driver in the agricultural policy in the first half of the 1900s. Countries wanted to increase their self-sufficiency and be less dependent on food imports. This was in part due to the two world wars, when trade embargoes and a lack of food were serious problems. Therefore, price support and deficiency payments were introduced to stimulate agricultural production.

In the long run, price and income support were insufficient to ensure the international competitiveness of the agricultural industry, which

meant that agricultural productivity had to be increased. However, this also resulted in more rapid structural development, fewer but larger agriculture units and increased migration. Furthermore, environmental problems began to occur as a direct result of the increase in productivity.

In the 1980s, there was an increasing focus on liberalization and decoupling within agricultural policy. Agricultural support was included in the GATT and subsequent WTO negotiations, and thus, a market orientation and a reduction in support became important issues on the agenda. Agricultural support was subsequently reduced, and increasingly decoupled from production as a part of liberalization.

As previously mentioned, environmental problems began to occur as a consequence of, among other things, increased productivity and more intensive farms. Therefore, especially since the 1970s, regulating agriculture in order to reduce its undesirable environmental impacts has been receiving much greater attention. The desire to protect or improve the quality of the environment still has a great influence on agricultural policy.

Multifunctional agriculture and related agricultural policy emerged at a time when the previous goals that were coupled with production had been met and then reduced, and when new goals for agricultural development had to be designed and legitimized.

The rise of the bioeconomy, which comprises the parts of the economy that use renewable biological resources to produce food, materials and energy, was initially driven by the development in the oil markets and the desire to develop alternatives to oil resources due to geopolitical and security of supply considerations. With reduced oil resources and with few large producers in the world, there was a latent risk of the emergence of a new oil crisis and oil price increases. At the same time, it became possible to use agricultural products such as cereals and sugar cane in the energy industry, which was useful and relevant at a time of liberalization and reduction in support. The bioeconomy subsequently gained in importance during the sustainability wave, which has received a high priority on the political agenda in recent decades.

Sustainability, i.e., meeting the needs of the present generation without compromising the ability of future generations to meet their own needs, was on the agenda in the 1990s as a result of the Brundtland report. However, the issue of sustainability became even more important when environmental policy became a focal point and the effects of climate change became more visible. Sustainability in relation to agriculture and agricultural policy can be achieved through reduced consumption

of resources, lower or negative growth, conversion from animal to plant-based production, etc. Sustainability can also be achieved through technological solutions and more proactive transformations of agricultural production.

The Covid-19 pandemic represented a completely novel and potentially disruptive trend. The pandemic caused major declines in world production: Many countries' industrial production was significantly reduced with particularly vulnerable industries such as tourism, air transport, restaurants, etc. experiencing a decline of up to 90 percent. Furthermore, the pandemic also led to a reduction in exports and international trade. However, international trade in agricultural and food products was less affected than, for example, exports of manufactured products. Nevertheless, the pandemic was an eye opener and increased awareness of the potential adverse effects of future pandemics on food security. As a result, a new agenda with a focus on shorter value chains, the protection of local or national production and food security was born.

Resilience and food security came on the agenda as a consequence of at least five major events in the early 2020s that had a significant influence on global politics and agricultural markets and policies:

- The Covid-19 pandemic: adapting to the pandemic and planning for future pandemics.
- The food crisis starting in mid-2020 led to large price increases throughout the world.
- Russia's invasion of Ukraine created uncertainty regarding the rules of the game for the global community. Export bans and trade embargoes had a significant impact on agriculture.
- Climate policy: increasingly stringent climate policy and the regulation of agriculture in the form of taxes and quotas.
- Increasing geopolitical tension between large parts of the Western World and Russia and China. The role of international trade as a peace-making instrument came under increased scrutiny.

These changes meant that the issue of food security has become more important. Are countries or regions able to ensure a stable and cheap supply of food for the population in times of crisis? Is agriculture and the food system resilient under such conditions? Should alternative food systems be developed?

6.3 Protectionism in Developed Countries

Support for agriculture in the Western World has been significantly reduced since the mid-1980s. In recent decades, the OECD has published extensive studies of the size of agricultural subsidies in the OECD countries. The OECD region accounts for approx. 60 percent of the world's total exports and imports of agricultural goods, so it is important in a global context.

Agricultural support calculated as Producer Support Estimate (PSE) in percent (transfers from consumers and taxpayers to agricultural producers as a share of gross farm receipts) was reduced by 50 percent in 1986–2022, cf. Figure 6.2.

The figure contains several methods of calculating the extent of agricultural support, which is explained in notes. The NPC, for example, is a measure of domestic prices (including direct payments) relative to the world market price. While domestic prices in the mid-1980s were 25–30 percent above world market prices, since 2007, they have remained stable at approx. 10 percent above the world market price.

As can be seen, there was a clear reduction in all three support measures during the time period, but since 2007, the level of support has stabilized and remained at a relatively constant level.

The level of the agricultural support can be compared to several different parameters, e.g.,

- Total production value in agriculture
- GDP
- Net income in agriculture
- The amount of agricultural land
- Total number of farmers

The basis for comparison depends on what you want to illustrate. Often, the level of support can be compared to several parameters. However, regardless of method and comparisons, trends and levels of support are fairly consistent.

If the level of agricultural support is compared to a country's total GDP, a picture emerges of the level in relation to the total production value of the country, cf. Figure 6.3.

Agricultural subsidies can be calculated per hectare and per farmer. The OECD has published such comparisons in the past, but it no longer

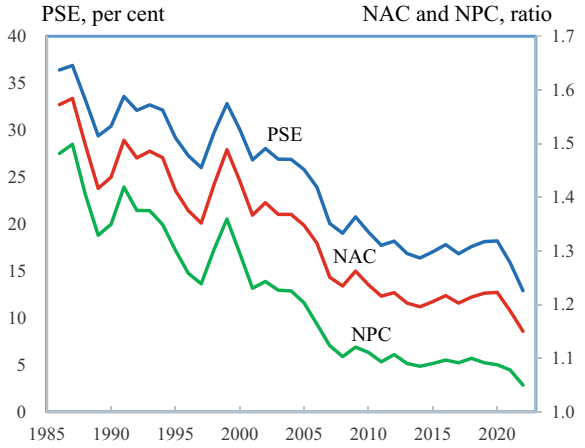


Fig. 6.2 Level of agricultural support in the OECD (1986–2022) (*Notes* PSE (%): Producer Support Estimate (PSE): The annual monetary value of gross transfers from consumers and taxpayers to agricultural producers, which is calculated at the farm gate level and arises from policy measures that support agriculture regardless of their nature, objectives or impacts on farm production or income. It includes market price support, budgetary payments and budget revenue foregone, i.e., gross transfers from consumers and taxpayers to agricultural producers arising from policy measures. PSE (%) illustrates transfers as a share of gross farm receipts. NAC (ratio): Producer Nominal Assistance Coefficient (producer NAC): The ratio between the value of gross farm receipts including support and gross farm receipts (at the farm gate) valued at border prices (measured at the farm gate). NPC (ratio): Producer Nominal Protection Coefficient (producer NPC): The ratio between the average price received by producers (at the farm gate), including payments per ton of current output and the border price (calculated at the farm gate). *Source* Own presentation based on statistical data from OECD)

does so to the same extent. The level of agricultural support per farmer provides an indication of the intensity of the support, and the dependence of farmers on support. Calculating the level of support per hectare and per farmer can be problematic as the characteristics of a hectare of land may vary substantially between countries. The total number of farmers can also be difficult to calculate precisely as it will include full-time, part-time, subsistence, and family farmers, so counting farmers (labor input) will lead to uncertainties.

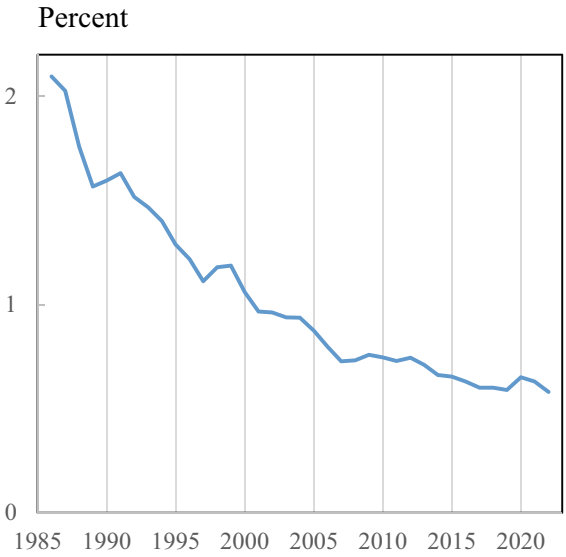


Fig. 6.3 Total support for agriculture (TSE) in the OECD as a percentage of GDP (*Note* Total Support Estimate (TSE): The annual monetary value of all gross transfers from taxpayers and consumers arising from policy measures that support agriculture, net of the associated budgetary receipts, regardless of their objectives or impact on farm production and income, or the consumption of farm products. (*Source* Own production based on statistical data from OECD)

Taking these uncertainties into account, Fig. 6.4 presents the level of agricultural support per farmer, here defined as an individual employed in agriculture.

The figure reveals a large spread that ranges from $58,000 per farmer in Switzerland to $–1,100 per farmer in Argentina.

Whereas overall, agricultural support is decreasing, the trend is toward increasing support per farmer as the total number of farmers is decreasing at a greater rate.

Calculating the level of support with the different methods reveals the same clear trend and pattern. The question is, of course, whether the level of support will continue to fall in the future. To answer this question, it is necessary to analyze the drivers behind the development. If they are clear and stable, it is more likely that the development will continue.

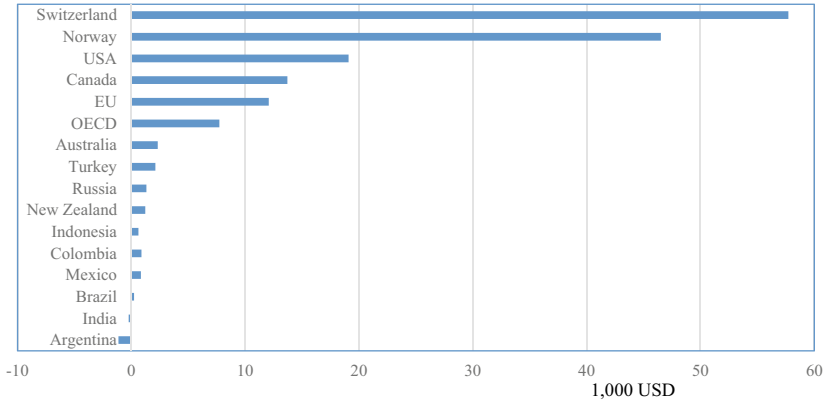


Fig. 6.4 Agricultural support (PSE) per farmer (employed in agriculture) in selected countries (2020) (*Source* Own production based on statistical data from OECD)

A number of factors and drivers will either stimulate or limit liberalization.
Factors that stimulate liberalization:

- GATT/WTO (General Agreement on Tariffs and Trade/World Trade Organization)
- Economic benefits from international specialization
- Globalization
- Cold war is over
- Bilateral trade agreements
- Declining importance of self-sufficiency as a goal
- Efficient infrastructure to facilitate trade
- Economic growth
- Pressure from consumers, taxpayers, trading partners and other stakeholders

Factors that limit liberalization

- Pandemics
- Geopolitical crises
- Food crises

The GATT/WTO was a major driver behind the liberalization of the international trade in agricultural products and the reduction and restructuring of agricultural subsidies.

Originally, trade in agricultural products was not part of the GATT-agreement. Agriculture was considered a special industry: Agriculture produces food, and food security and a certain degree of food self-sufficiency were important political goals. The agricultural sector was also experiencing to substantial structural change including the emigration of labor, which led to problems. The extensive emigration of labor was used as an argument to limit the structural development and the liberalization by means of support schemes and trade protection. In the seven rounds of GATT negotiations from 1947 to 1979, during which tangible results were achieved on freer international trade, agriculture was not on the agenda.

It was not until the Uruguay Round (1986–1994) that agriculture as an industry appeared on the agenda and was subject to partial liberalization. In 1995, the WTO was established, which led to more binding cooperation among the members than had been established in the GATT agreements. The number of members of the GATT/WTO increased, and an increasingly large share of the total export and import of agricultural goods was thus covered by the agreements, cf. Figures 6.5 and 6.6.

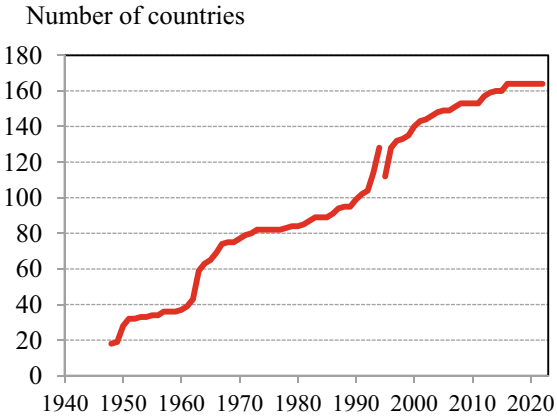


Fig. 6.5 Number of member countries of GATT/WTO (*Source* Own presentation based on information from WTO)

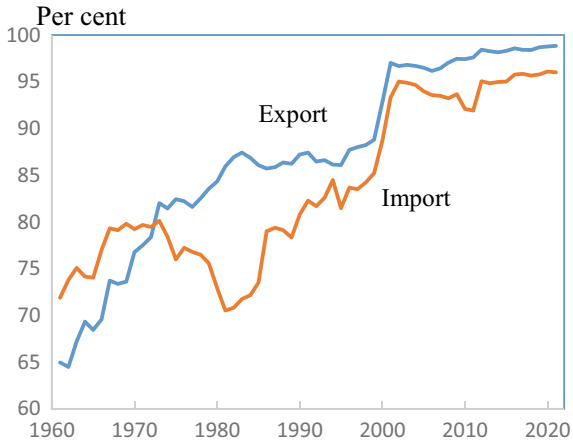


Fig. 6.6 Share of total global imports and exports of agricultural products from GATT/WTO member countries (*Source* Own presentation based on statistical data from FAO and WTO)

The main function of the WTO is to ensure that trade flows as smoothly, predictably and freely as possible (WTO, n.d.), so if the principles and cooperation in the WTO can be maintained, the WTO will be an important guarantor or driver for the continued liberalization of trade in agricultural products.

The common understanding that economic welfare is increased by the free movement of goods is also a driving force behind liberalization. When several countries trade together without significant barriers, a win–win situation emerges. In general, agricultural subsidies will result in a financial loss for consumers and taxpayers, and the long-term resource allocation in a country and throughout the world will be negatively affected. Although consumer costs are relatively non-transparent, and food costs represent a declining and relatively small share of total consumption, a significant decline in economic welfare may occur.

Globalization has also been both a driving force behind—and a result of—liberalization. Globalization as increasing cooperation and integration across national borders will put political pressure on governments to open up to more free trade between countries.

The end of the Cold War has enabled increasing market-based international trade. The countries in the former Comecon cooperation, where

state trade was extensive, today account for just under 10 percent of the total global exports and imports of agricultural goods. Comecon, Council for Mutual Economic Assistance, was an organization from 1949 to 1991. Members were the Soviet Union, Eastern European countries, Cuba and Vietnam. The purpose was to facilitate and coordinate the economic development of the member countries.

Bilateral agreements and regional trade agreements and trade blocs may be used to promote trade liberalization. A limited bilateral agreement with a neighboring country may be a step toward liberalization, and at the same time, experience can be gained, which can be used in subsequent more far-reaching trade agreements.

Security of supply and food security achieved through a high degree of self-sufficiency used to be a very important goal of agricultural policy in many countries. However, it is no longer as dominant as it was a few decades ago as other goals have become more important. Access to food does not need to be ensured exclusively through domestic production, and thus support and trade barriers to support domestic agricultural production are no longer as necessary.

A lack of infrastructure used to be a major international trade barrier. With the continued development of infrastructure within, e.g., shipping and aviation, the opportunities for transporting agricultural and food products over long distances have been significantly improved.

Economic growth is an important goal of many countries' economic policy. Increasing trade liberalization can create increasing international trade, which can then contribute to greater economic growth.

Pressure to liberalize trade may grow both internally in individual countries and externally from other countries.

Agricultural support will incur consumer and taxpayer costs, and it will also affect its competitiveness in relation to other domestic industries. At the same time, agricultural support may also involve market interventions such as overproduction, storage, the destruction of food, dumping on the world market, etc., which may result in further pressure to reduce agricultural support.

External pressure from the most competitive and most export-oriented countries will also influence and strengthen liberalization. The inclusion of agriculture in the GATT negotiations in the 1980s was largely due to pressure from the USA, the so-called Cairns countries and a number of developing countries.

Historical trends and driving forces will not necessarily continue, and new scenarios, shocks and possible disruptions must also be considered.

New pandemics may cause increased protectionism in the agricultural sector in the future. The Covid-19 pandemic gave an indication of this. Although agricultural and food exports were relatively unaffected by the pandemic, increased protectionism and less international trade as a direct result of the pandemic were identified. The connection between the pandemic and protectionism and international trade has been analyzed in several sources, e.g., OECD (2020), Politi (2020), and Espitia et al. (2020).

There is a tendency for crises—be they political, economic, environmental, structural or health-related—to be used to support a protectionist agenda. Increased protectionism, selfishness and reduced trade are promoted as the solution. At a time when existing and new superpowers are fighting for power, and national interests appear to be the top priority, the emergence of serious global political crises in the future is not unthinkable. The question is probably: when will they occur, how serious will they be and what consequences will they have for international trade?

Prolonged food crises may also trigger new protectionism in agricultural and food markets. During the food crises of 2007–2008, 2011–2012 and 2020–2023, several cases of countries attempting to protect national markets were observed. Political arguments for increased trade protectionism were also espoused because dependence on imported food had become too great.

6.4 Protectionism in Developing Countries

As discussed in the previous section, agricultural support and agricultural protectionism have generally been decreasing in recent decades, albeit from a relatively high level. However, the opposite is the case for several countries with a relatively low level of economic development but rapid economic growth. A number of low-income countries follow the same pattern, whereby agricultural support is increasing, albeit from a very low level; indeed, the level of support is often negative.

Emerging countries—countries being in a transitional phase between developing and developed status—have been identified as Argentina, Brazil, China, Costa Rica, India, Indonesia, Kazakhstan, the Philippines, Russia, South Africa, Ukraine and Vietnam (where extensive and reliable data is available via the OECD). These 12 countries account for 50

percent of the world's population, 35 percent of the total agricultural area, 51 percent of agricultural production and 54 percent of the world's grain production, so it is an important group of countries in relation to agricultural production.

In the 12 emerging economies, total agricultural support (TSE) grew from $44 billion in 2000–2002 to $280 billion in 2018–2020, an increase that was driven by increasing rates of producer support in the largest emerging economies, especially China, India and Indonesia. The TSE (Total Support Estimate) for the emerging economies averaged 1.2 percent of GDP in 2018–2020, which reflects the importance of agricultural support in the largest emerging economies, which are home to large agricultural sectors with sizeable rural populations.

Total agricultural support in the 12 emerging countries was approx. $200 billion in 2020, which corresponds to 83 percent of the level of agricultural support in the OECD countries.

Total agricultural support in emerging countries has exhibited an increasing trend in recent decades, cf. Figure 6.7.

Other measures of agricultural support reveal the same trend with increasing agricultural support in emerging countries and declining support in the OECD, cf. Figure 6.8.

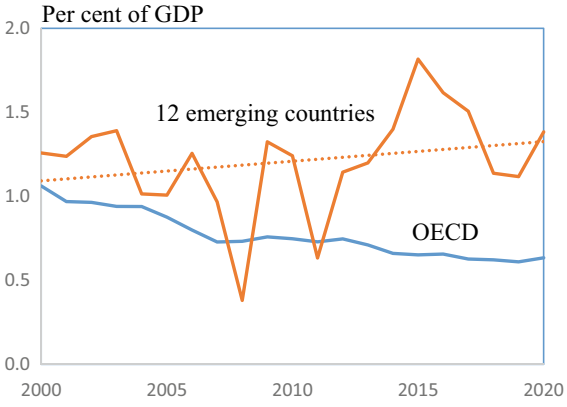


Fig. 6.7 Change in total support (TSE) to agriculture in the OECD and in 12 emerging economies, 2000 to 2020 (*Note* Trend curve for emerging countries is plotted. *Source* Own production based on statistical data from OECD)

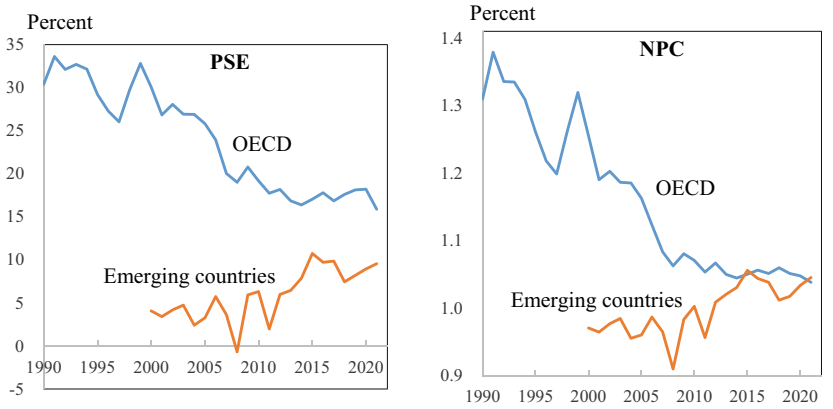


Fig. 6.8 Change in support (PSE and NPC) to agriculture in the OECD and 12 emerging economies, 2000 (1990) to 2022 (*Source* Own production based on statistical data from OECD)

China and Indonesia are mainly responsible for the increase in the overall agricultural support for the 12 emerging countries. In contrast, agricultural support in India and Argentina, for example, has been declining, cf. Figure 6.9.

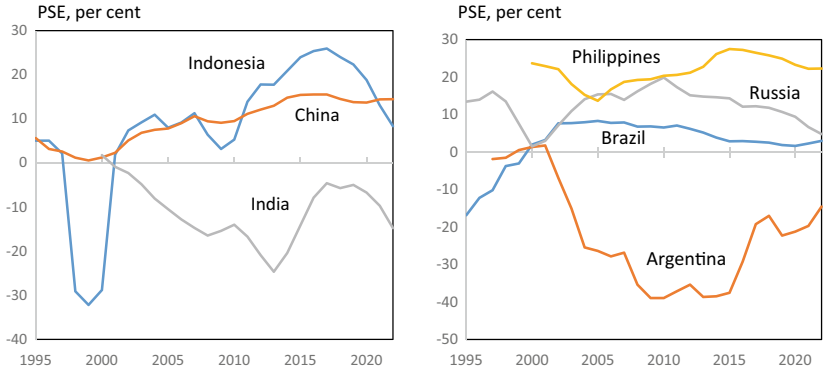


Fig. 6.9 Agricultural support (PSE) for selected emerging countries, 1995–2022 (*Note* Three-year moving average. *Source* Own production based on statistical data from OECD)

China accounts for 23 percent of the world's total agricultural production in terms of value and is, therefore, a very important player.

The long-term trend in the goals and instruments of China's agricultural policy reflects the changing role of agriculture as the country develops. Regarding China's development, some important milestones can be identified. Firstly, in the 1950s and 1960s, the aim was to support industrial development, and therefore industry was subsidized at the expense of agriculture. In the late 1970s, China started to reform its centrally planned economy in order to transition to a market-based economy, which had a large influence on its agricultural sector.

Following the general liberalization of international trade in agricultural products and China's accession to the WTO in 2001, China sharply reduced import duties on agricultural products.

In the 2000s, the focus was on improving farmers' incomes and achieving self-sufficiency. In order to improve farmers' incomes, minimum prices, a purchasing and storage system and subsidies to reduce farmers' costs were introduced (OECD, 2022). Market price support became the most important instrument, and domestic prices were gradually increased until they were significantly above world market prices, and this level was maintained. Support for agriculture increased until 2015, when new reforms were introduced which reduced market price support.

Argentina differs in that its agricultural support is very negative, which is due to the fact that the country has a significant export tax, which increases the domestic supply and pushes domestic prices down below the world market price (OECD, 2022). For periods, the export of maize was banned. The negative and fluctuating agricultural support that has been occurring since the beginning of the 2000s is due to unstable macroeconomic conditions such as the depreciation of the Peso.

When it comes to agricultural support in low-income countries, the same pattern as the one in emerging countries can be identified: In general, agricultural support is low, but the trend is increasing—less negative—agricultural support, cf. Figure 6.10.

The figure presents agricultural support calculated as the nominal protection rate. The figures for the OECD and high-income countries come from two sources, but the trend is identical. The figures for low-income countries are based on data from a number of selected countries for which information is available.

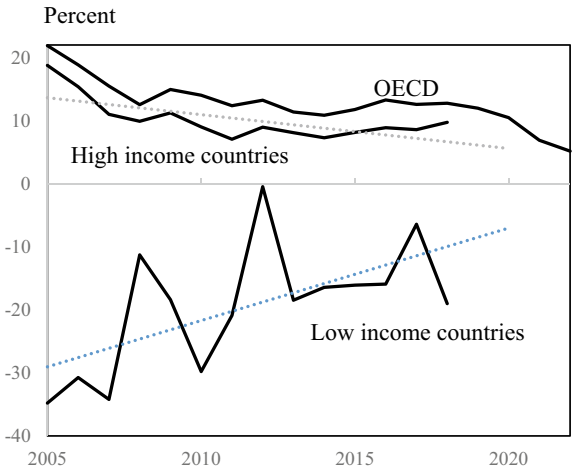


Fig. 6.10 Nominal rate of protection 2005–2018 (2022) (*Note* Trendlines for high and low countries respectively. *Sources* Own presentation based on statistical data from OECD and AgIncentives)

This international pattern has been observed previously. World Bank (1986) concluded that developing countries clearly tend to tax agricultural commodities, while industrial countries tend to support domestic production and thereby inhibit imports and encourage exports.

6.5 Waves of Regional Trade Agreements

While previously, liberalization was primarily the result of multilateral negotiations, today regional trade agreements, i.e., two or more countries agreeing to engage in free trade together, are becoming increasingly important. On the one hand, such agreements may be a "second-best" alternative to further WTO liberalization, while on the other hand, they may be the first step toward a more general opening of the countries' trade and economy to the outside world.

Regional trade agreements have both advantages and disadvantages as they can both favor and distort international trade. The net effect must be assessed in each individual case. However, significant examples of distortion as a result of regional trade agreements have been identified.

Regional trade agreements also have an important economic impact on international food markets, although food often has a special status in these agreements.

Regional trade agreements are becoming increasingly important, and they are growing in number with an increasing share of world trade taking place according to special terms included in regional trade agreements. The recent development has had the following direction:

- Regional trade agreements are increasingly being used by countries that would otherwise prefer and rely on multilateral trade liberalization. Regional trade agreements are then given the same priority as, e.g., WTO negotiations.
- Regional trade agreements are becoming increasingly complex and non-transparent.
- Two or more trade agreement groups (and not single countries) are increasingly entering into regional trade agreements.
- Measures other than just trade access are included in the agreements such as foreign direct investments, cooperation on economic development, etc.
- Agriculture is increasingly being treated like other products in regional free trade agreements and agricultural products are less often exempt from such agreements than previously (OECD, 2019).

The trend in regional trade cooperation indicates that the development has occurred place in waves, although the sources disagree slightly in terms of the location and content of the waves (Gaulier et al., 2004; Mariano et al., 2021). Nevertheless, four significant waves or "eras" can be identified—as shown in Fig. 6.11.

The first wave was the result of the establishment of the two European regional trade agreements, the EC and EFTA (The European Community and The European Free Trade Association), which began the process of European integration inter alia in response to the Second World War.

The second wave started in the mid-1980s with the establishment of the EC's internal market and free trade agreements between the USA and Canada and later also with Mexico. The EC's internal market further strengthened free internal competition by including new dimensions of market integration.

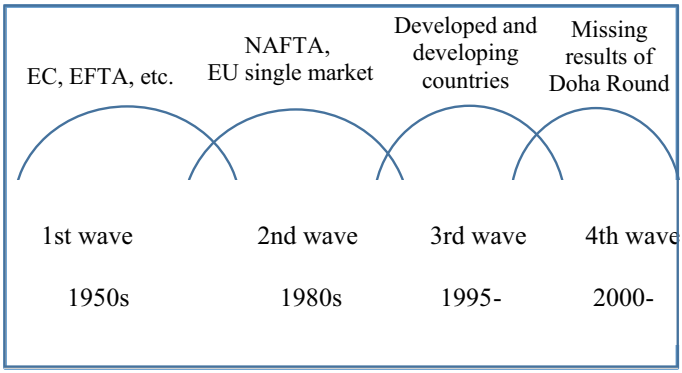


Fig. 6.11 Waves in regional trade cooperation (*Sources* Own presentation based on Mariano et al. (2021), Gaulier, Jean and Ünal-Kesenci (2004), and WTO (2011))

The 3rd wave began at the end of the 1990s and the beginning of the twenty-first century. Several new agreements between developed and developing countries were concluded, and thus an attempt was made to stimulate the economic development and welfare of the developing countries through trade and by strengthening the conditions of the developing countries in terms of international trade and investment. Finally, the establishment of the WTO and the negotiation rounds also created a new generation of free trade agreements.

The 4th wave was a substitute for the WTO agreements that had not or had only partially been achieved. The mere expectation that a round of WTO negotiations would not achieve the desired results was the motivation for the creation of several regional trade agreements. For example, the setback in the Doha Round of negotiations in Cancún in 2003 was a reason behind the subsequent increased interest in establishing regional trade agreements (Crawford & Fiorentino, 2005).

New waves spurred by other drivers are likely to emerge in the future. Regional trade agreements may be more directly driven by political and strategic motives rather than trade interests.

A 5th wave could also be driven by anti-globalization, whereby trade with more local countries is supported.

6.6 Driver: Self-Sufficiency Rate and Economic Welfare

The level of agricultural support varies greatly between countries—even among the more developed countries in the world. Calculated as PSE, the agricultural support varies from approx. –20 percent to +55 percent, and TSE in percent of GDP varies from –2 percent to 2.5 percent cf. Figure 6.12.

However, a pattern in the level of agricultural support can be identified, and two factors can explain a very large part of the level of support:

Firstly, the amount of aid depends on the countries' level of income. As a general rule, agricultural support is highest in the richest countries as only these countries can afford to support agriculture. In high-income countries, agriculture plays a relatively small role in the economy, which also makes it easier to support the industry.

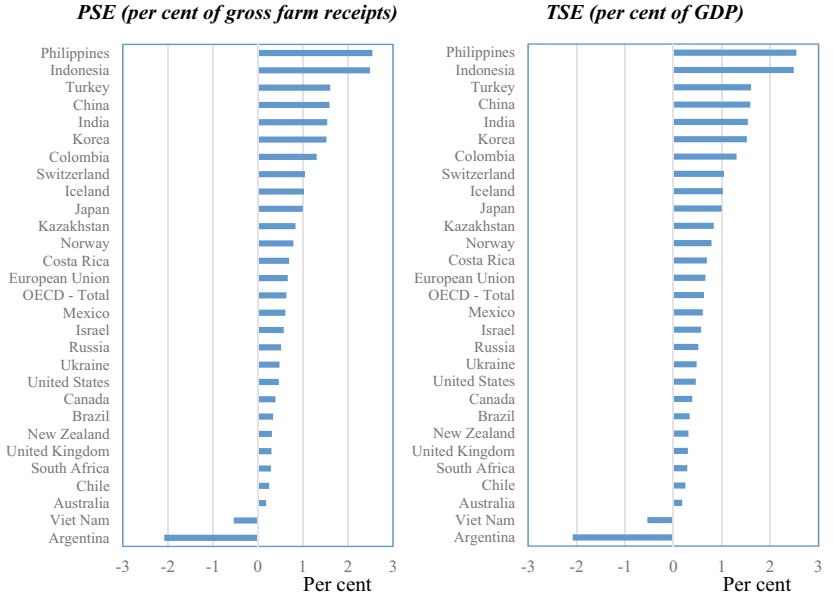


Fig. 6.12 Agricultural support (2022) (*Source* Own presentation based on statistical data from OECD)

Another explanation is that low-income countries will often get tax revenue via export duties as this is a relatively uncomplicated way of raising revenue. Taxing exports also creates an oversupply on the domestic market, which also results in cheaper food, which may also be a political goal. In low-income countries, access to cheap food is critical. The result, however, is that the farmers' selling prices are kept artificially low in relation to the world market price, which means the agricultural support becomes very low or even negative.

Secondly, the countries' net export of agricultural goods is also a factor that can explain the level of agricultural support among the countries: Countries with a large net import and thus a low degree of self-sufficiency can more easily support agriculture by using, e.g., trade regulations: An import tariff provides revenue for the government, and when exports are small or non-existent, the effect on public finances is positive and may be significant. In such cases, the costs are exclusively financed by consumers. If a country has a large net export, agricultural support will often necessitate export support, which will burden the public budget. The greater the net export, the greater the cost for the public budget.

The correlation between the level of agricultural support and the income level of the countries and net exports is presented in Figs. 6.13 and 6.14.

Income and net exports are not connected: Some countries are rich and are net importers (Norway, Japan, Switzerland), while other countries are rich and are net exporters (New Zealand, Australia and Denmark and the Netherlands, which are part of the EU in the figures).

The figures provide a snapshot based on cross-sectional data and cannot necessarily be interpreted as time series analyses. We cannot conclude that countries will increase agricultural subsidies if welfare and income increase or net exports decrease. From an economic point of view, however, it is clear that a country with a low level of self-sufficiency and a high level of income (relatively small agricultural sector and large public revenues) will typically have a relatively high level of agricultural support.

6.7 Market Support and Direct Support

In recent decades, agricultural support has changed significantly. The level of support has decreased—protectionism has weakened and liberalization has strengthened. At the same time, the composition of the agricultural

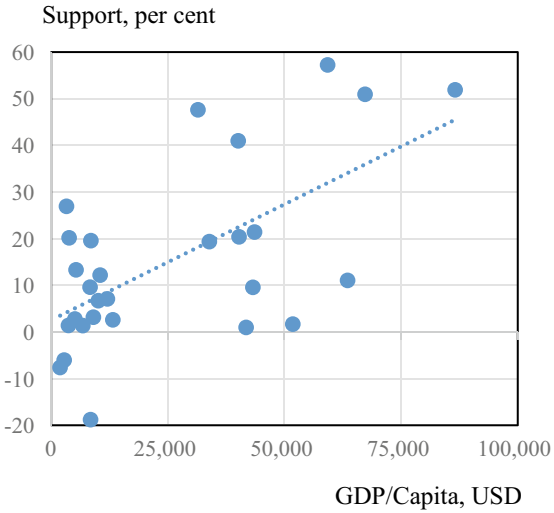


Fig. 6.13 Income level and agricultural support (*Note* Agricultural support is calculated as PSE in percent. *Source* Own presentation based on statistical data from FAO and OECD)

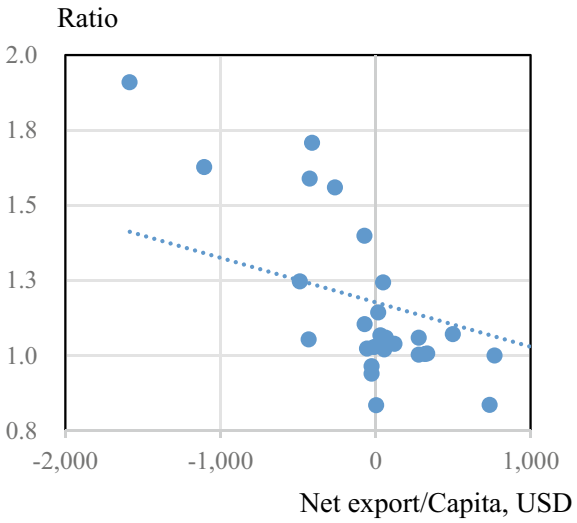


Fig. 6.14 Self-sufficiency level and agricultural support (*Note* Self-sufficiecy level is illustrated as net export per capita. Agricultural support is calculated as PSE in percent. *Source* Own presentation based on statistical data from FAO and OECD)

support has also changed substantially. Consumer-financed market price support has decreased, and taxpayer-financed direct support has increased, cf. Figure 6.15.

The figure illustrates who has financed the agricultural support in the OECD countries since 1986: Agricultural support can be financed either by consumers via artificially high prices for agriculture and food (high price system), or by taxpayers via direct payments to farmers (low-price system).

A system change or a paradigm shift occurred during the period. The EU, in particular, has moved away from a consumer-financed support system to a taxpayer-financed system. This is primarily because a high-price system is often more disruptive to trade and is, therefore, more exposed to criticism and restrictions in the WTO. In low-price systems, market prices are more or less unaffected, support can be decoupled from production, and farmers receive prices which in principle correspond to world market prices. Instead, market support payments are given directly to farmers.

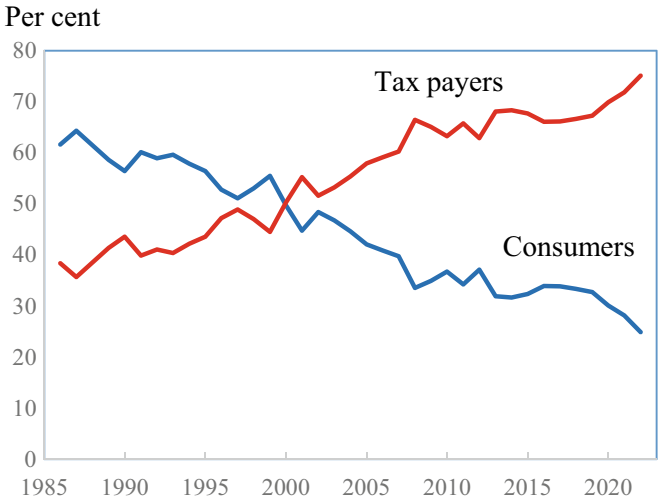


Fig. 6.15 Taxpayers' and consumers' share of the financing of agricultural support in the OECD (1986–2022) (*Source* Own presentation based on statistical data from OECD)

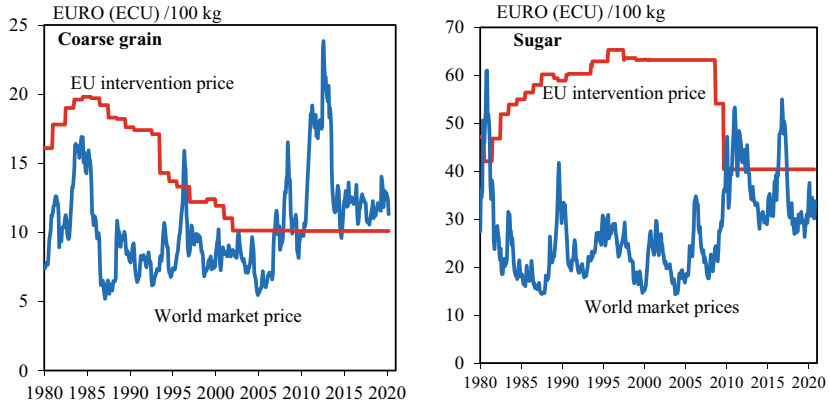


Fig. 6.16 EU prices and world market prices (*Source* Own presentation based on European Commission (several issues) and market data)

Figure 6.16, which is based on actual market prices, illustrates how the market support for coarse grain and sugar was reduced during the 1990s.

It does not make sense, a priori, to attempt to determine whether one system is superior to the other. The support level is independent of the support system, and both systems have advantages and disadvantages. However, in a high price system, trade discrimination is inevitable, and protection by means of trade barriers becomes increasingly difficult to maintain in an increasingly globalized world.

In the near future, the previous trend will probably continue: Support will change from high to low-price systems, decoupling and reduced impacts on markets, a general reduction in support, and freer competition on international agricultural and food markets.

6.8 Coupled and Distorting Support

Agricultural support can have many different forms, effects and consequences. In particular, the impact of agricultural support on production and international trade is important as it has a major influence on the design of agricultural policy—historically and in the future.

When it comes to the impact of agricultural support on agricultural production (coupled support), the instruments in agricultural policy can be divided into groups:

Price Support

Support in the form of higher market prices than, e.g., on the world market.

Deficiency Payments

Transfers from taxpayers to farmers which correspond to the production multiplied by the difference between the world market price and a given target price on the domestic market.

Support Coupled With Input Factors

- Area premiums
- Headage premiums
- Financial support
- Other support to reduce costs

Direct Support Coupled With Other Factors

- Extensification
- Protection of landscape
- Support to enhance structural change
- Economic development in rural areas

Support Fully Decoupled From Production

- Compensation caused by drought, etc.
- Income support, lump-sum payments
- Early retirement schemes

Furthermore, a number of additional instruments exist, which should not directly be used to achieve the objectives, but should be used to reduce supply and/or costs related to agricultural policy. Quotas and set-aside are examples of such instruments.

The choice of specific instruments is important for several reasons:

First, a clear connection between goals and instruments (means) is important. Instruments must be chosen so that they best contribute to achieving the desired goals.

Second, instruments may have very different implications for the markets and stakeholders. If price support is chosen, domestic production will be stimulated, imports will be limited, markets will be "disrupted" and competitors—both within and outside the agricultural sector—will be discriminated. Alternatively, if income support, set-aside support, extensification support or the like is given—decoupled and independent of how much or whether production occurs—far less disruption will result.

As Fig. 6.17 illustrates, recent decades exhibit a clear trend toward a decreasing proportion of agricultural support being based on commodity output, i.e., linked and coupled to agricultural production.

Countries have substantially altered their agricultural trade and domestic support policies during the past two decades (OECD, 2022). In general, support provided to farmers has become more decoupled from production, which means that many farmers no longer receive payments for producing a specific commodity, and instead it is increasingly

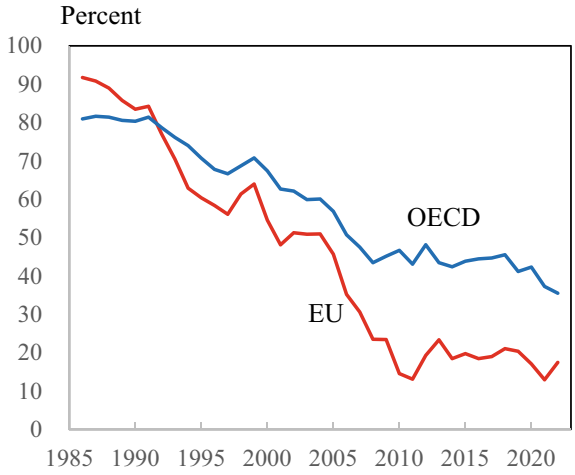


Fig. 6.17 Share of support in the OECD based on commodity output, in total PSE (percent). (*Source* Own presentation based on statistical data from OECD)

being targeted at environmental improvements, farmer income, landscape protection, etc. In the WTO and in the international negotiation rounds, the focus has been on making the support less trade-distorting. However, in some developed countries, support remains high and linked to production, while some emerging economies have also significantly increased policy interventions that distort production.

The most distorting instruments—market price support, payments based on output and payments based on variable inputs without constraints—still represent more than half of all transfers to and from producers in many countries, although some countries have implemented reforms that have decoupled support from production levels.

Figure 6.18 presents the level of and change in the share of distorting support as a percent of PSE in the OECD countries on average and in some selected countries.

The figure shows that the OECD countries on average have almost halved the proportion of distorting support (from 85 percent to 44 in the period 1986–2022). The EU has reduced the most (from 92 to

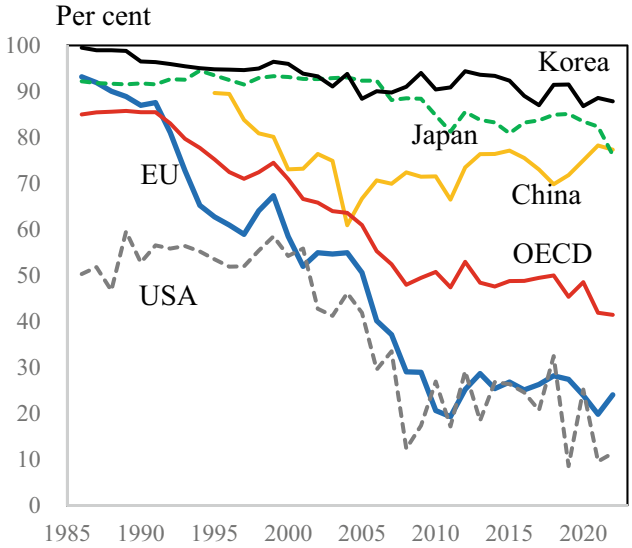


Fig. 6.18 Share of distorting support as percent of PSE in selected countries (*Source* Own presentation based on statistical data from OECD)

24 percent), while Japan and Korea, which already had high levels of agricultural support, have only reduced the distorting support slightly.

6.9 Agricultural and Environmental Policies

As discussed in the previous sections, the environment has been given increasingly high priority on the agricultural policy agenda. A trend has emerged whereby agricultural and environmental policy merge, or where the environment becomes an explicit part of agricultural policy. This agri-environmental policy includes payments for environmental services that pay farmers to reduce the negative externalities of agricultural production, while serving as an instrument to transfer public funds to farmers.

The reduction of externalities is not a clearly defined concept, and it may be the result of many different interventions. The change from coupled to decoupled support, which mostly had a trade policy purpose, has basically also led to less intensive production and thus fewer negative externalities and thereby an improvement in the quality of the environment—ceteris paribus.

In some cases, support schemes are made conditional on the fulfillment of specific environmental conditions, while in other cases, an environmental improvement is the primary or only goal.

Agricultural policy has both direct and indirect effects on the environment, which makes it difficult to identify or quantify the development of agri-environmental policy. Agricultural and environmental policy seem to merge in several ways, which makes it difficult to separate goals, means and consequences.

However, it is possible to identify the agricultural policy instruments which limit negative externalities, although the environmental effects may differ between instruments.

The OECD prepares a comprehensive mapping of agricultural policy and agricultural support in which the support schemes are grouped based on, e.g., commodity output, input use, production required/not required, non-commodity criteria.

One criterion is *With or without input constraints*, which stipulates whether there are specific requirements concerning farming practices related to the program in terms of a reduction, replacement or withdrawal of inputs or a restriction on certain farming practices. The payments with input constraints are further broken down into:

- Payments conditional on compliance with basic requirements that are mandatory.
- Payments requiring specific practices that go beyond basic requirements and voluntary.
- Specific practices related to environmental issues.
- Specific practices related to animal welfare.
- Other specific practices.

Support under this scheme will typically have direct or indirect positive effects on the environment. This type of support has increased in importance significantly in the OECD countries in recent decades, cf. Figure 6.19.

The figure illustrates that almost 45 percent of agricultural support in the OECD is now connected with input constraints, while the share is over 60 percent in the EU. In both cases, there has been a significant increase in recent decades. The proportion is relatively small but increasing in countries such as Korea and Japan, while it is now decreasing and low in China.

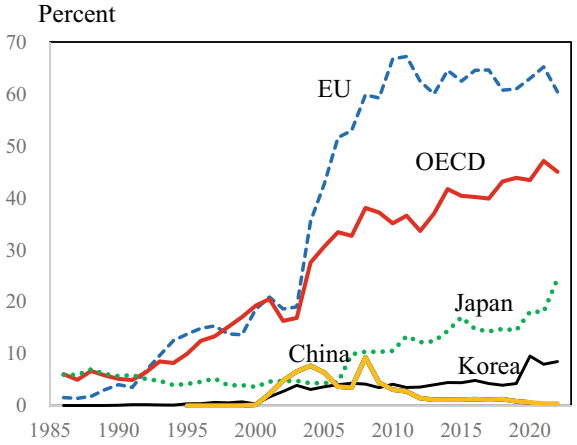


Fig. 6.19 Proportion of support with input constraints for selected countries (*Note* Three-year moving average. *Source* Own presentation based on statistical data from OECD)

6.10 New Balances in the Agricultural Policy

As discussed in Sect. 6.2, agricultural policy develops in waves. Some agricultural policy goals are met, while new challenges and new goals become more urgent. Both challenges and solutions may be very diverse, which makes agricultural policy complicated: it will often be difficult to define and implement new objectives, as there may be conflicting considerations. For this reason, new balances must be secured in agricultural policy, so that as many objectives as possible are met in the best possible way at the lowest cost.

New goals for agriculture will certainly emerge in the future. The aim of agriculture and agricultural policy is to meet the triple challenge of:

- Ensuring food security and nutrition for a growing population.
- Providing livelihoods for farmers and others in the food chain.
- Improving the environmental sustainability of the sector (OECD, 2021).

These three goals, which everyone would probably agree with, are clear, and agricultural policy instruments are obvious to use. However, internal contradictions and paradoxes in the three goals make implementation difficult. For example, a focus on sustainability will often lead to less intensive agricultural production and thus less agricultural production. This may then result in worse living conditions for farmers and reduced food security.

New serious challenges in terms of sustainability, climate adaptation, the bioeconomy, etc., will definitely also set new agendas for agricultural policy. Parallel to this, hunger is a major global problem, while food security and food supply are significant ongoing challenges. Agricultural policy must thus embrace many diverse objectives. In a global perspective, at least five parallel goals, challenges and balances must be dealt with, cf. Figure 6.20.

Sustainability: (Considerations for the Environment, Climate, Nature, Animal Welfare, etc.)

The broad definition of the term sustainable development is *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs"* (UN, 1987). The definition

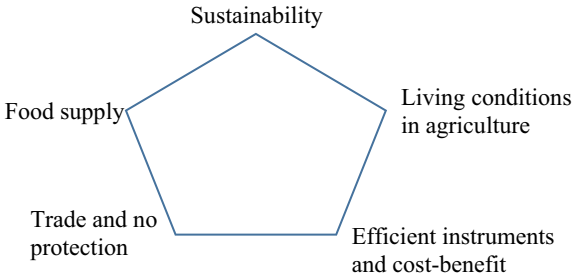


Fig. 6.20 Goals, challenges and balances in international agricultural policy (*Source* Own production)

includes a number of biological and technical conditions. In this context, other considerations such as animal welfare, access to nature, etc., are also included as they are increasing in importance in a number of countries.

Ensuring Fair Living Conditions In Agriculture

Ensuring fair living conditions for farmers is also an important goal in many countries.

On the one hand, from a socio-economic perspective, continuing to support or protect a business sector is not rational. Every business sector must adapt to market conditions and competition. Every business follows a dynamic development and must take advantage of technological advantages and compete with other businesses domestically and internationally. The agricultural treadmill (Sect. 9.6) will continue and pressure on emigration and income will be persistent. Decoupling market forces to ensure fair conditions is not a sustainable long-term solution.

On the other hand, the agricultural industry is already undergoing drastic change, emigration and structural development, which is being driven by rather poor earnings in agriculture. From an economic or political perspective, a controlled development and emigration may be advantageous. In addition, other considerations may also justify maintaining a certain level of local and domestic food production.

Securing Effective Instruments, Resource Optimization and Cost–Benefit

Applying effective measures without an unnecessary waste of resources is an important goal. The potential advantages and disadvantages and the cost–benefit must be assessed in context, so that very costly measures which will have little effect in the short or long term are not introduced.

Agricultural policy initiatives imply costs, which are paid by taxpayers, consumers, companies, etc. It is important that these costs are transparent, and that they are compared with the potential effects and that impact assessments are carried out.

Enable Trade, Avoid Protectionism and Exploit Comparative Advantages

A country or region can seek to manage the triple challenges mentioned above by introducing trade protection (import barriers). In this way, the country or region can support agriculture, become self-sufficient and possibly also export food, and sustainability can be ensured through support schemes, legislation and other regulations. However, trade protection undermines other goals, and it does not solve the common challenges, which are largely global in nature.

Food Supply: Ensuring Sufficient, Good Quality Affordable Food Globally

The world's population is expected to increase year by year. The increasing population alone necessitates an annual increase in agricultural and food production. Agricultural policy is an important tool for ensuring an adequate food supply that can meet the increasing demand.

Food supply is not just a matter of large agricultural production. Agricultural and food products must also be available and affordable for consumers, so infrastructure, competitiveness, efficiency, market formation, waste reduction, etc., are also important parameters.

The dilemma in agricultural policy can be defined as follows: How to ensure efficient agriculture that can create an increasing and affordable food supply, while also ensuring more qualitative values such as animal welfare, organic production, biodiversity, etc.

The dilemma means that trade-offs between, e.g., efficiency and animal welfare are inevitable—as illustrated and exemplified in Fig. 6.21.

As the figure illustrates, the various interests and forces will pull the development in different directions.

The five goals, challenges and balances in Fig. 6.21 can probably be supplemented with the more general goals, which are found in agricultural policy in developed countries, cf. Section 6.2. As a result, an agricultural political complex is constructed, which encompasses many diverse and often opposing directions and considerations. When business priorities have to be in line with sustainability, environment and climate goals, selecting the instruments that will most effectively ensure the desired results becomes challenging. Complexity is likely to increase in the future, when new and completely different goals such as energy supply, biodiversity, resilience and geopolitics are likely to become an increasingly large part of agricultural policy.

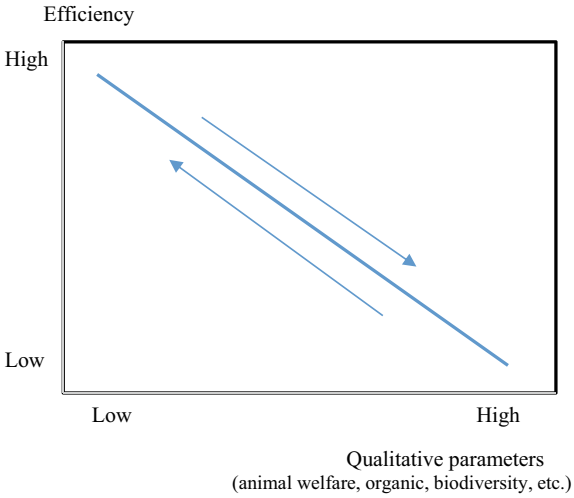


Fig. 6.21 Example of a trade-off in agricultural policy (*Source* Own production)

6.11 Non-Tariff Barriers and Food Safety

While custom and tariff barriers and directly coupled support are being reduced, non-tariff barriers are becoming increasingly important. As previously discussed, custom and tariff barriers and directly coupled support are relatively transparent, measurable and distorting. Therefore, their decreasing importance is natural. The increasing non-tariff barriers, which are sometimes called technical trade barriers, are more opaque, but their importance has increased. The development of the two types of barrier is shown schematically in Fig. 6.22.

Non-tariff measures encompass a diverse set of instruments in terms of their purpose. One group includes regulations, standards, testing, certification and phytosanitary (SPS) measures. Food safety plays a key role in this group, as it is a primary objective in many cases.

Countries are becoming increasingly concerned about the quality and safety of imported products. With increasing international trade and globalization, food security risks are growing.

Also, the WTO recognizes that import restrictions are sometimes required in order to ensure that food is traded safely, and that animal and plant pests or diseases are not spread through trade.

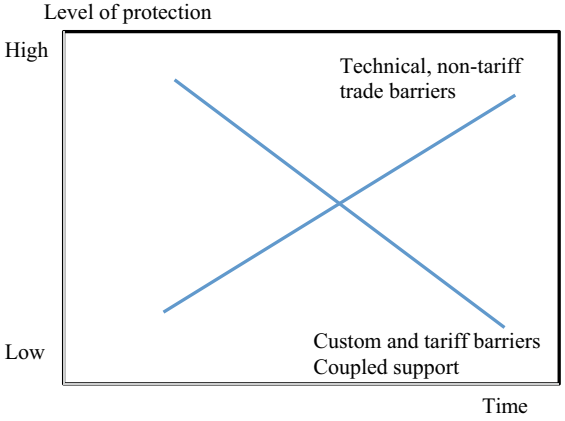


Fig. 6.22 Schematic illustration of the development in non-tariff barriers and tariff barriers (*Source* Own production)

The Agreement on the Application of Sanitary and Phytosanitary Measures (the "SPS Agreement") aims to ensure that WTO members' health protection measures in the area of food safety, animal and plant health do not restrict international trade more than is necessary (WTO, 2021c). However, it is always a difficult balance between legitimate targeted measures to protect public health and creative import barriers for which the primary aim is to protect domestic production.

The SPS Agreement seeks to strike a balance between the right of WTO members to protect health and the need to allow the smooth flow of goods across international borders. The Agreement recognizes the right of WTO members to adopt legitimate measures to protect food safety and animal and plant health while ensuring these measures are not applied in an unnecessary manner for protectionist purposes (WTO, 2021a).

The SPS Agreement requires WTO members to notify the WTO Secretariat whenever they intend to impose any new requirements or make any changes that may affect trade. These notifications give trading partners the opportunity to comment on the planned regulations before they are adopted and allow producers to adapt to the new requirements. The number of notifications, therefore, gives an indication of the importance of such regulations.

To this end, Fig. 6.23 presents the number of regular and emergency notifications (including addenda and corrigenda) submitted per year since 1995.

The figure illustrates a significant increase in the number of SPS notifications. Almost half (47 percent) of all the notifications from 1 January 1995 to 31 December 2020 had food safety as the primary objective.

The trend is likely to continue: international trade in agricultural and food products will increase and become more important, and thus the risk of a global spread of plant and livestock diseases will increase. This development creates stronger incentives to limit imports. In addition, especially livestock diseases (African Swine Fever, Foot and Mouth Disease, Avian influenza, etc.) are likely to become greater risk factors with increasing and more intensive livestock production in large parts of the world.

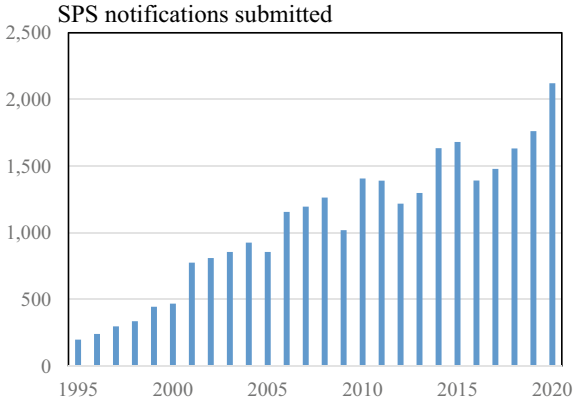


Fig. 6.23 Number of SPS notifications submitted to the WTO 1995–2020 (*Source* Own presentation based on WTO (2021a, 2021b, 2021c)

References

Crawford, J.-A., & Fiorentino, R. V. (2005). *The changing landscape of regional trade agreements*. World Trade Organization. https://www.wto.org/english/res_e/booksp_e/discussion_papers8_e.pdf

Espitia, A., Rocha, N., & Ruta, M. (2020). *Covid-19 and food protectionism: The impact of the pandemic and export restrictions on world food markets*. World Bank. https://documents1.worldbank.org/curated/en/417171589912076742/pdf/Covid-19-and-Food-Protectionism-The-Impact-of-the-Pandemic-and-Export-Restrictions-on-World-Food-Markets.pdf

Gaulier, G., Jean, S., & Ünal-Kesenci, D. (2004). *Regionalism and the regionalisation of international trade*. Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). http://www.cepii.fr/PDF_PUB/wp/2004/wp2004-16.pdf

Mariano, K. P., Bressan, R. N., & Luciano, B. T. (2021). Liquid regionalism: A typology for regionalism in the Americas. *Revista Brasileira De Política Internacional, 64*(2), e004. https://doi.org/10.1590/0034-7329202100204

OECD. (2019). *The evolution of the treatment of agriculture in preferential and regional trade*. OECD. https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=TAD/TC/CA/WP(2018)5/FINAL&docLanguage=En

OECD. (2020). *COVID-19 and international trade: Issues and actions*. https://www.oecd.org: https://www.oecd.org/coronavirus/policy-responses/covid-19-and-international-trade-issues-and-actions-494da2fa/

OECD. (2021). *Agricultural policy monitoring and evaluation 2021: Addressing the challenges facing food systems*. OECD Publishing. https://doi.org/10.1787/2d810e01-en

OECD. (2022). *Agricultural policy monitoring and evaluation 2022: Reforming agricultural policies for climate change mitigation*. OECD Publishing. https://doi.org/10.1787/7f4542bf-en

Politi, J. (2020, May 10). Multinationals fear rise in protectionism because of pandemic. *Financial Times*.

UN. (1987). *Our common future: The world commission on environment and development*. Oxford University Press

WTO. (n.d.). *WTO in brief*. Retrieved February 11, 2024, from https://www.wto.org/; https://www.wto.org/english/thewto_e/whatis_e/inbrief_e/inbr_e.htm

World Bank. (1986). *World development report 1986*. Oxford University Press. https://openknowledge.worldbank.org/handle/10986/5969

WTO. (2011). *The WTO and preferential trade agreements: From co-existence to coherence*. World Trade Organization. https://www.wto.org/english/res_e/booksp_e/anrep_e/world_trade_report11_e.pdf

WTO. (2021a). *Annual overview: Implementation of SPS transparancy provisions and specific trade concerns*. World Trade Organization. https://docs.wto.org/dol2fe/Pages/SS/directdoc.aspx?filename=q:/G/SPS/GEN804R13.pdf&Open=True

WTO. (2021b). *Sanitary and phytosanitary information management system. Notifications submitted per year*. WTO. http://spsims.wto.org/en/PredefinedReports/NotificationsSubmittedPerYearPage

WTO. (2021c). *Sanitary and phytosanitary measures agreement. 10 key results from 2020*. World Trade Organization. https://www.wto.org/english/res_e/booksp_e/sps10key2020_e.pdf

CHAPTER 7

Markets

7.1 Introduction

Markets are important for agriculture and for the supply and processing links in the entire food sector. Efficient markets are necessary to reduce transaction costs, avoid bottlenecks, optimize specialization in value chains, ensure effective competition, etc. At the same time, markets develop continuously, driven by several factors, e.g., technology.

The significance of markets is increasing due to:

- Fewer state-controlled economies and planned economies and more market economies
- Less subsistence farming, more market-oriented agriculture.
- Less agricultural support, more market-based agriculture.
- An increase in the importance of controlling markets and the value chain through, e.g., "from farm-to-fork", traceability and vertical integration.
- More global and less domestic trade, until now.
- Stronger division of labor between the links in the value chain.

Inefficient markets and a lack of market access are important barriers to the development of the agricultural and food sector in many parts of the world.

H. O. Hansen, *Megatrends in Agriculture, Food Industry and Food Markets*, Palgrave Advances in Bioeconomy: Economics and Policies,
https://doi.org/10.1007/978-3-031-58152-6_7

The importance and position of the markets in a megatrend perspective can have many dimensions and related topics, including for example:

- The importance of markets and market access in agricultural development.
- Position and significance of markets in value chains.
- The development and significance of food demand—and impact on the markets.
- Market and bargaining power.
- Domestic or international marketing and globalization.
- Exploitation of international markets: Sales or production? Entry modes?

Markets are, directly or indirectly, a common element in all the chapters of this book. Markets are prerequisites for value chains, the food industry, consumers, trade policy, etc. However, the first four bullet points above are discussed in different other chapters, while the trends in national or international sales and globalization are explained in more detail in this chapter.

7.2 International Trade with Agricultural and Food Products

In general, trade with agricultural and food products across borders is relatively small compared with trade on the domestic markets.

The limited importance of the world market is one result of agricultural and trade policy, although other factors also play a role. In general, the modest global trade is due to the following factors:

- The short shelf life of the produce, which makes long distance transportation difficult and expensive.
- All countries have the necessary resources to produce agricultural products. A certain degree of domestic production is always possible without significant waste of economic resources, which limits the need for imports.

- The political goal of achieving a certain level of self-sufficiency through import barriers limits the potential for trade. Many countries do not want to be too dependent on food imports as it reduces food security and increases risk in politically unstable situations.
- Fixed resources and general low adaptability in agriculture. Countries with weak comparative advantages in agricultural production cannot—or will not—reallocate resources to other industries at the necessary speed to ensure optimal resource utilization. Agricultural resources may be locked in the agricultural industry.

Even though political and economic obstacles limit the internationalization of agricultural markets, significant growth in international trade in agricultural products has occurred. International trade as a percentage of total production has increased significantly for most of the important agricultural products, cf. Figure 7.1.

For all included agricultural products, the importance of international trade is increasing—albeit from a low level. International trade as a percentage of total production has increased significantly for most of the

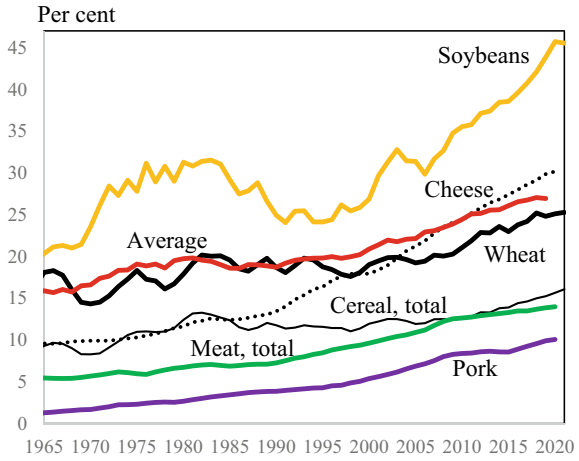


Fig. 7.1 International trade as a percentage of the world's total production, 1965–2021 (*Note* Average for 12 major agricultural products. *Source* Own calculations based on statistical data from FAO)

important agricultural products, and a weighted average for several agricultural products exhibits a steadily increasing trend during the entire period.

Increasing internationalization appears to be relatively unaffected by external and internal factors such as financial crises and food crises.

A picture of the long-term development of the world's agricultural production and international trade is provided in Fig. 7.2.

Figure 7.2 illustrates a very clear long-term trend: The world's total international trade in agricultural goods is growing significantly faster than the world's total agricultural production.

The trend toward increasing trade in agricultural and food is clear. It is, however, worth noting that the development in international specialization has so far been relatively weak regarding agricultural products. As shown in Fig. 7.3, international specialization, calculated in terms of the development in international trade and production, has been much more significant regarding products as a whole than agricultural products in the past few decades.

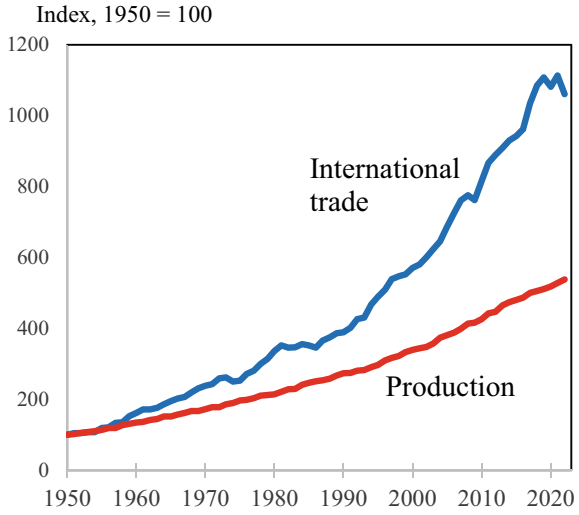


Fig. 7.2 The development in world trade and production of agricultural products, 1950–2022 (*Source* Own calculations and presentation based on WTO (2022) and statistical data from FAO)

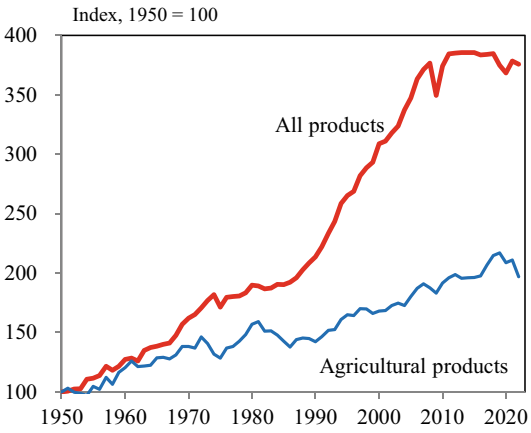


Fig. 7.3 The development in international specialization of agricultural products and all products 1950–2022 (*Source* Own calculations and presentation based on WTO [2022])

The figure illustrates the development in international trade and total global production. As can be seen, in general, international trade has increased by more than production, although the trend is much stronger for industrial goods than it is for agricultural products. This illustrates the fact that there is an apparent limit regarding the extent to which imports can displace local products on domestic markets. Local production will still be preferred on the domestic market and the market will not suddenly become fully internationally oriented.

Increasing globalization does not just develop over time—internationalization is also a function of economic development.

Therefore, one of the features of most developing countries is that they have a very small net export or net import of agricultural products. However, these countries increasingly become either net exporters or net importers in line with economic development. Thus, international specialization increases as countries adapt to a division of labor which is in line with their comparative advantage.

The increasing international trade and specialization in agriculture in line with economic development is illustrated by Fig. 7.4, which shows the countries' total international food trade per capita.

The very clear correlation between economic development and international trade, as shown in Fig. 7.4, suggests that economic development is a prerequisite for participation in international trade and specialization.

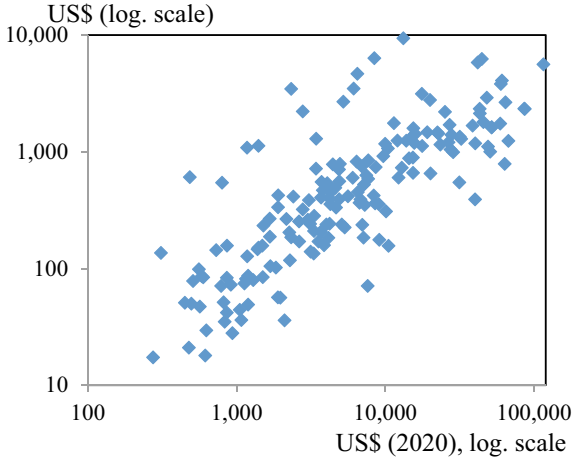


Fig. 7.4 Total international food (excluding fish) trade per capita as a function of per capita GDP in selected countries (2020) (*Source* Author's calculations based on statistical data from FAO and World Bank)

International trade is one element of globalization which is very decisive for the future development of agriculture and the food industry and markets. If other driving forces and megatrends within trade liberalization, technological development, etc., continue, this increase in international trade and specialization will probably also continue.

Whether international trade and globalization together can also be expected to be a persistent and continuing megatrend of significance for agriculture, the food industry and food markets is discussed in more detail in Chapter 11.2.

7.3 Foreign Direct Investments

As discussed in Sect. 7.2, international trade has been increasing steadily for several decades. Chapter 3.6 made the point that global M&As represented a megatrend within the manufacturing industry and the food industry. These megatrends illustrate that international trade is only one way of expanding internationally; the ways in which companies become more international and global have changed.

The internationalization of companies may occur in several ways, but two ways are particularly important: by exports from the home country or by investing and producing abroad. The choice between the two different entry modes depends on several conditions both internally in the companies and externally on the markets, cf. Hansen (2013). The driving forces that support or strengthen one of the two entry modes include:

- Trade barriers, which can stimulate foreign investments and production.
- Restricted capital markets, which can reduce foreign investments.
- Economic and political risks which will favor reversible and low-risk entry modes, i.e., direct export.
- Weak infrastructure, which can limit transportation over long distances and thus also exports.
- Preference for domestic production, which will discourage export.
- Internal factors such as ownership and access to capital, which may be important prerequisites.

There is a clear increasing trend for both international trade and foreign (international) investments. However, foreign investments have increased significantly in recent decades, thereby building a foundation for increasing foreign activities and foreign sales, cf. Figure 7.5.

The figure illustrates the world's total foreign direct investments measured in percent of GDP. For the entire period, there is a significant positive trend, but foreign direct investments are very sensitive to economic cycles. International recession, financial crises, pandemics, economic growth and turbulence in stock markets have a major impact on foreign direct investments. Since 2000, the trend has been negative, but net inflow has been positive each year.

Foreign direct investments are used to finance foreign mergers and acquisitions, foreign greenfield operations, growth in foreign subsidiaries, affiliates, etc. These foreign direct investments create sales that are far greater than the "traditional" exports, i.e., actual exports of goods from the home country. Sales of foreign affiliates are a greater source of globalization than exports, see Fig. 7.6.

The figure illustrates significant growth in sales through foreign affiliates, while internationalization through exports increased less rapidly. The

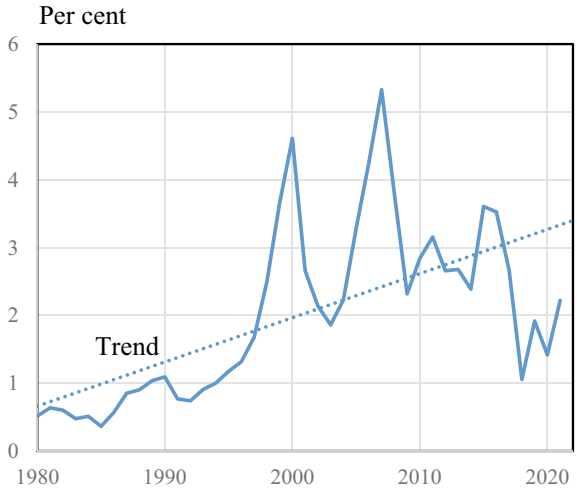


Fig. 7.5 Foreign direct investment, net inflows (percent of GDP) (*Note* Foreign direct investments (FDI) include those made by a company or government in a foreign company, but it does not include, e.g., stock investments. *Source* Own presentation based on statistical data from World Bank)

figure thus also illustrates the importance of foreign direct investments for globalization.

The megatrend toward increasing foreign investments is also visible in the food industry. Food companies are also making more investments in foreign countries, cf. Figure 7.7.

Based on selected countries with available data, the figure illustrates foreign direct investment (inflows) in the food, beverages and tobacco industry, calculated in fixed 2015 prices. As can be seen, the same pattern for the food industry as for the entire economy emerges: a decline after the financial crisis, and a decline during the Covid-19 pandemic, but an increasing trend for the entire period.

A number of studies confirm that foreign direct investments are playing an increasingly important role in the food industry:

According to Punthakey (2020), FDI in the agriculture and food sectors remains small compared to industry and services. However, FDI plays an important role in driving participation in agro-food GVCs and increasing global FDI activity in the agriculture and food sectors have

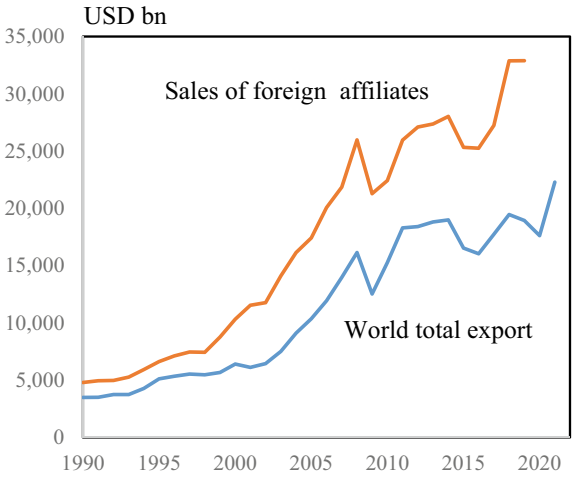


Fig. 7.6 Sales of foreign affiliates and exports: World total (*Note* Sales of foreign affiliates: Data for 1990, 2005–2007, 2018–2020; *Source* Own presentation based on UNCTAD [2022] and statistical data from FAO)

been created by a number of drivers including lower transportation costs and reductions in barriers to trade and investment.

Doğan (2022) confirms that FDI is quite low in agriculture compared to other economic sectors. However, after 2007 FDI inflows to developing country agriculture rose significantly. FDI is considered an essential way to attract capital, and to increase food production and agricultural productivity. The study concludes that FDI in agriculture has an inverse effect on food security in the host country, which is also an important observation.

7.4 Regionalization of International Agricultural and Food Trade

The regionalization of international trade means that trade increasingly takes place between countries in the same region. A region may be a geographical area, and it is clear that countries that are undergoing a process of internationalization initially trade with their neighboring countries, cf. Johanson and Vahlne (1977). A region may also be a political or

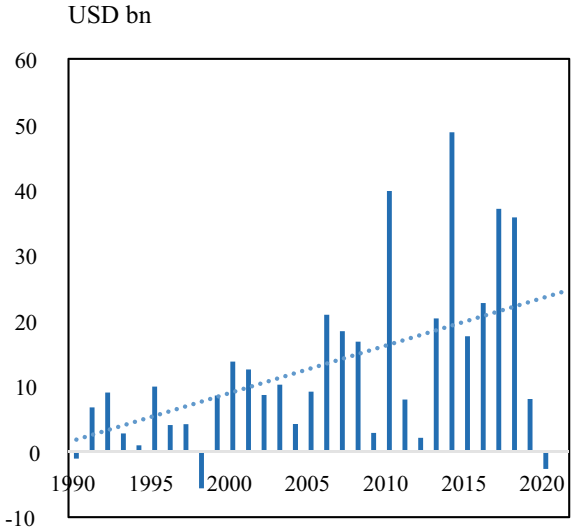


Fig. 7.7 Foreign direct investments, inflows to food, beverages and tobacco industry, 2015 prices (*Note* Including countries with available data: Austria, Denmark, France, Germany, Iceland, Italy, Japan, Thailand, the UK, the USA and Korea. *Source* Own presentation based on statistical data from FAO)

commercial area in the form of a regional trade agreement (RTAs), free trade area, common market, customs union, etc.

Therefore, regionalization may become visible and develop in two ways based on the following two different drivers:

Purely geographical regionalization is the result of, among others, reshoring and nearshoring, which is increasingly taking place (Chapter 3.8). Some drivers indicate that trade in goods and services will increasingly take place between countries in the same geographical region. This development is due to uncertainty about the future in the context of global pandemics, trade conflicts and geopolitical tension. The uncertainty may cause companies to shorten their supply chains in order to increase supplier security. Technological developments, including robotics, support this trend with shorter value chains.

Political or commercial regionalization occurs as a consequence of, among others, RTAs, etc., which are also discussed in Chapter 6.4. RTAs include several types of cooperation one of which exists in a free trade area

where there is, in principle, the free movement of goods across borders. In relation to third countries, countries in free trade areas can maintain their individual trade barriers. In a customs union, economic integration is greater as a common external tariff with the rest of the world is maintained.

The different forms of RTAs, their degree of integration, complexity, etc., are discussed in Hansen (2013).

In recent years, RTAs have become increasingly important, and the number of RTAs is increasing cf. Figure 7.8.

The multilateral trade negotiations in the WTO have not had much momentum for several years. The negotiations in the Doha Round failed in 2011 after a decade of negotiations, and with this deadlock in multilateral trade negotiations, RTAs have gained far greater importance as a real alternative. The majority of world trade now occurs between pairs of countries that have established a reciprocal trade agreement (Legge & Lukaszuk, 2021).

For all types of RTAs, the internal trade between the countries included in the agreement is given special preference. The preference for internal

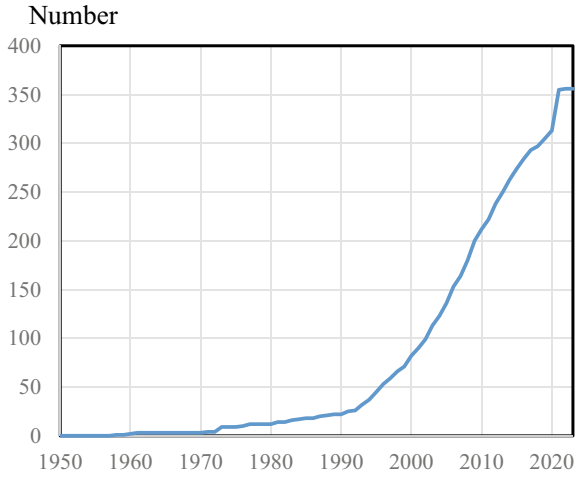


Fig. 7.8 Cumulative number of regional trade agreements (RTAs) in force 1950–2023 (*Note* First RTA was ratified in 1958. *Source* Own presentation based on statistical data from WTO)

trade may be greater or lesser, product groups may be omitted, and there may be special conditions attached to the preference. However, increasing internal trade is in any case to be expected.

The question is whether RTAs really create more regionalization in world trade: Does trade between countries in an RTA grow more rapidly than other trade—compared to a situation without an RTA? This question is based on a counterfactual scenario, which means it is difficult to answer: Many factors affect trade between countries. Sometimes agricultural and food products are subject to special conditions in RTAs, and agreements on foreign direct investment may also be included and may affect trade.

Legge and Lukaszuk (2021) investigate whether predictions about regionalization are supported by the data. They conclude "that you could see regionalization everywhere, except in the data". Altman and Bastian (2022) note that while there was a clear trend toward less regionalized trade between 2003 and 2012, no consistent trend appears in more recent years. They also conclude that "trade flows have actually stretched out over longer distances since 2004, albeit with a pause between 2012 and 2018".

According to FAO (2022), globalization and regionalization have generally developed in parallel, but the regionalization of trade in food and agriculture increased in importance between 1995 and 2019. As globalization weakened after the financial crisis in 2008, countries apparently traded more within their regions.

The EU is a good example of an RTA: There is a complete internal market with no excluded products. Calculated in terms of the degree and scope of integration, the EU is probably the most significant example. The number of member states has increased several times, and therefore it is possible to see the consequences of participation in RFTs.

The EU was enlarged in 2004 by ten countries and by two countries in 2007, and in both cases, the new member states' trade with the EU was significantly affected, cf. Figure 7.9.

The figure illustrates that new member countries' import and export countries change when they become members of an RTA—in this case an economic and political union. As can be seen from the figure, a significant change occurred around 2004, when 10 new countries became members of the EU. The new member states increased their exports to the EU, but their imports from the EU also increased. The enlargement in 2007—with Bulgaria and Romania—also brought major changes: the two new member states' imports from the EU increased from approx. 55 percent

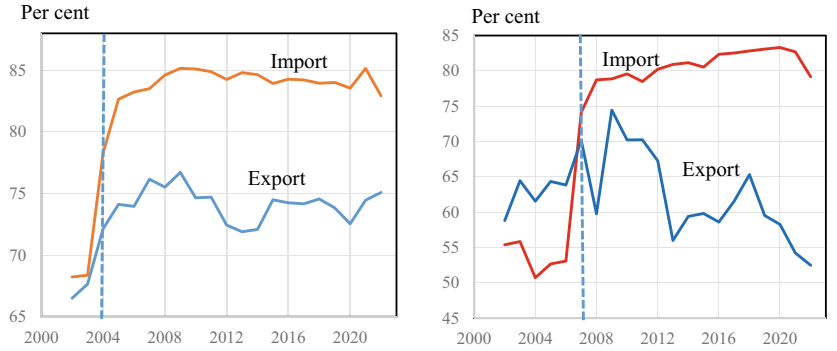


Fig. 7.9 New member countries' intra-EU food export and import before and after their entry into the EU (*Note* New member countries as of 1 May 2004: Cyprus, Czechia, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia. New member countries as of 1 January 2007: Bulgaria and Romania. Import and export of food, drinks and tobacco. *Source* Own presentation based on statistical data from Eurostat)

to 80 percent of total imports, while their exports to the EU did not change significantly, instead exhibiting a slightly longer-term downward trend.

In conclusion, several factors promote increased regional international trade, but it is difficult to demonstrate any empirical trend. Other changes in markets including FDIs and a general increase in international trade, are likely to dilute a possible regionalization trend. Furthermore, regionalization through various forms of RTAs promotes internal trade, and several examples can document this empirically.

In one scenario, regionalization in international trade will increase:

- The many RTAs that have been concluded will probably gradually result in increasing internal trade.
- The increasing trend toward reshoring and nearshoring will also lead to increased geographical regionalization.
- Climate policy and a focus on the carbon footprint will likely limit long distance trade and transportation, which will encourage geographical regionalization.

In another scenario, globalization will increase at a faster rate than regionalization in international trade:

- Freight costs and container shipping costs will probably exhibit a long-term declining trend due to logistical technologies and further economies of scale.
- The emerging economies will probably obtain an increasing share of global trade. As they tend to trade over longer distances, regionalization will decrease.
- Full utilization of the comparative advantages and international specialization necessitates trade between countries with different factor endowments. The factor endowments may vary widely between continents when it comes to agriculture and food, which may be a driver for long distance trade.

7.5 Trends in Farm Gate Real Prices

The agricultural and food markets are characterized by some specific conditions compared to other markets. One characteristic is that prices generally and in the slightly longer term rise at a slower rate than inflation, i.e., there is a real price fall. Agricultural commodity prices will often be quite volatile, which means that short-term periods of even large real price increases can occur, but the long-term trend toward real price falls is relatively clear.

Long price series with the most important agricultural commodities thus show a downward trend in real prices. Figures 7.10 and 7.11 provide examples of this change.

Wheat, which is one of the most common crops in the world, is used as an example in Fig. 7.10. As the figure shows, both significant price volatility and a clear decline in the real price characterize the development.

There are also clear examples of a decline in real prices in livestock production, cf. Figure 7.11.

The figure illustrates that the long-term trend is almost identical in the two countries. Denmark became a member of the EU in 1973, which contributed to a small short-term increase in producer prices. In the subsequent years, the two curves exhibit almost identical courses.

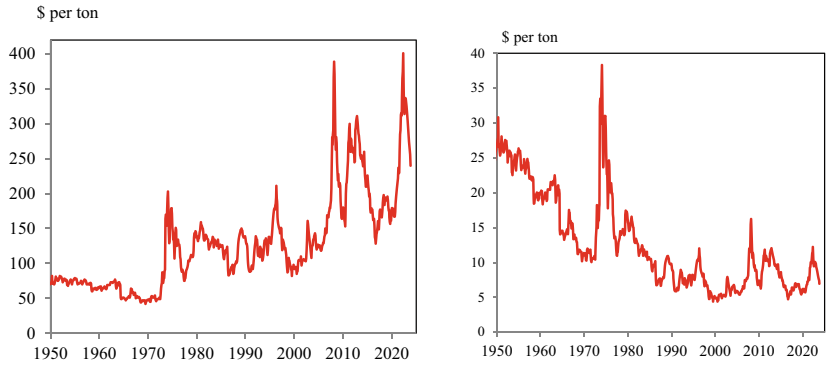


Fig. 7.10 Average monthly wheat price in the USA in nominal and real terms (1908 prices) 1950–2023 (*Source* Own calculations and presentations based on statistical data from USDA and U.S. Bureau of Labor Statistics)

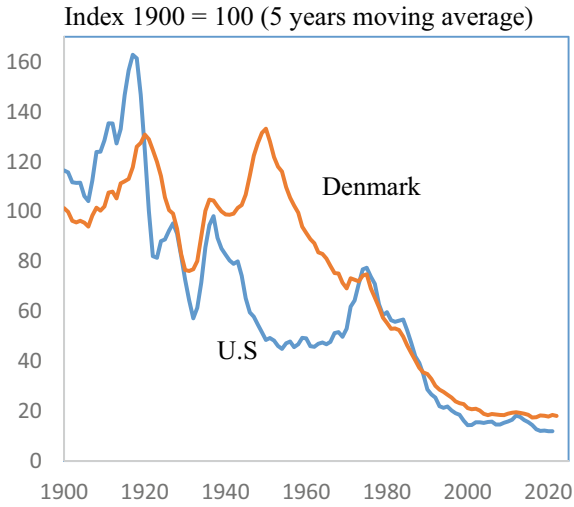


Fig. 7.11 Change in the real price for pork 1900–2022 in the USA and Denmark (*Notes* Denmark: Price per kg carcass weight paid to farmers; USA: Wholesale Price. *Source* Own calculation and presentation based on statistical data from Danish Agriculture & Food Council, Statistics Denmark, and Davidjacks.org)

Note that the figure presents the price change from the year 1900, and that nothing can be concluded about the price level in or between the two countries.

Declining real prices apply to most agricultural products. According to Jacks (2019), from 1900 to 2020, there were significant declines in real prices for most important agricultural products. The size of the real price declines varies between products, but the tendency is for products with the highest productivity increases to also exhibit the largest declines in real price.

The declining real prices are no coincidence. The development can be largely explained by several underlying driving forces:

- Relatively large increases in productivity in agricultural production.
- Relatively homogeneous products (commodities or bulk products). With relatively uniform products, price competition will be stronger, which will suppress the price.
- Moderate or limited demand growth. Food can be considered a basic good, which means that demand does not increase in line with rising income.
- Agricultural products can be produced almost anywhere in the world, and rising prices will relatively quickly lead to increased supply, which will in turn reduce prices.

These underlying driving forces are relatively robust, so it is likely that the trend toward decreasing real prices for agricultural commodities will continue. In a perfect market, these declines in real prices will be transmitted downstream in the value chain, so that the ultimate result is cheaper food at the consumer level.

Declining real prices in the long term is a decisive element in the agricultural treadmill, which is discussed in more detail in Chapter 9.6.

7.6 Farmers' Terms of Trade

As discussed in the previous section, farmers' selling prices for agricultural goods increase at a slower rate than inflation, so there is a decline in the real price. It also turns out that farmers' selling prices increase at a slower rate than the prices of the inputs used in agriculture. This price relationship between output and input prices, which is called farmers'

terms of trade, deteriorates in the long run. It is a general phenomenon in agriculture, and it is also a megatrend.

Given the volatile prices of agricultural commodities, farmers' terms of trade can also vary over time. Food crises can, e.g., improve price relations in the short term and thus also farmers' terms of trade. In the slightly longer term, the trend is both explainable and clear.

Farmers' terms of trade may develop differently internally in agriculture: Higher prices for grain will improve the terms of trade for crop farmers but result in deteriorating terms of trade for livestock farmers, including especially poultry and pig farmers for whom grain is an important input.

The way the farmers' terms of trade develop is explainable and is a consequence of both changes in productivity and the treadmill: Increasing productivity, low growth in demand for food and fixed assets means that the price of both agricultural and food products increases at a slower rate than inflation in the long term, so the terms of trade will deteriorate.

Despite fluctuations over time, and despite differences between production branches within agriculture, the general picture is that deteriorating terms of trade occurs in agriculture in almost all countries. As can be seen in Fig. 7.12, deteriorating agricultural terms of trade occur in countries as diverse as the USA, Australia and Denmark.

The figure illustrates very uniform trends throughout the period—despite the fact that the countries have different agricultural policy systems, structures and branches of agricultural production.

The deteriorating terms of trade over time is a phenomenon that is particularly true for agriculture, and it will probably continue in the future. As long as the underlying drivers behind inter alia the agriculture's treadmill are consistent and persistent, farmers' terms of trade will continue to deteriorate, although short-term fluctuations may occur as a consequence of volatile prices.

7.7 Price Volatility

The food crises that have occurred since 2005 have resulted in significant attention on food markets and their stability worldwide. The large price increases and subsequent price decreases caused considerable turbulence, and many sectors that were directly or indirectly dependent on agriculture and the food industry were affected. Price volatility was found to have several disadvantages for consumers, finances and businesses.

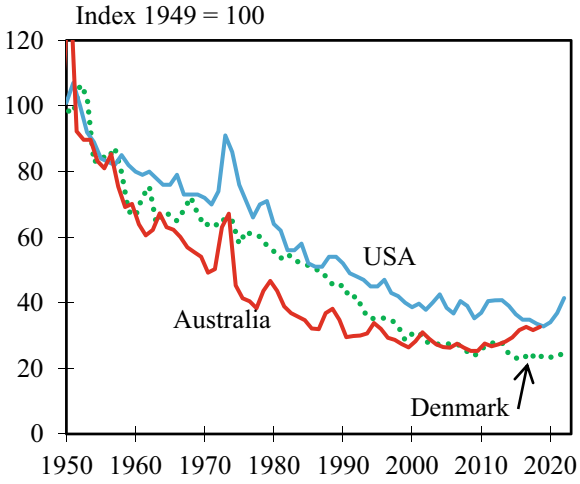


Fig. 7.12 The change in farmers' terms of trade in Australia, the USA and Denmark (*Source* Author's calculations based on Dansk Landbrug [several issues], USDA [several issues a], USDA [several issues b], Zammit and Howden [2020], and statistical data from Statistics Denmark, and Australian Bureau of Agricultural and Resource Economics and Sciences [ABARES])

Unstable or changing prices are not necessarily a disadvantage. Price changes may be a consequence of changes in demand, and the new prices are a signal to the suppliers to alter production.

Also, in other cases, fluctuating prices may also be an advantage. If the supply is low due to, e.g., a bad harvest, the prices will (cf. the cobweb theory) in the relatively short term adapt. Therefore, the gross income, i.e., supply multiplied by price, stabilizes.

Unstable markets and prices as well as food safety have been highly political topics on the agenda in the UN and at the G8 and G20 meetings. Initiatives to ensure a stabler and better functioning food market have been discussed in many fora.

The high, unstable and less predictable agricultural and food prices have led to a debate about whether market conditions are about to change decisively, and whether the development will continue in the future. If major price instability continues in the future, the risk management of both farmers and companies will face major challenges. The international food supply will also come under increased pressure.

Box 7.1 Volatility, variation and instability

The instability of markets and prices is often determined by calculating their so-called volatility, which can, in principle, be performed in two ways:

Historical (realized) volatility is calculated on the basis of observed (realized) data from a historical period. Historical volatility thus provides a picture of the past price and market conditions. The changes in price can be examined from day to day, month to month, year to year, etc., which can be decisive in terms of the results and how they are interpreted.

Implied volatility is used to predict future prices based on market expectations. It provides a picture of the expected change in future prices as market participants perceive the situation. Implied volatility can be calculated on the basis of future prices, which are determined continuously on the commodity markets.

Agriculture and agricultural production are characterized by a significant degree of market instability and variations over time compared to other businesses. Price volatility is more evident in agriculture than in other economic sectors due to a variety of economic, natural and political factors (Díaz-Bonilla, 2016).

The level of agricultural production in any given year is influenced by many factors that farmers cannot fully control such as the climate, pests and livestock diseases, which results in large annual fluctuations in production—primarily in crop production.

Although, e.g., droughts rarely occur in all agricultural countries in the same year, instability in total world production is significant.

In addition, supply often reacts more slowly than demand. Therefore, changes in supply will cause major price changes. Furthermore, the demand for food is rather price inelastic and with relatively few or no substitutable products, which can further create price volatility: If the supply of food declines, the demand will not decline correspondingly because food is a necessity, which means that prices rise.

As a consequence, price volatility is a fundamental condition that is likely to persist. This prediction is supported by the fact that price volatility in the international grain market is not a new phenomenon but has been present at least since the beginning of the twentieth century, cf. Figure 7.13.

The figure presents one way of illustrating the price volatility of a specific agricultural product over a long time period. The figure shows

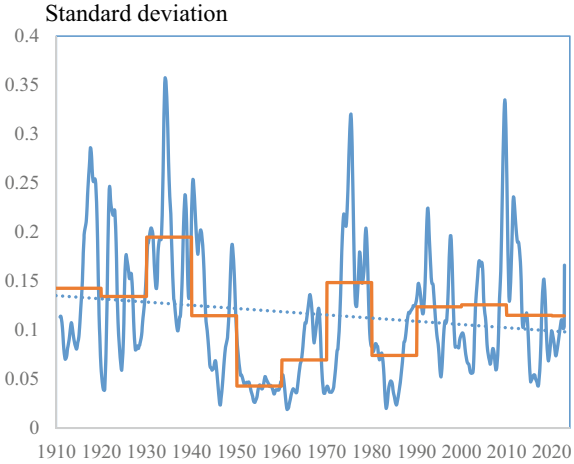


Fig. 7.13 Calculated wheat price volatility on the Chicago Board of Trade 1910–2023 (*Note* Price volatility is calculated as the standard deviation over 12 months using LN (Price $_t$/Price $_{t-12}$), where t = month. Also 10-year average and trendline. *Source* Own calculations based on statistical data from USDA)

that, in the period, volatility has been decreasing slightly. Volatility was high in the 1930s and during the recent food crises.

Several analyses of both the short- and long-term price volatility of agricultural products have been carried out. Since methods, data and periods vary, no clear picture can be drawn.

In an analysis by the European Commission (2009), the historical volatility of several agricultural commodities on the Chicago Board of Trade was examined. The study goes back to 1980, and increasing price volatility from the 1990s onward was observed.

The European Parliamentary Research Service concludes that global price volatility has been on the increase since 2005 and is likely to remain a major concern for farmers in the coming decades (Tropea, 2016).

FAO and OECD (2011) conclude that there is little or no evidence that volatility in international agricultural commodity prices, calculated on the basis of standard statistical measures, is increasing in the long term.

In Díaz-Bonilla (2016), different methods and models are discussed and used to analyze price volatility. Some significant results are presented in Table 7.1.

Table 7.1 Food price volatility in nominal and real terms, in US dollars and SDRs using several indicators of volatility

	Nominal	*Real EUVI*	*Real US CPI*	*SDRs*	*USD*	*HP*	*CF*	*LT*	*StDev of LN Prices*
1960s	3.4	2.8	3.9	3.4	3.4	5.1	6.1	20.6	3.4
1970s	21.3	17.1	21.4	18.8	21.3	17.2	13.8	31.1	21.3
1980s	6.7	5	7	6.9	6.7	5.1	6.7	20.4	6.7
1990s	7.2	6.4	6.9	7.1	7.2	7.4	7.2	9.6	7.2
2000s	9.9	6.4	9.1	8	9.9	8.7	9.9	20.8	9.9
2010s	10.2	7.4	9.8	8	10.2	5.6	19.2	22.4	10.2

EUVI = Export Unit Value Index, CPI = Consumer Price Index, SDRs = Special Drawing Rights, HP = Hodrick-Prescott filter, CF = Christiano-Fitzgerald filter, LT = Lineal Trend, StDev = Standard Deviation, 2010s refers to the years 2010 to 2014. *Source* Díaz-Bonilla (2016)

The results in Table 7.1 are almost identical to those presented in Fig. 7.10: High volatility in the 1970s, low volatility in the 1980s followed by increasing volatility. The table also reveals almost uniform trends regardless of the methods or models used.

The conclusion regarding the historical price volatility is not entirely clear since the choice of method, time period, product, etc., has an influence on the calculated result. Over a one-hundred-year period, the price volatility of wheat on the world market is slightly decreasing. However, when examining the time since the beginning of the 1960s, it has been increasing slightly.

A prediction of future price volatility should be based on the future drivers that are expected to create volatility:

Several sources have tried to explain the reasons and driving forces behind price fluctuations in agriculture, cf., e.g. Balcombe (2009), Tangermann (2011), FAO (2010). Since price volatility often refers to price fluctuations that cannot be explained, identifying and calculating the result of all the drivers behind price volatility is inherently difficult.

When it comes to price volatility on the world market, which is generally more volatile than national markets, specific conditions must be taken into account.

For many years, the world market for agricultural products was affected by dumping, import restrictions, export subsidies, etc. The consequence was that price formation was not optimal and the importance of the world market was very limited. This disruption also created major price

fluctuations from year to year. However, recent years' liberalization and increased free trade have contributed to increased price stability on the world market—ceteris paribus.

Conversely, the volatility of many national markets has increased. The liberalization of agricultural policy has, in some cases, been a driving force behind—and explanation for—increasing price volatility. An important aspect is that, in the past, the aim of agricultural policy was often to ensure farmers stable—and previously also high—sales prices. In line with liberalization and a reduction in support, the safety net on the domestic markets has been removed. Since then, in general, domestic prices follow the prices on the world market, where volatility has typically been higher.

An example of this liberalization and subsequent increasing price volatility occurred inter alia in the EU: In the 1980s and up to the implementation of the reforms of the EU's agricultural policy at the beginning of the 1990s, the EU's internal market prices were stabilized by means of trade regulations and interventions. Internal prices were relatively stable, and seasonal variations, which are relatively easy to predict, were the most significant contributors to the overall variation. Subsequently, both the price level and price volatility in the EU have largely followed the world market, which is completely in line with the consequences of trade liberalization.

The change in the price of wheat in both the EU and the world market since 1980 is presented in Fig. 7.14.

As the figure illustrates, fluctuations in world wheat prices in the 1980s were significant. However, these fluctuations did not immediately have any significant impact on market prices in the EU, which were shielded by trade barriers. In the latter part of the period, price volatility on the world market had a significant effect on EU wheat prices.

Both price increases and decreases during the food crises of 2007–2008, 2011–2012 and again from 2020 led to increasing price volatility.

The liberalization of agricultural policy including, in particular, the removal of trade-distorting measures, has come a long way, cf. also Chapter 6. Therefore, agricultural policy is not expected to increase price volatility to the same extent in the future.

Food crises will also create price volatility. The likelihood that food crises will occur in the future is assessed in more detail in Chapter 10.5. Factors such as the size of grain stocks, bioenergy, the price of oil, demand growth, etc., will thus be decisive in terms of both the emergence of food crises and price volatility.

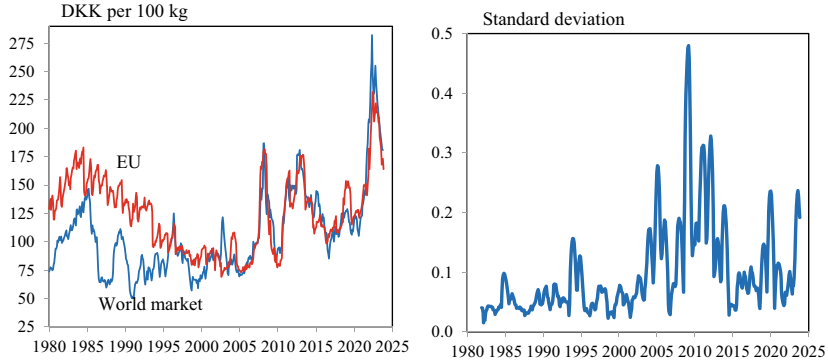


Fig. 7.14 Wheat prices in the EU and on the world market and price volatility in the EU (*Note* EU prices = The Danish prices are farmers' selling prices. The world market price is the price of the Chicago Board of Trade. Price volatility is calculated as the standard deviation over 12 months using LN (Price $_t$/Price $_{t-12}$), where t = month. *Source* Own calculations and presentation based on statistical data from USDA, Statistics Denmark, and Danish Agriculture & Food Council)

Several factors point to high price volatility in the future:

- Climate change and more extreme weather events will lead to more unstable and variable plant production around the world. This will also cause greater price fluctuations.
- Increasing demand for agricultural products for food, feed and energy purposes will in itself mean increasing pressure on the market, which may lead to situations of undersupply and thus price fluctuations. The increasing demand pressure will also lead to the use of more marginal agricultural resources, but this will also reduce production security and subsequently also price stability.
- Water resources are becoming increasingly scarce, which increases the risk of stunted growth due to drought and limits the agricultural area that can be irrigated. This situation may also lead to lower yields and major variations in annual production.

Several additional factors suggest low-price volatility in the future:

An increasing focus on plant breeding, more efficient dissemination of knowledge, improved infrastructure, reduced food loss and increasing international trade may contribute to increasing price stability.

Finally, the degree of political attention on the problem—and the specific political measures—will also contribute to limiting price volatility in the future.

Based on the studies and sources presented, no clear trends for the future can be predicted. However, price volatility will probably also be significant in the future and more evident in agriculture than in other economic sectors.

7.8 Price Spread

The price spread refers to the difference between the farm price and the retail price of food for corresponding commodities. This price spread involves costs incurred by various intermediaries and their margins, and it reflects charges for processing, shipping, and retailing farm goods. Therefore, the farm-to-retail price spread includes payments for value-added services beyond the farm gate that are needed to transform a raw product into a retail product.

Movements in price spread are important because an increase in the price spread may signal a change in the level of competition in one or more sectors of a food supply chain (ABARES, n.d.). However, and as discussed below, analyses of such price structures have limitations as many factors may lead to an increase in the price spread.

When farmers' sales prices for raw materials are to be compared with consumer prices, which are often highly processed and complex, the data base is important. Furthermore, very long time series over several decades must be used when assessing the long-term trends. This also means that care must be taken when interpreting and comparing the results.

Several factors explain the increasing price spread, cf. for example Zammit and Howden (2020), ABARES (n.d.), and Hahn (2004):

- An increase in farm-to-retail price spread may indicate that productivity in the farm sector is increasing at a faster rate than it is in the processing or retailing sectors.
- A change in consumer preferences that requires more value to be added by processors or retailers will increase the price spread. As the processing function increases the price spread of agricultural

commodities, the price spread will vary widely between products depending on the degree of processing.
- An increase in the price of inputs in the processing or retailing sectors such as energy or labor costs will increase the total cost and thereby sales prices and the price spread.
- An increase in processors' or retailers' bargaining power over farmers may increase the price spread. In general, imperfect markets or a change in the level of competition in one or more sectors of a food supply chain may result in changes in the price spread.
- Short-term changes in the price spread may be a result of imperfect price transmission.
- Changes in agricultural policy, including shifting from market price support to direct payments, will reduce farmer prices. Therefore, the price spread may increase in the short term.
- Levies and taxes on food at the retail level may affect the price spread. Normally, corrections for such levies and taxes must be made to obtain an accurate picture of the development.

Considering the range of factors that can influence the long-run farm-to-retail price spread, it is difficult to determine the precise contribution of any particular factor to any change in the farm-to-retail price spread (Nguyen et al., 2016).

As indicated above, the extent of the farm-to-retail price spread and how it changes varies between products and between cases. At the same time, limited access to—or availability of—data means that results from several studies from different countries and segments must be presented.

Figure 7.15 presents the price spread for two identical products in two different countries over a 50-year period, cf. Figure 7.15.

The figure shows farmer and retail real (deflated) prices for pork in the USA and Denmark. In both cases, increasing price spreads are seen in the period. For 1970–2020, where comparable data is available, farmer pork prices have exhibited almost the same trend in the two countries.

Since the mid-1990s, US real retail prices have remained almost constant, thereby increasing the price spread, while there has been a continuous decline in real retail prices in Denmark. However, increased processing in the USA may explain this difference. In any case, the increasing price spread is apparent in both countries.

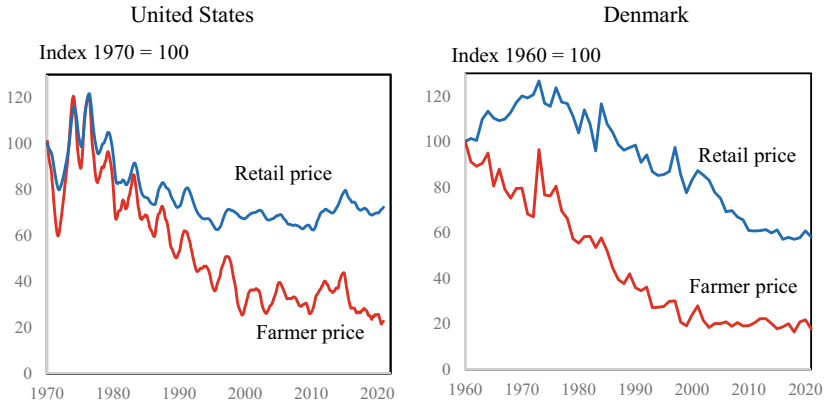


Fig. 7.15 Farmer and retail real pork prices in the USA and Denmark (*Note* USA: 12-month moving average. Denmark: Annual data. *Source* Own calculations based on statistical data from Statistics Denmark, USDA, and U.S. Bureau of Labor Statistics)

A longer-term case study finds a similar trend, i.e., an increasing price spread, albeit with significant turbulence and divergent directions in periods of political tension, war and market restrictions, cf. Figure 7.16.

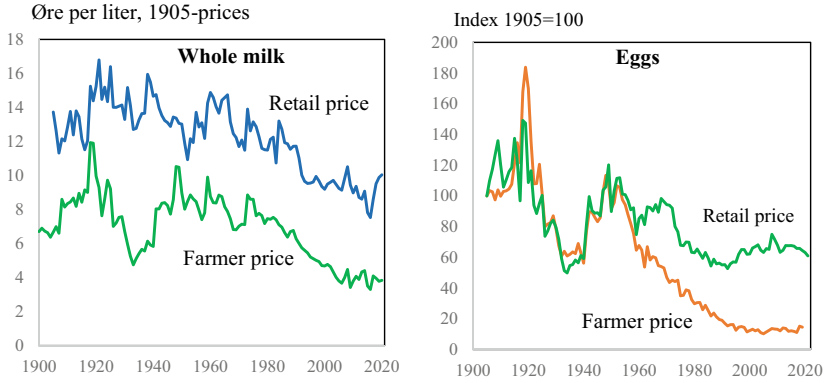


Fig. 7.16 Long-term change in farm and retail prices (deflated) in Denmark (*Sources* Own calculations based on statistical data from Statistics Denmark)

The figures illustrate a very long time series for two relatively raw material-based and non-processed products: Whole milk and eggs (fresh and unprocessed eggs) do not change significantly from farmer to retailer, apart from packaging, etc., which means that comparability is high and price spreads are not significantly affected by additional costs in the value chain after the agricultural link.

The figures reveal a fairly clear development from the middle of the twentieth century—after the Second World War—until today. During this period, the real price of milk in agriculture has fallen by approx. 55 percent, while the price in the retail sector has fallen by approx. 25 percent. The real (deflated) price of eggs in agriculture has fallen by 80 percent, while the retail price has also fallen, but not as significantly. In recent years, the development has been more stable, which may be due to both diminishing productivity increases and more differentiated egg products with a higher value (organic, free-range, etc.).

An increasing price spread can also be identified in plant production. Potatoes, which are fairly homogeneous products, and which are also marketed as unprocessed products, are produced and sold on a market that can be used as a case to illustrate the long-term price change, cf. Figure 7.17.

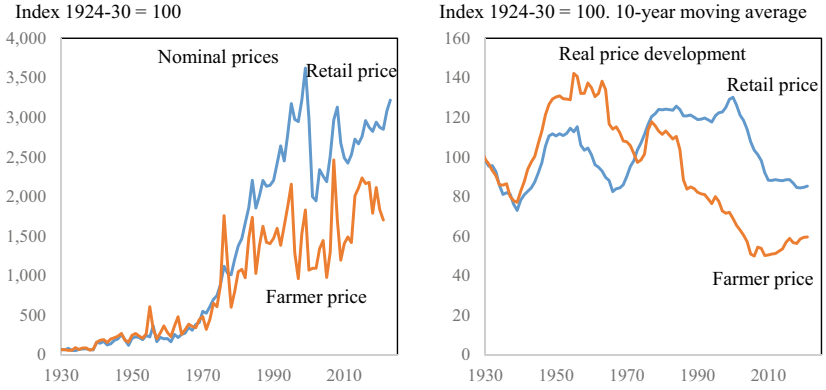


Fig. 7.17 Potatoes: Long-term change in farm and retail prices (nominal and deflated prices) in Denmark (*Sources* Own calculations based on statistical data from Statistics Denmark)

Prices are from Denmark due to the availability and reliability of the data. However, Denmark is considered to be fairly representative of many other countries.

Firstly, the figure shows that retail and farmer prices exhibit similar fluctuations: rising farmer prices lead to rising retail prices without any visible lags.

Secondly, large annual price fluctuations—mostly due to changes in supply as a consequence of production conditions—are reduced using a 10-year moving average, and prices are deflated with the consumer price index. The figure shows that the price spread emerged and grew in the 1970s. Subsequently, farmer prices have almost halved in real prices.

In general, the decreasing farmer prices and the increasing price spread is a rather clear phenomenon, which cannot be explained by increasing processing in the value chain. On the contrary, the relatively large increases in productivity in egg, milk and potato production in agriculture—as discussed in other chapters—are realistic and significant explanations.

As previously mentioned, eggs, milk and potatoes remain almost unchanged throughout the value chain as they do not undergo much processing, which means a clearer picture of the price spread can be drawn. When more processed goods, food service, restaurants, cafeterias, takeaways, etc., are included, the relatively cheap agricultural raw materials account for a decreasing share of the consumer price, while labor costs in particular, which is an increasingly expensive input, account for a larger share of the retail price. On this basis, food prices (including the price of increasingly processed foods) can be expected to rise more than the price of agricultural raw materials, and the price spread will thus increase to a relatively large extent.

An aggregate case study that includes a farmer's total sales price index and a total food consumer price index confirms this expectation, cf. Figure 7.18.

The figure illustrates a significant increase in agricultural sales prices at the beginning of the 1970s, which was primarily due to the fact that Denmark became a member of the EC and, therefore, obtained the benefits of the Common Agricultural Policy from 1973. Subsequently, there was a significant decline in sales prices, which was due to the reforms to the EU's agricultural policy, associated price reductions, and significant increases in productivity in agriculture.

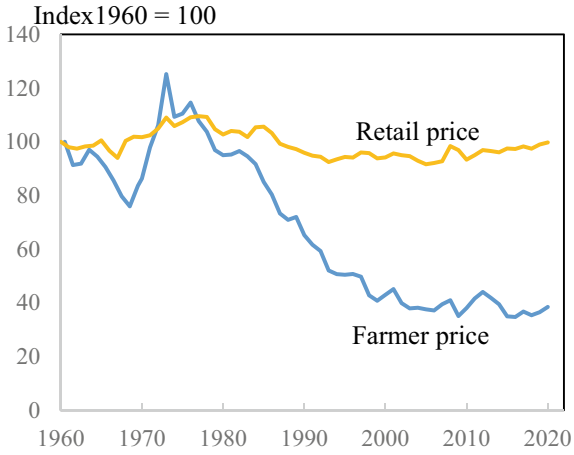


Fig. 7.18 Agricultural and food products: Change in farmer and retail real price (Denmark) (*Sources* Own calculations based on statistical data from Statistics Denmark)

While the retail price remained at an almost constant level, farmer prices declined by 60 percent—both in real terms. The price spread increased considerably during the relatively long period presented in the figure.

7.9 Consumer Food Prices

In the previous section, statistical long-term trends showed that consumer food prices tend to decrease when analyzing standard products such as eggs and milk over a long period.

The product group "food" changes character during economic growth as food products become increasingly processed. Increasing cost for labor, marketing, transportation, innovation, etc., is included in food prices, as the farmers' share of the food retail value is decreasing (Chapter 4.11), so cheap agricultural inputs will account for a decreasing share of the production value, while more expensive inputs like labor costs will account for an increasing share. Overall, the price per unit increases—sometimes by more than inflation—as unit labor costs will usually increase by more than inflation.

The price change is sometimes obscured by the fact that food accounts for a decreasing share of total consumption as the demand for food is relatively income elastic. Also, increased processing means that calculating the real change in prices is complex.

By focusing on a few food products that are very similar over a long period, the decline in real food retail prices can be illustrated, cf. Figure 7.19.

The figure illustrates rather uniform price trends for the two product groups. The two world wars led to significant price increases, and the food crises of 2007–2008, 2011–2012 and 2020–2023 also led to higher retail prices, albeit with different consequences for the two products.

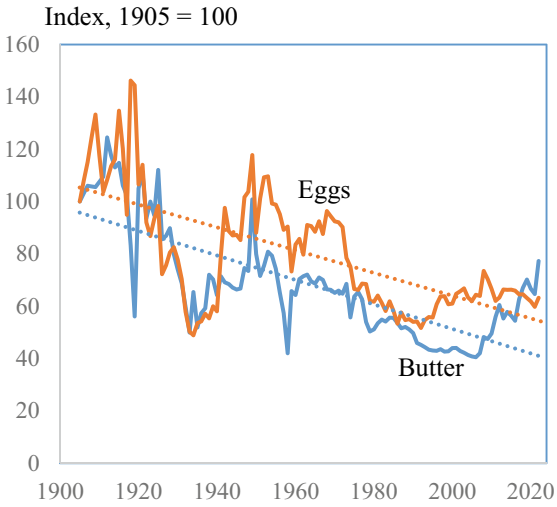


Fig. 7.19 Long-term change in retail prices (deflated) in Denmark (*Note* Prices are from Denmark due to the availability and reliability of the data. Linear trend-lines included. *Sources* Own calculations based on statistical data from Statistics Denmark)

References

ABARES. (n.d.). *Farm share and price spread*. Retrieved from Australian Government. Department of Agriculture, Fisheries and Forestry: https://www.agriculture.gov.au/abares/research-topics/agricultural-forecasting/farm-share-price-spread

Altman, S. A., & Bastian, C. R. (2022, May 31). Trade regionalization: More hype than reality? *Harward Business Review*. https://hbr.org/2022/05/trade-regionalization-more-hype-than-reality

Balcombe, K. (2009). *The nature and determinants of volatility in agricultural prices. An empirical study from 1962–2008*. Munich Personal RePEc Archive (MPRA Paper No. 24819). https://mpra.ub.uni-muenchen.de/24819/1/MPRA_paper_24819.pdf

Díaz-Bonilla, E. (2016). Volatile volatility: Conceptual and measurement issues related to price trends and volatility. In M. Kalkuhl, J. von Braun, & M. Torero (Eds.), *Food price volatility and its implications for food security and policy*. Springer Open. https://doi.org/10.1007/978-3-319-28201-5_2

Doğan, B. (2022). Does FDI in agriculture promote food security in developing countries? The role of land governance. *Transnational Corporations Journal, 29*(2). https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4203590

European Commision. (2009). Historical price volatility. European Commision, Directorate L. Economic analysis, perspectives and evaluations. https://agriregionieuropa.univpm.it/sites/are.econ.univpm.it/files/volatility_en.pdf

FAO. (2010). *Price volatility in agricultural markets: Evidence, impact on food security and policy responses*. https://www.fao.org/3/am053e/am053e00.pdf

FAO. (2022). The state of agricultural commodity markets 2022. The geography of food and agricultural trade: Policy approaches for sustainable development. https://doi.org/10.4060/cc0471en

FAO and OECD. (2011). *Price volatility in food and agricultural markets: Policy responses*. Policy Report by FAO, IFAD, IMF, OECD, UNCTAD, WFP, the World Bank, the WTO, IFPRI and the UN HLTF. https://www.fao.org/fileadmin/templates/est/Volatility/Interagency_Report_to_the_G20_on_Food_Price_Volatility.pdf

Hahn, W. (2004). *Beef and pork values and price spreads explained*. USDA Economic Research Service. https://www.ers.usda.gov/webdocs/outlooks/37369/49585_ldpm11801.pdf?v=6246.2

Hansen, H. O. (2013). *Food economics: Industry and markets*. Routledge.

Jacks, D. S. (2019). From boom to bust: A typology of real commodity prices in the long run. *Cliometrica, 13*, 201–220. https://doi.org/10.1007/s11698-018-0173-5

Johanson, J., & Vahlne, J.-E. (1977). The internationalization process of the firm: A model of knowledge development and increasing market commitments. *Journal of International Business Studies, 8*, 23–32. https://doi.org/10.1057/palgrave.jibs.8490676

Legge, S., & Lukaszuk, P. (2021). *Regionalization vs globalization: What is the future direction of trade?* World Economic Forum. https://www.weforum.org/agenda/2021/07/regionalization-globalization-future-direction-trade/

Nguyen, N., Mobsby, D., & Goesch, T. (2016). *Farm-to-retail price spread and farm share in food supply chains: Background paper*. ABARES. https://doi.org/10.13140/RG.2.2.18569.60001

Punthakey, J. J. (2020). Foreign direct investment and trade in agro-food global value chains. *OECD Publishing*. https://doi.org/10.1787/993f0fdc-en

Tangermann, S. (2011). *Policy solutions to agricultural market volatility: A synthesis*. International Centre for Trade and Sustainable Development (ICTSD). https://www.files.ethz.ch/isn/138403/tangermann-price-volatility-and-policy-options.pdf

Tropea, F. (2016). *Price volatility in agricultural markets: Risk management and other tools*. European Parliamentary Research Service. https://www.europarl.europa.eu/RegData/etudes/BRIE/2016/586609/EPRS_BRI(2016)586609_EN.pdf

UNCTAD. (2022). *International tax reforms and sustainable investment*. United Nations Publications. https://unctad.org/system/files/official-document/wir2022_en.pdf

WTO. (2022). *World trade statistical review 2022*. World Trade Organization. https://www.wto.org/english/res_e/booksp_e/wtsr_2022_e.pdf

Zammit, K., & Howden, M. (2020). Farmers' terms of trade. *Update to farm costs and prices paid*. Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES). https://doi.org/10.25814/5e339b991ce73

CHAPTER 8

Consumers and Consumption

8.1 Introduction

Consumers and consumption are different when it comes to food compared with many other products. The markets, the products and the business conditions are different, some of which have already been discussed elsewhere in this book. Some very specific conditions apply to food consumers and food consumption:

- Food is a basic necessity, which means that opportunities for substitution and the scope for differentiation are very limited. Everyone demands and consumes food daily.
- Consumption and demand is rather constant and less affected by economic recession and economic booms. Demand growth in volume is quite low.
- Food is a fast-moving consumer good (FMCG), i.e., a product that sells quickly at a relatively low cost. FMCGs have a short shelf life because of high consumer demand or because they are perishable.
- Structural trends affect food demand: More women on the labor market, smaller households, preferences for more leisure time, etc., change food demand.
- The products food and water are on the lowest level of Maslow's hierarchy of needs. They are the only consumer products at this level.

H. O. Hansen, *Megatrends in Agriculture, Food Industry and Food Markets*, Palgrave Advances in Bioeconomy: Economics and Policies,
https://doi.org/10.1007/978-3-031-58152-6_8

A specific focus on consumption and consumers is, therefore, relevant from a food perspective.

Consumers and customers are the last link in the value chain and are positioned downstream. Fundamentally, consumers are the central players as all activities in the agricultural and food sectors are aimed toward fulfilling consumer needs. The position and role of consumers in the entire value chain is changing: For decades, agriculture and food production was based on what was possible technically, biologically and economically. Today, a paradigm shift is occurring from traditional production-driven agriculture toward market and consumer-driven agriculture, so that the value chain "from field to fork" is increasingly becoming "from fork to field".

This change has been reinforced by a power shift in the value chain. Consumers have become more powerful and critical and this power shift has been supported by media attention on consumer interests. Furthermore, food consumption has gained a new dimension as a result of the climate discussion in that consumers are more aware of the negative effects of their consumption on the environment. The industrialization of agriculture has also created new forms of production which create awareness and debate right down to the consumer level.

8.2 Demand for Animal-based Products

The consumption of animal foods and the consumption trend are both important and interesting. Animal foods are more resource-demanding and have a greater impact on the climate than vegetable foods. However, animal-based foods have nutritional benefits. In addition, the consumption of animal foods—hereafter based on meat consumption—follows consistent global patterns that are relatively easy to explain and predict.

An example of the consistent global patterns is presented in Fig. 8.1.

As can be seen, meat consumption increased significantly in Asia compared to Africa, in particular, during the period. This change parallels an increase in incomes, which have improved more in Asia than they have in Africa.

The global increase in meat consumption is due to both rising incomes and a growing population. At the global level, the correlation between income and meat consumption is very clear—see Fig. 8.2.

Figure 8.2 presents economic income (GDP per capita—the horizontal logarithmic axis) and meat consumption (kg per capita per year—the

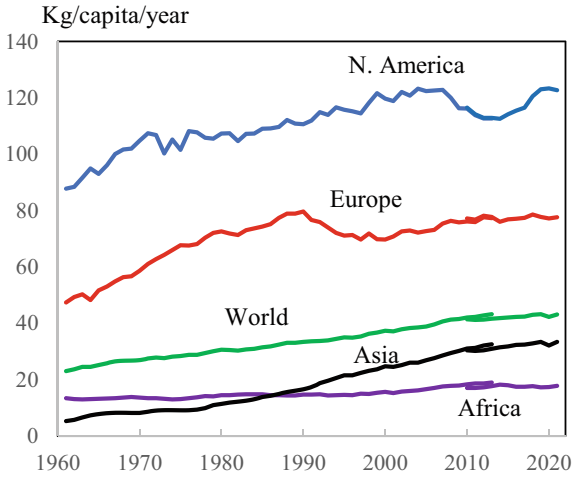


Fig. 8.1 Meat consumption in selected regions, 1961–2021 (*Note* Consumption is calculated as "meat supply" for each country and region. Two different methods of calculation were used for 1961–2013 and 2010–2021. *Source* Own presentation based on statistical data from FAO)

vertical axis) for all the countries in the world. The countries furthest to the left are the poorest, and here meat consumption is below 20 kg per year. As we move to the right, countries' economic welfare and income increase, and at the same time meat consumption also increases to over 100 kg. The connection is relatively clear: the richer the country, the more meat that is eaten.

The richest countries such as the USA, Switzerland, Norway and Australia are located on the far right. Here, there is no clear connection between income and meat consumption: Meat consumption does not seem to increase when the income per population exceeds approx. US$45,000 per person.

For the countries with an average GDP of over US$45,000 (marked by a vertical dashed line in the graph), there is thus a small negative correlation between income and meat consumption. Meat consumption increases with rising income but only up to a certain threshold, after which point it tends to fall.

The stagnation in the growth in meat consumption at very high incomes is also illustrated in Fig. 8.3.

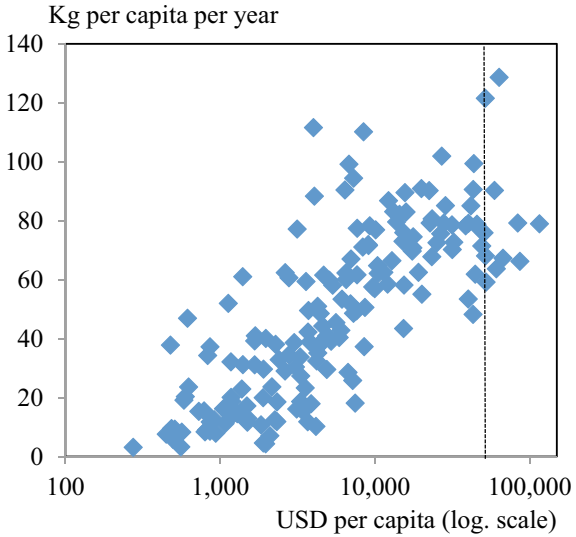


Fig. 8.2 Meat consumption in all countries as a function of income (2020) (*Note* Consumption is calculated as "meat supply" for each country and region. *Source* Own presentation based on statistical data from FAO)

The figure shows several different features: Each line represents one country and it shows the meat consumption for seven years, namely 1990, 1995, 2000, 2005, 2010, 2015 and 2020. The figure illustrates that meat consumption in the countries with the highest incomes has remained at an almost constant level. In contrast, meat consumption in low-income countries has increased sharply. The figure allows both a static and dynamic interpretation to be made: The current differences in consumption among the countries can largely be explained by the level of income. In recent decades, meat consumption has risen sharply in the low-income countries, while it has remained at a fairly constant level in the high-income countries.

Meat consumption is also affected by other factors including price, climate challenges, livestock diseases, income distribution, etc., so the relationship shown in the graph only illuminates one of many factors. In the high-income countries, climate issues will undoubtedly help limit meat consumption. In many other countries, rising incomes will be the main reason for increasing meat consumption.

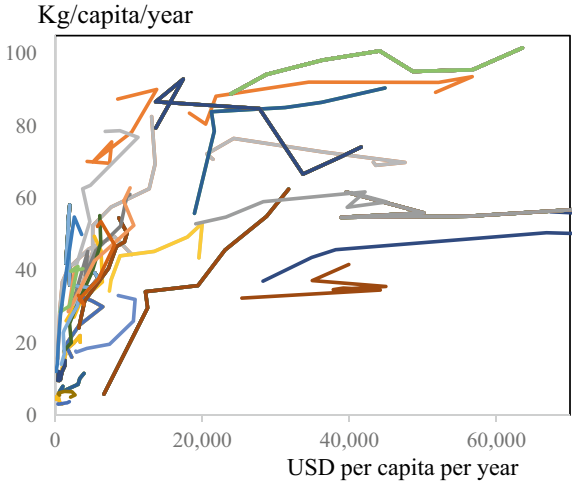


Fig. 8.3 Meat consumption in 38 countries in relation to their income in 1990, 1995, 2000, 2005, 2010, 2015 and 2020 (*Note* The 38 countries are selected by OECD and FAO and they cover a wide range of countries. *Source* Own presentation based on OECD and FAO [2022])

As shown in Fig. 8.2, global meat consumption has increased significantly in recent decades. From 1961 to 2020, the average total meat consumption per capita worldwide increased from 23 to 43 kg. During this time, poultry meat, in particular, became increasingly important for consumption, cf. Fig. 8.4.

The increasing importance of pork is largely due to developments in China, which is home to almost half of the world's pig population. Since the beginning of the 1960s, consumption of pork in China has increased from 2 to 62 kg per person per year.

Poultry meat is now the most important type of meat in terms of weight. In this case, it is important that poultry meat is relatively cheap, easy to produce and relatively low in fat.

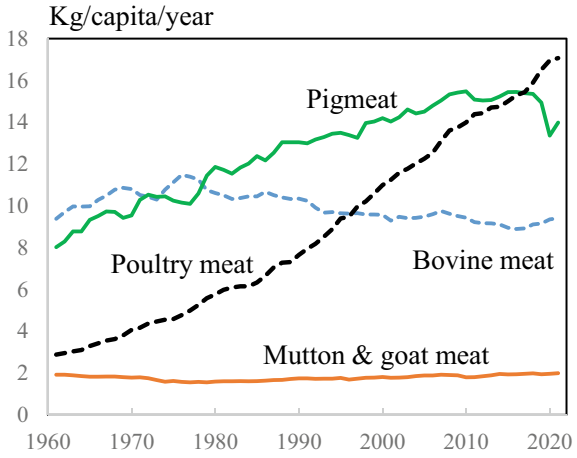


Fig. 8.4 Global meat consumption per capita 1961–2021 (*Source* Own presentation based on statistical data from FAO)

8.3 Demand for Plant-based Food

In general, the consumption of calories from animal products—of which meat accounts for a significant share—rises in line with a country's economic growth. However, the consumption of calories from vegetables remains almost unchanged, see Fig. 8.5.

The figure illustrates that the poorest countries almost exclusively consume vegetable products. 1.500–2.500 calories per day come from vegetable products, while less than 500 calories come from animal products. The consumption of animal-based foods increases in line with economic growth, while the consumption of vegetable products is almost constant.

Therefore, the overall trend is constant demand for vegetable products and increasing demand for animal-based food during economic growth. The share of vegetable-based food will decline in line with increasing income, cf. Fig. 8.6.

The figure illustrates a very clear correlation—vegetable-based food accounts for a decreasing proportion of total food calculated in calories in line with increasing income in the countries.

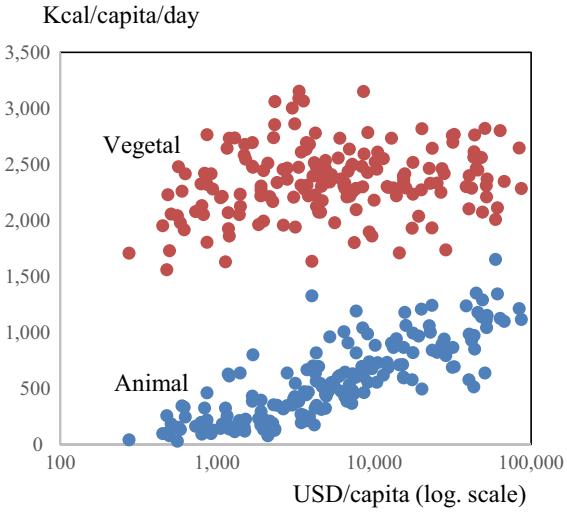


Fig. 8.5 Consumption of calories from animal and vegetable products in relation to the level of economic growth (2020) (*Source* Own presentation based on statistical data from FAO)

Countries with a very low proportion of plant-based foods are thus rich countries but also countries with a relatively poor climate for plant production (the Nordic countries) and countries with large fish resources (for example Iceland).

There do not seem to be any indications that the rich countries are changing their behavior: In the last 10 years, consumption of animal-based foods per capita has increased in the rich countries at a faster rate than it has in the rest of the world. New trends, which are described elsewhere in this book, are emerging on a large or small scale, but so far they have not changed the overall picture.

Between 2010 and 2020, the growth in consumption of animal-based foods increased in line with increasing income. This means that countries with high incomes have experienced a relatively large increase in the consumption of animal-based foods in this time. Thus, there is no sign of a new vegetable-based trend.

In a global perspective, when income is such an important factor for consumers' choice between plant-based and animal-based foods, it is difficult to influence consumption. On average, income and living conditions

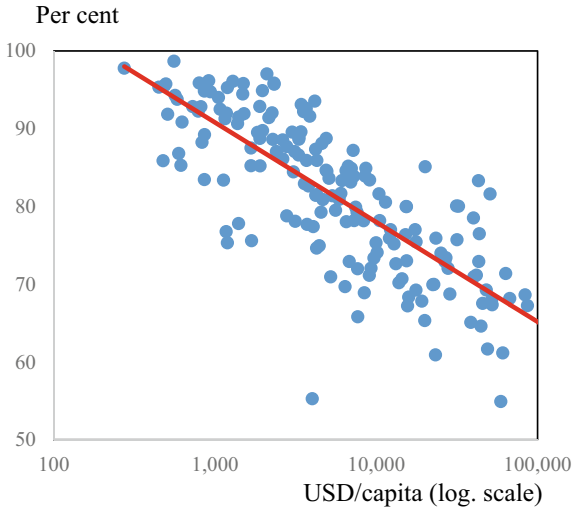


Fig. 8.6 Consumption of vegetable calories as a percentage of all calories—for all countries as a function of the countries' income (*Source* Own presentation based on statistical data from FAO)

worldwide are gradually improving, which results in a relatively large increase in the demand for animal products. This trend and correlation are at odds with the need for a more plant-based diet.

8.4 Convenience Food

There is no clear definition of the concept of "convenience food". However, convenience food (also called tertiary processed food) is typically a full meal that is ready, or almost ready, to eat when it is bought and can be prepared quickly and easily by thawing or heating. Convenience food can be considered as the industry's solution for making the process of cooking easier for the user, so it often includes ready-to-eat dry products, frozen foods, shelf-stable foods and prepared mixes. Convenience also has a link to the food service (catering) market, which offers meals to the user.

Convenience is thus strongly associated with concepts such as catering, takeaway, fast food, ready-to-eat, etc. Several drivers reinforce the trend toward greater convenience such as a reduction in the size of households

and time spent in the kitchen and an increase in the number of women in the workforce.

Convenience is becoming increasingly important with regard to food demand. In general, there is an increasing demand for more processed goods, which require less preparation in the home.

Convenience food as a global megatrend can be illustrated in several ways:

One way is to observe the drivers behind convenience. These drivers seem to follow a similar global tendency, which will push food convenience in a common direction:

Firstly, increasing incomes and economic welfare will lead directly to an increasing demand for food convenience.

Secondly, an increasing number of women will enter employment outside the home, which will increase the demand for convenience.

Thirdly, households are becoming increasingly small in line with economic growth. Despite cultural differences, etc., there is a very strong correlation. With increasingly small households, demand for convenience on the food market will, ceteris paribus, increase.

Fourthly, the demand for more leisure time reduces the time spent in the kitchen, which will also increase demand for more processed and "easy" food—and food convenience. The reduced time spent in the kitchen is a result of the supply of more processed food while it also stimulates demand for convenient food.

The time spent cooking in the kitchen has been studied by several sources. Figure 8.7 shows the long-term development from the UK.

The figure illustrates that the average time spent cooking dinner in the UK has decreased significantly in recent decades: From 100 minutes in 1960 to 27 minutes in 2016. The example from the UK reflects a rather clear global trend: With increasing income, citizens spend less time in kitchen—see Fig. 8.8.

The figures illustrate a very significant correlation and trend: People are spending less time cooking and are demanding more convenience.

Based on several inputs from many stakeholders, UBS (2018) asks the question: Is the kitchen dead? The authors present a likely scenario for 2030, when "most meals currently cooked at home are instead ordered online and delivered by either restaurants or central kitchens". Ordering food online is considered to be part of a megatrend, and that global online food ordering will increase from $35 billion in 2018 to $365 in 2030—an annual growth of more than 20 percent.

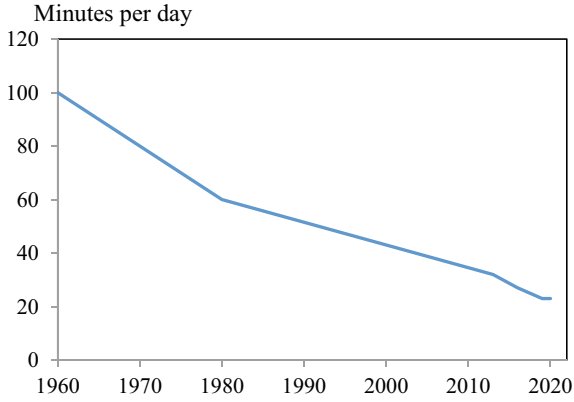


Fig. 8.7 Time spent cooking dinner in the UK (*Source* Cawthray and Murphy [n.d.] and Kirkova [2013])

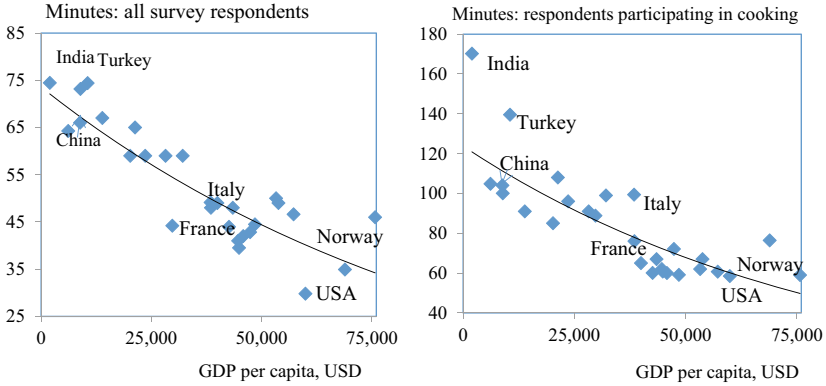


Fig. 8.8 Average minutes spent cooking and washing up per day per person all survey respondents and respondents participating in cooking (*Note* All respondents = includes people not participating in cooking. Participants = Participating in cooking. GDP per capita in 2011. *Source* Own calculations based on OECD [2011] and statistical data from World Bank)

So, what is driving this potential growth (UBS, 2018):

- Lower meal production costs thanks to economies of scale in mass production, large purchases, automation, etc.
- Improved logistics (drones and droids) will reduce costs further in the future.
- Demographic trends. Millennials are 3 times more likely to order take away than their parents. As this generation matures, home cooking may disappear altogether.

Catering is an indicator of food convenience, or catering can be described as a proxy or part of food convenience.

Catering can be defined as the business of providing food or food services for customers through, e.g., canteens, hotels, hospitals, aircrafts, companies, etc. This also indicates that food catering and food convenience are strongly connected.

Catering is a growing business in many countries. Although food demand is growing slowly, demand for food catering services is increasing relatively rapidly. Comparing households' expenditures on catering with households' expenditures on all food (including catering) reveals a long-term increasing market share for catering in developed countries, cf. Fig. 8.9.

The figure illustrates the increasing importance and market shares of food catering compared to the total demand for food including catering. Figure 8.9 only includes a few examples, but data from all developed countries (cf. Fig. 8.10) supports the assertion that demand for catering increases with increasing income. As can be seen, catering's share of total food expenditures is increasing for households in several countries, cf. Fig. 8.10.

8.5 Takeaway and Eating Out

Takeaway and eating out is a direct consequence of the increasing demand for convenience. As part of the wave of convenience and well-being and in line with the increasing participation in the labor force, an increasing proportion of consumption will take place outside the home.

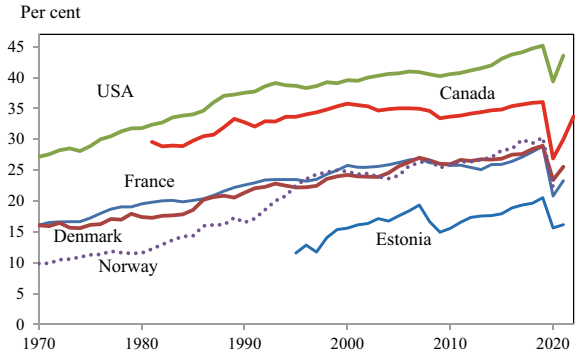


Fig. 8.9 Households' long-term expenditures: Catering as a share of total food expenditures for selected countries (*Note* For selected countries with available data. Total: Food, beverages and catering. *Source* Own presentation based on statistical data from OECD)

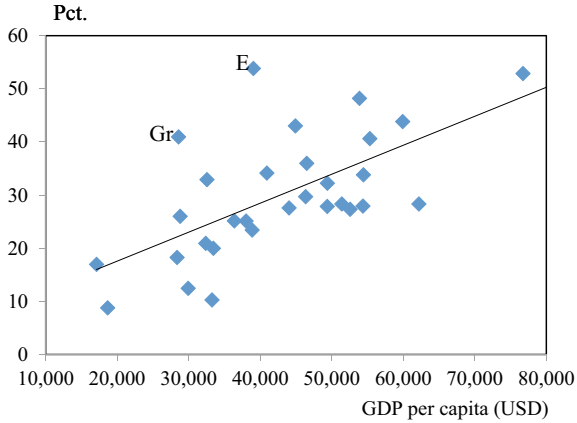


Fig. 8.10 Households' expenditures: Catering as a share of total food expenditures as GDP per capita (2017) (*Note* Total: Food, beverages and catering. *Source* Own presentation based on statistical data from OECD and World Bank)

Eating out is especially dependent on income and thus sensitive to economic conditions. Therefore, eating out will increase in parallel with economic growth.

Almost half of the food consumed in the USA, which is often a trend setter in this area, is consumed outside the home, see Fig. 8.11.

The figure illustrates the value of eating out as a percentage of total food consumption. The figure shows a clear international trend toward more eating out.

In the USA, USDA statistics tells that food consumed outside the home as a percentage of total food expenditure increased from 20 to 53 percent in the years 1930–2000. However, a similar but faster development is also currently emerging in several less developed countries.

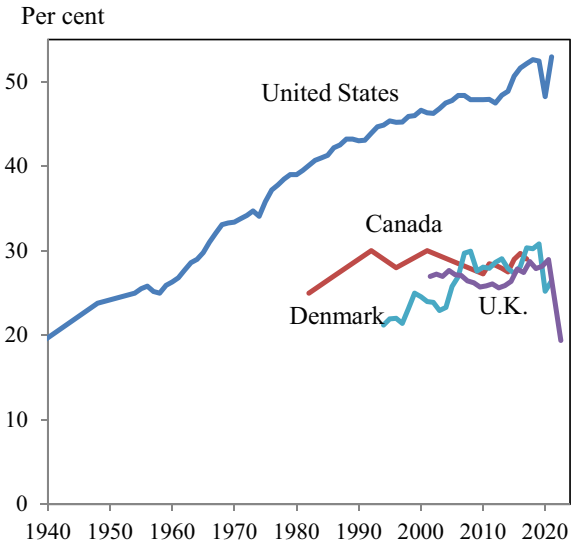


Fig. 8.11 Eating out as a percentage of the total (*Note* USA: Food consumed outside the home as a percentage of total food expenditure. Canada: Food purchased from restaurants as a percentage of total food consumption. U.K.: Eating out as a percentage of total expenditure on food and beverages. Denmark: Consumption in restaurants, canteens, etc., as a percentage of total food and beverage consumption. *Source* Author's calculations based on statistical data from Department for Environment, Food & Rural Affairs [UK], Statistics Canada, Statistics Denmark and USDA)

In urban China, total expenditure on food consumed outside the home increased from 10 to 23 percent between 1995 and 2006, cf. Fig. 8.12.

Other middle-income countries have exhibited very similar growth in terms of eating out: In Egypt and India, the number of meals eaten outside the home almost doubled in less than 20 years (FAO & The World Bank, 2018).

Eating out and takeaway are two almost identical trends with the same drivers. In practice, it is also impossible to separate the two trends in terms of their extent and prevalence. For this reason, they are discussed together.

The convenience trend toward more takeaway, eating out and fast food is also evident when the number of outlets is mapped, cf. Fig. 8.13.

As the figure illustrates, growth has been significant in the time period with strong growth in the number of stores, outlets and coffee shops for the 4 selected companies all of whom are front runners in their business area.

Focusing on takeaway, information about consumer expenditure in the UK is used to illustrate the trends. The examples from the UK, more specifically London, are presented in Figs. 8.14 and 8.15.

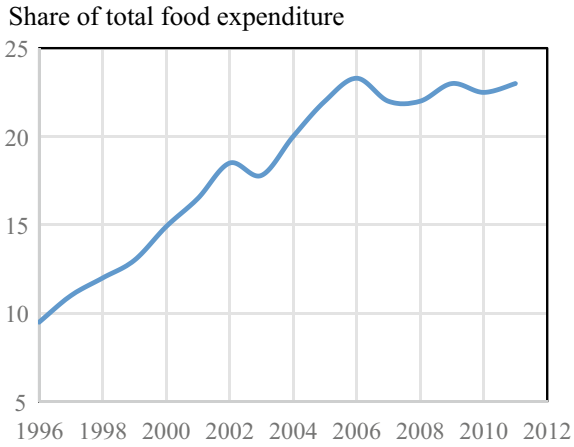


Fig. 8.12 Urban China: Eating out as a percentage of total food expenditure (*Source* Own presentation based on FAO and The World Bank [2018])

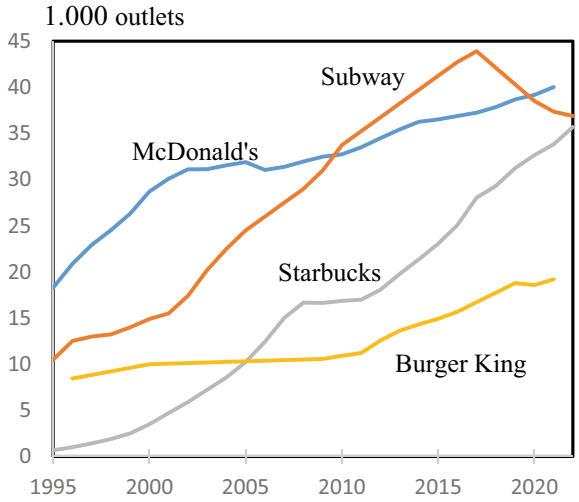
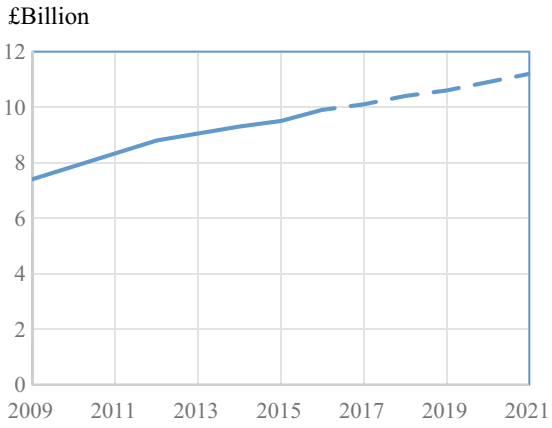


Fig. 8.13 Global number of some fast food- and takeaway outlets (*Source* Own production and presentation based on ReferenceForBusiness [n.d.] and DMR [n.d.])

Fig. 8.14 Household expenditure on takeaways in the UK (*Source* Own presentation based on statistical data from Office for National Statistic [UK])



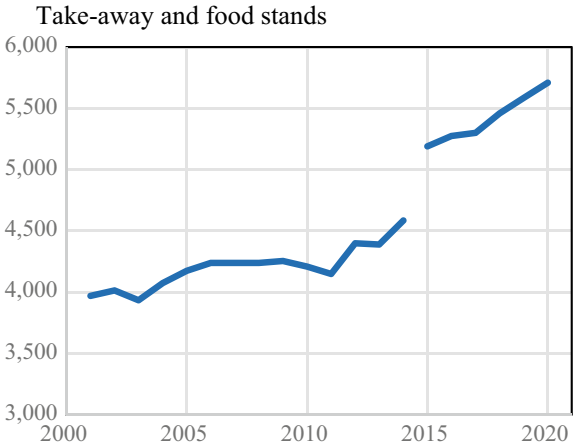


Fig. 8.15 Number of "take away food shops and mobile food stands" in London 2001 to 2020 (*Source* Own presentation based on statistical data from Office for National Statistic [UK])

Figure 8.14 illustrates a steady increase in household expenditure on takeaways. An average annual nominal increase of 8 percent from 2009 to 2016 is quite significant. The trend after 2016 is a future projection.

Furthermore, the number of "take away food shops and mobile food stands" in London is increasing significantly, thereby indicating a clear trend toward more takeaways (Fig. 8.15).

8.6 Household Size

The size of households is also an important—direct or indirect—parameter that has an impact on food markets and especially food demand. The composition of food demand is affected when the size of individual households changes in parallel with economic growth in a country.

Despite cultural differences, etc., a very strong correlation between economic development and household size can be observed. The global trend is driven by both economic growth and socio-economic factors.

One consequence of the increasingly small households—and more households with only one person—is that the demand for convenience, eating out, food service, catering, etc., increases. Therefore, the change

in the size of households in the individual countries and in the individual markets is an important parameter in the market analysis performed by food companies.

Figure 8.16 illustrates the long-term trend in the share of households with only one person in selected countries.

The trend toward more households with only one person is relatively clear and consistent. Such a development naturally occurs gradually, and no significant changes will occur in the short term.

Both geographical and age differences in the individual countries play a role: most households with only one person are located in the big cities and among older people.

Economic growth and economic welfare are important parameters in terms of the change in the size of households. This correlation is shown in Fig. 8.17.

The figure illustrates a decrease in the size of households with increasing income. Middle East (ME) countries are shown separately as cultural differences in these countries are supposed to have an influence on the change.

The figure also illustrates that the proportion of households with only one person is related to—and logically positively influenced by—the countries' level of economic development.

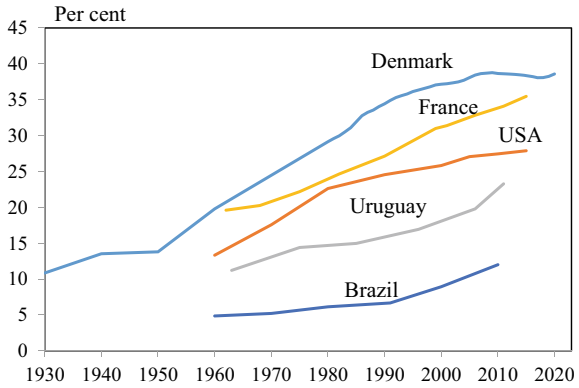


Fig. 8.16 Share of households with only one person (*Source* UN [n.d.] and statistical data from Statistics Denmark)

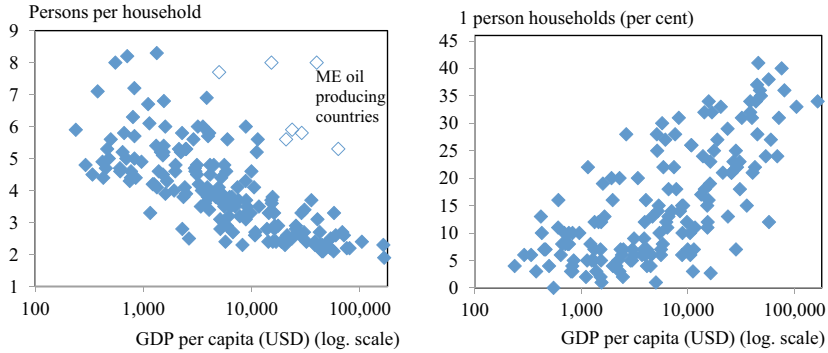


Fig. 8.17 Size of households during economic growth (*Source* Own calculations based on UN [n.d.] and statistical data from USDA)

The trend toward smaller households and more households with only one person will thus strengthen the existing development toward more convenience, food service, catering, etc.

The trend toward increasingly small households will also affect total food consumption. In a previous study, Deaton and Paxson (1998) found that per capita demand for food decreases with increasing household size. The increasing number of small households will thus—ceteris paribus—lead to an increase in food consumption.

Another characteristic of the change in household size and composition is that the proportion of three-generation households (households with three generations) falls with economic growth, cf. Fig. 8.18.

As the figure suggests, the development is not linear, but rather asymptotic in relation to the X-axis. New examples from the USA, which lie far to the right of the figure, even indicate that there is an increasing trend. According to Pilkauskas (2018), the share of multigenerational households in the USA started to rise in the 1980s. The share of three-generation households increased from 4 to 9 percent from 1980 to 2015.

However, the overall development is smaller households and fewer three-generation households—a trend which will also affect the food market and demand and will further stimulate a trend toward more food convenience.

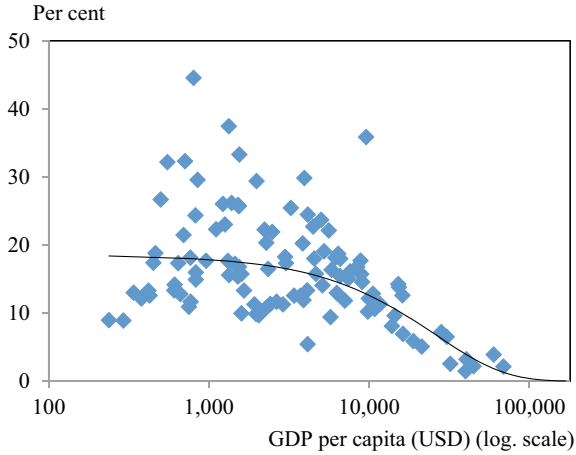


Fig. 8.18 Share of three-generation households of total households during economic growth (*Note* Three-generation households include households with three or more generations of related members. Exponential trendline included. *Source* Own calculations based on UN [n.d.] and statistical data from World Bank)

8.7 Female Labor Force

The food markets and the food value chain are affected by the fact that the proportion of women employed in the labor market outside the home increases in line with economic growth, which means that the demand for convenience, eating out, food service, catering, etc., increases. The reason is that an increasing number of meals are consumed at workplaces, etc., and that time spent in the kitchen at home declines.

The long-term change among the economically most developed countries illustrates a relatively clear trend: The number of women on the labor market increases in parallel with economic growth, cf. Fig. 8.19.

Economic development and welfare, on the one hand, and women's participation in the labor market, on the other, have a twin effect: When women play a greater role in the labor market, resources are freed up, which contributes to increasing overall economic welfare. At the same time, increasing economic welfare means that women's opportunities to enter the labor market improve: High economic welfare also means, e.g.,

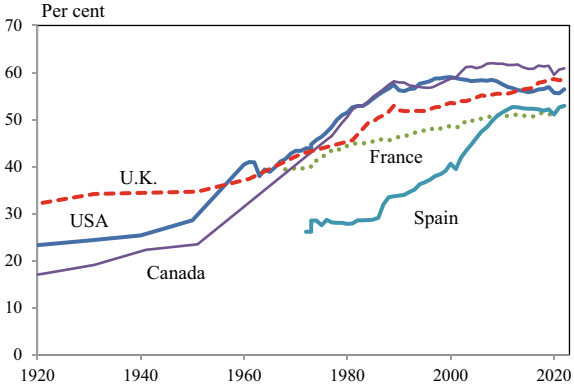


Fig. 8.19 Long-term female labor force participation rates for selected countries (*Note* The calculation of the number of women in the workforce is not completely clear. Age, part-time and full-time employment, temporary unemployment, etc., may be decisive for the calculation methods. For a more detailed explanation, refer to the sources. *Sources* Ortiz-Ospina and Tzvetkova [2017] and statistical data from World Bank)

more public services, improved education, improved gender equality, etc. In this way, the development is self-reinforcing.

However, the trend toward more women in the labor market is not completely clear. As Fig. 8.19 illustrates, in recent years, the share of women in the labor market has stagnated. A possible explanation is that there may be a certain upper threshold in terms of women's participation in the labor market, or that the economic development following the financial crisis may have had an impact.

In addition, the pattern looks somewhat different when all countries, including the least developed countries, are included in the analysis. In this case, women's participation in the labor market is highest in the poorest and in the richest countries, while it is lowest in the middle-income countries. The trend almost follows a "U" when labor market participation is plotted in relation to the countries' GDP per capita, cf. Fig. 8.20.

The first figure illustrates the share of women in the labor force, while the second figure presents the share of women in the labor force as a percentage of the participation of men in the labor force. Both graphs indicate a U-shaped trend during increasing economic growth. When

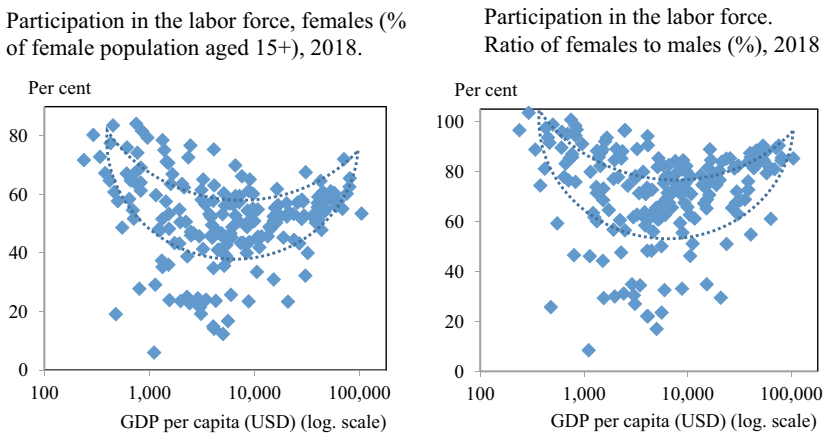


Fig. 8.20 Participation in the labor force, 2018. Ratio of Females to males (*Source* Own presentation based on statistical data from World Bank)

examining the group of countries with GDP per capita > approx. $7500, an upward trend emerges.

The conclusion is that the total number of women that participate in the workforce is influenced by economic, social and cultural factors, and the economic factor—income—may result in an increase or a decrease in the number of women participating.

8.8 Functional Foods

Functional foods (also known as nutraceuticals, food supplements or pharmafoods) are foods that have been developed or modified so that they have a scientifically documented beneficial effect on health. Therefore, foods are now playing more than just a nutritional role, cf. Fig. 8.21.

The ability to produce foods with beneficial health effects can be traced back several thousand years. Yogurt is an example of a food with such qualities. Japan has been a pioneer in developing and promoting the functional foods concept. According to Ichikawa (1994), functional food was supported by the Japanese government due to concerns about the country's aging population and the associated costs for the healthcare system. However, functional foods have also become popular in Japan for cultural, historical and philosophical reasons.

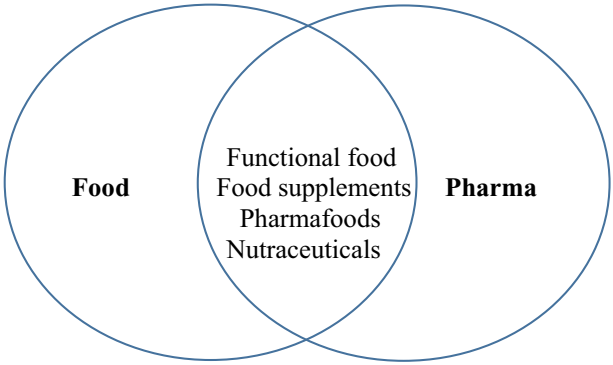


Fig. 8.21 Functional food: a combination of food and pharma (*Source* Own presentation)

Originating in Asia and Japan, the functional food wave has moved to the USA and subsequently Europe, albeit with a varying degree of success.

The following three examples of functional foods are often presented:

Probiotics are defined as live microorganisms—mostly bacteria—which confer health benefits.

Prebiotics promote the growth of bacteria that are beneficial to intestinal health and inhibit the growth of those that are potentially harmful in the large intestine.

Stanols and sterols are used to lower cholesterol levels.

Functional foods are considered to be the third generation of health foods:

The first generation started in the middle of the 1970s and consisted of healthy but also convenient foods such as fruit juice, yogurt, whole-meal bread.

The second generation came in the middle of the 1980s and was based on the concept of low-fat and low-sugar foods.

The third generation represents proper functional foods, which emerged partly as a result of technological progress within food science and partly thanks to consumer demand for foods that were beneficial to health.

One of the advantages of functional foods from a producer's point of view is that it is now easier to differentiate the products and to add

new features. New characteristics can be added to the foods, which makes them unique compared to other products on the market. The result is less price-elastic demand, which may increase both revenue and profit.

The market for functional foods is growing rapidly and in line with increasing income. Various sources have estimated and predicted the market growth:

Chrzan (2019) estimates that the global nutraceutical market will increase from $241 billion in 2019 to $373 billion in 2025, which equates to an annual average growth of 11.7 percent.

Food supplements, which are considered a subset of functional foods, also exhibit significant growth rates according to annual surveys by the Nutrition Business Journal, cf. Fig. 8.22.

Annual surveys from Asia, which in general has been home to pioneers in functional foods, still reveal high growth rates. In Korea, the number of companies in the functional food sector and total sales of functional foods are increasing significantly, cf. Fig. 8.23.

During the selected time period, total sales of functional foods on the domestic and export markets increased by, on average, 11 percent per year

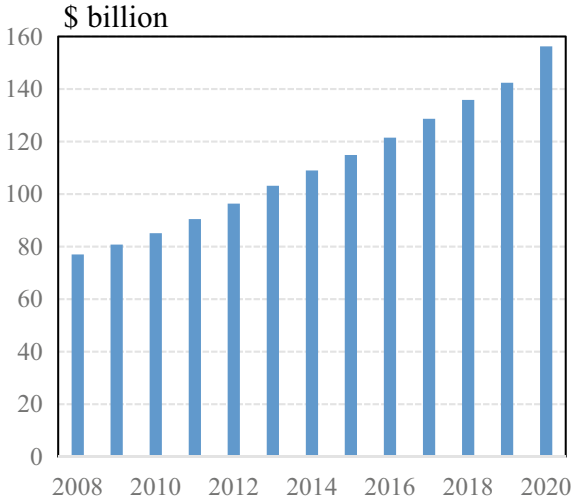


Fig. 8.22 Global market revenue for food supplements, 2008–2020 (*Source* Nutrition Business Journal [several issues])

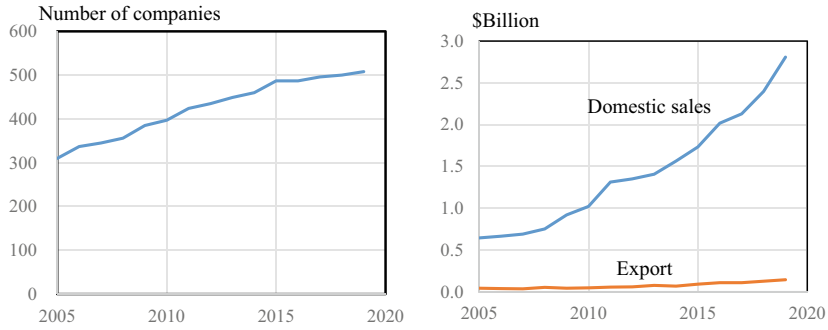


Fig. 8.23 Functional foods in Korea: Companies and sales (*Source* Ministry of Food and Drug Safety of South Korea [2021])

in Korea. Compared to total food sales, the growth rate for functional foods is significantly higher. During the same period (2005–2019), the average annual increase in expenditure on food and non-alcoholic beverages in Korea was 2 percent, so functional food is definitely a high-growth segment, which is exhibiting a rather consistent trend.

Exports account for around 5 percent of total sales, which is a remarkably high share: Korea is a significant net importer of agricultural and food products, so an export ratio of 5 percent may indicate a comparative advantage within functional foods.

The future supply and demand of functional foods is stimulated or hindered by several conditions:

- Consumer preferences for health, a healthy lifestyle, etc., will lead to increasing demand for functional foods.
- An aging population, which means that measures to ensure a healthy and active old age such as functional food are becoming more important.
- New technology and innovation will drive the market for functional foods. Enzyme technology is a potential driver of new food products that improve the health of consumers.
- Increasing health problems such as obesity and chronic lifestyle diseases resulting from the consumption of an increasing amount of processed foods, high-calorie ready meals, soft drinks and unhealthy snacks. This trend increases the demand for foods that may help to

reduce weight. Low-fat products are regarded as a sub-category of functional foods (Tudoran et al., 2012).

- Food legislation to protect consumers from misleading health claims about the benefits of functional foods, which are often made, may be an important obstacle to the increasing consumption of functional foods.

8.9 Vegans, Vegetarians and Flexitarians

There is no doubt that vegans, vegetarians and flexitarians belong to a rapidly growing population group in large parts of the world. Lifestyle, ethics, health, religion and animal welfare are among the driving forces that are pushing this change. For several reasons, it is difficult to identify the extent of these consumer trends: the segments are not clearly defined and there are several subgroups. Box 8.1 presents some definitions and delimitations.

Box 8.1 Vegans, vegetarians, flexitarians and pescatarians: definitions

Vegetarians:

Vegetarians do not eat animal meat products such as beef, pork, lamb, fish or poultry. This can also include not eating animal by-products that are processed into food. Health, ethical, religious, economic and environmental reasons are typically behind the choice to become a vegetarian.

There are several sub-types of vegetarians:

- Lacto-ovo-vegetarians exclude meat but they include eggs and dairy products.
- Lacto-vegetarians exclude meat, fish and eggs but they include dairy products.
- Ovo-vegetarians exclude meat, fish and dairy products but include eggs

Vegans:

Vegans do not consume red meat, fish, poultry, eggs, dairy products, insects, or any other animal by-products such as honey, rennet, gelatin, collagen or other types of animal protein and fats derived from animals. Veganism as an ideology and concept includes more than just the consumption of animal products. Ideally, vegans also avoid any product that directly or indirectly involves the human exploitation of animals

including leather goods, wool, silk, beeswax, cosmetics tested on animals, latex products that contain casein etc.

Flexitarians:

Flexitarians (semi-vegetarians or demi-vegetarians) mostly eat plant food, but occasionally eat meat. There is no clear definition as to how much meat a flexitarian can eat during the week. Health, animal welfare, and environmental reasons are typically behind the choice to become a flexitarian.

Pescatarian:

Pescatarians do not consume any kind of meat except fish. A pescatarian is like a vegetarian except they also eat fish and other seafood such as shrimps, mussels, salmon, crabs and lobsters.

In addition, there is a number of minor and more or less associated consumer segments based on political or ideological attitudes. A group of consumers prefers unprocessed or less processed food attempting to obtain a more simplistic or a healthier lifestyle. Another segment searches for originality in an attempt to get back to basics.

Source Based on McRae (2019)

The segment "flexitarians" in particular is difficult to quantify as the definitions are imprecise and fluid. The foods cannot be directly linked to the individual segments either as plant-based foods are consumed by all types of consumers—more or less. If the size and development of the market is to be quantified, it is necessary to start by examining the consumers rather than the products.

Several authors have attempted to estimate the size of the vegan/vegetarian consumer segment. According to Euromonitor International (2020), consumers following strict vegan or vegetarian diets represent a small group of the population, whereas those restricting their intake of animal-based foods accounted for over 40 percent of global consumers in 2020, which indicates that flexitarians are driving the plant-based trend.

Buchholz (2022a) notes that vegetarianism is increasing gradually in several developed economies around the world such as Europe and the USA. However, vegetarianism is in decline in other parts of the world, e.g., India, where traditional vegetarian diets are being increasingly substituted by an omnivorous approach to eating. While in 2018/19, around a third of urban Indians said they were vegetarians, only about a quarter gave the same answer in 2021/22. Vegetarianism is also declining in China.

Figure 8.24 presents the change in the number of vegetarians in selected countries as a function of the average income per capita.

The figure illustrates a fairly clear correlation: Relatively few vegetarians in low-income countries and a relatively high number in high-income countries.

In several low-income or middle-income countries, increasing income will mean increasing demand for animal-based food. Demand for such products is income elastic in these countries. Consuming animal-based food is a welfare good.

In high-income countries, the demand for plant-based food is increasing due to other driving forces such as lifestyle, health, animal welfare and climate considerations. Different drivers in countries with varying levels of income lead to diverse demand patterns.

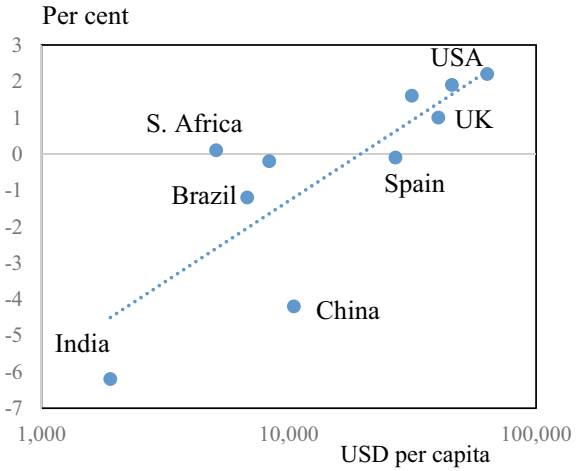


Fig. 8.24 Change in number of respondents who said they followed a vegetarian diet (2018/19–2021/22) (*Note* Change in percent points. *Source* Own presentation based on Buchholz (2022a, 2022b))

8.10 Responsible Consumption and the Political Consumer

Responsible consumption means that buyers (private individuals, public institutions or private companies) of both goods and services make decisions regarding their consumption that take into account the impacts on the environment. The profile of responsible consumption has increased recently as it is one of the UN's Sustainable Development Goals (SDGs). SDG 12 is titled "responsible consumption and production", and food plays an important role in this connection. The FAO (2011) supports SDG 12 by highlighting the fact that food loss and food waste are responsible for a major share of global greenhouse gas emissions.

Political consumerism refers to the deliberate purchase or avoidance of products, goods or services for political reasons. A political consumer is characterized by having specific consumer preferences that are not directly related to the fulfillment of basic personal needs.

A political consumer expresses conscious attitudes or values which are socially oriented when choosing producers or products. Demand is often based on the consumer's political position. In the 1980s and 1990s, the typical political consumer was left-wing, well-educated and had very clear opinions and attitudes on many issues. Subsequently, political consumers have become more broadly represented in terms of political beliefs and social classes. Political consumption was first recognized as a form of political participation in the mid-1990s in connection with the Brent Spar campaign against Shell.

According to Micheletti and Boström (2014), there are four types of political consumerism:

Boycotts (or negative shopping decisions) are defined as a deliberate choice not to purchase a commodity, brand, or even a good from a particular country.

Buycott (or positive purchasing decisions) is the practice of deliberately purchasing certain goods over others. The goods are typically preferred because they are more environmentally friendly, ethically superior, etc. Buycotted goods may also be preferred because of better conditions for workers or because they are healthier.

Discursive political consumerism does not directly include consumption but is more an attempt to influence public opinion.

Finally, lifestyle politics is defined by de Moor (2017) as "the politicization of everyday life, including ethical, moral or politically inspired

decisions". Lifestyle politics means that everyday decisions are considered political statements. Vegans may fall into this category. Downsizers (buying less, used goods and green products) and freegans (collecting food waste from waste containers, etc.) may belong to this category. Freegans are often critical of the conventional food sector.

There are several examples of political consumerism in relation to the food sector including:

- The consumer boycott of French goods, especially wine, in protest against French nuclear testing.
- In 2005, a Danish newspaper published 12 cartoons of the Prophet Muhammad, which led to strong reactions within Islamic countries followed by a boycott in most Arab countries to which Denmark had significant exports of mainly dairy products, but also meat and other products.
- Animal welfare: Consumers actively boycotting (negative shopping decisions) products due to poor animal welfare, e.g., cage eggs, fur garments, etc., which is a global phenomenon.
- Preferences for organic food are driven by considerations regarding the environment, animal welfare and health.
- Climate change has created a whole new segment of political consumerism. People are changing their consumption habits and preferences in order to reduce their climate impact. Demand for oat milk, soy milk and in general more plant-based food and less animal-based food are examples of political consumerism resulting from climate change.

Several factors indicate that the prevalence of responsible consumption and the political consumer will increase in the future, although the number of empirical and international studies is limited:

Precise comparisons between countries are difficult as the motives, scope and significance may vary greatly between countries and cases. In addition, it is difficult to quantify and calculate political consumerism. Calculation may be based on people's perceptions of and attitudes toward companies, products or countries, but this always involves a certain degree of uncertainty.

Despite these difficulties, Copeland and Boulianne (2022) have collected and compared data, which is included in Fig. 8.25, from various studies.

The figure includes data on various forms of political consumerism as a percent of total population.

The prevalence of political consumerism is presented in relation to the countries' average income per capita. As can be seen, there is a clear correlation between political consumerism and income per capita. With increasing income, increasing political consumerism can be expected.

This is also in line with the analysis by Copeland and Boulianne (2022), who find that high income and high education are associated with increased participation in political consumerism.

Animal welfare is one of the issues behind political consumerism. The authors of a study on animal welfare labelling in Europe mapped and assessed consumers' awareness of animal welfare standards and their demand for additional information (European Commission, 2022). Data from this mapping can be used to indicate a possible trend regarding political consumerism, assuming that the level of awareness is correlated with—or is a proxy for—political consumerism. As Fig. 8.26 illustrates,

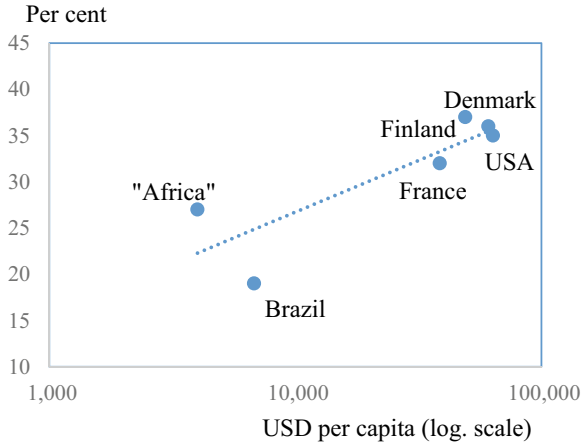


Fig. 8.25 Prevalence of political consumerism in selected countries/regions and level of income (*Source* Own presentation based on Copeland and Boulianne [2022] and statistical data from World Bank)

the average level of awareness across member states is correlated with the countries' income per capita.

As can be seen, the level of awareness of animal welfare standards increases with increasing income. Assuming that, in general, incomes and economic welfare will increase in the world, interest in political consumerism can also be expected to increase.

Finally, several additional indicators also suggest that political consumerism is on the increase globally and can be considered a mega-trend: Corporate Social Responsibility (CSR) is increasing in importance and is a proxy for political consumerism. Furthermore, the stakeholder value trend is also in a parallel context and development with political consumerism.

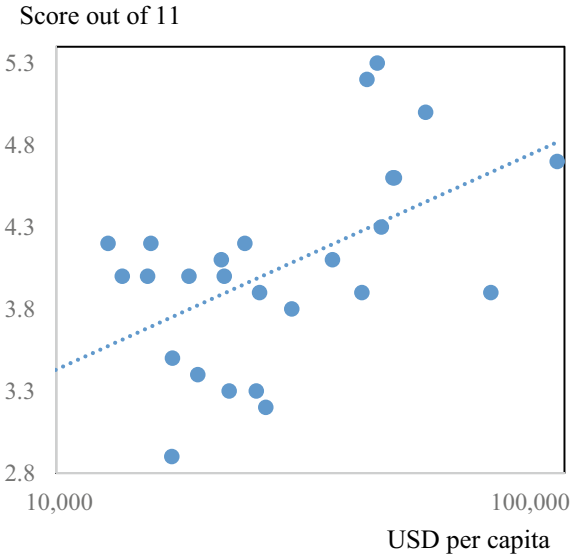


Fig. 8.26 Average level of awareness of animal farming practices in EU member states (score out of 11) (*Source* Own presentation based on European Commission [2022] and statistical data from World Bank)

8.11 Differentiation and Segmentation

At the global level, the nature of the food industry is changing as it is moving away from mass production and mass marketing toward greater segmentation and an orientation toward niche markets.

Differentiation (or product differentiation) involves distinguishing a product or service from the others on the market. By differentiating their products, companies can offer something which is different to the other products or services and which is more attractive to a particular target market.

Segmentation (or market segmentation) involves dividing the marketplace into smaller categories, or segments, which are definable, homogeneous and share similar characteristics.

The principle behind increased differentiation and segmentation in the agri-food value chain is outlined in Fig. 8.27.

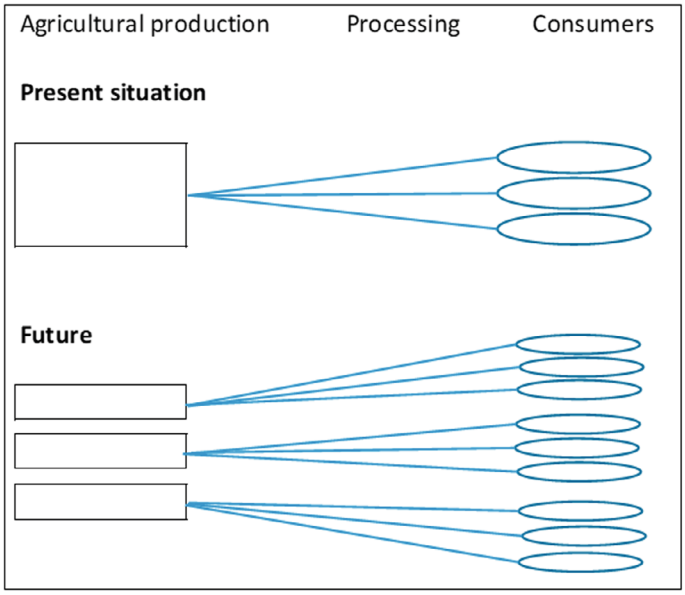


Fig. 8.27 From mass production to segmentation in the agri-food value chain (*Source* Own production)

As the figure illustrates, several individual consumer segments are identified. The raw material basis is basically the same, but in order to be able to separate the segments and differentiate the products down to the consumer level, the raw materials must also be differentiated to a certain extent.

The potential benefits of differentiation and segmentation are not unlimited, and the trend is also limited in scope. Endless growth is by no means guaranteed as the following prerequisites must be met:

- Real demand and a market must exist for the differentiated product or it must be possible to create them, while a willingness to pay for the product among consumers must also be present.
- The processing and logistics functions must be able to manage and separate the products, which may require a larger setup including traceability and control.
- Market access is also a crucial prerequisite. Some supermarkets may prefer to limit the assortment or to protect their own private labels, and thereby limiting access to new or more differentiated products.
- It must be possible to differentiate the raw materials, so that there are documentable differences.

The scope and meaning of differentiation and segmentation change over time. We are currently in a period of increasing differentiation and segmentation, but the development in the past was characterized by phases or waves:

In the first phase—until around the 1970s—production was locally oriented. Local or national markets were limited and opportunities for economies of scale were also relatively limited. Food was primarily produced for and distributed to segments in close proximity to the site of production.

In the next wave, local production and local markets were replaced by mass-produced products for mass markets. This shift was driven by increasing globalization, which included the expansion of national retail stores, efficient global value chains and generally increasing international trade, as well as the utilization of economies of scale and the international spread of mass media. Offshoring and outsourcing also often requires some degree of standardization and mass production to secure the full benefits. Mass production means that companies decide to ignore

differences in market segments and target the entire market with one product.

In the third wave, which has been especially widespread in this century, mass production and mass markets have gradually been replaced by, or supplemented by, differentiation, niches and segmentation. Unlike previously, segmentation can now be cross-border. New technology has made it possible and relatively inexpensive to produce small quantities, while production equipment has become more flexible, so that it can meet specific requirements. At the same time, many additional individual consumer preferences have emerged, while the mainstream preference has declined in importance. Consumers are demanding niche brands and products that meet their distinct personal, cultural and situational requirements, thereby solving personal needs. Consumers will pay a higher price for products that have been created specifically for them.

The increase in differentiation and segmentation and the underlying driving forces are outlined in Fig. 8.28.

When companies pursue a differentiation and segmentation strategy, the aim is often to move from a market with strong price competition, cannibalism and relatively low market growth to a market with reduced price sensitivity and price competition, higher market growth and reduced mass marketing. This means that a company aims to move from an existing red ocean market, which is characterized by many competitors, to a blue ocean market with no competitors via what is known as a Blue Ocean Strategy.

The aim of the Blue Ocean Strategy is to make the company unique on the market (Kim & Mauborgne, 2005). Instead of focusing on the traditional competitive parameters such as price, Blue Ocean companies seek to create market advantages through creativity and innovation, so that they become a "big fish in a small pond".

The Blue Ocean Strategy may be a source of significant inspiration for many food companies as agricultural and food products often belong to a homogeneous group, where product differentiation and innovation is limited and price is an important competitive parameter.

Such strategic shifts from mass production to differentiation and segmentation are difficult to quantify, although examples can be used to illustrate the development:

The market for specialty beer, which is basically differentiated beer, has increased very significantly in recent years, and clear global trends can be

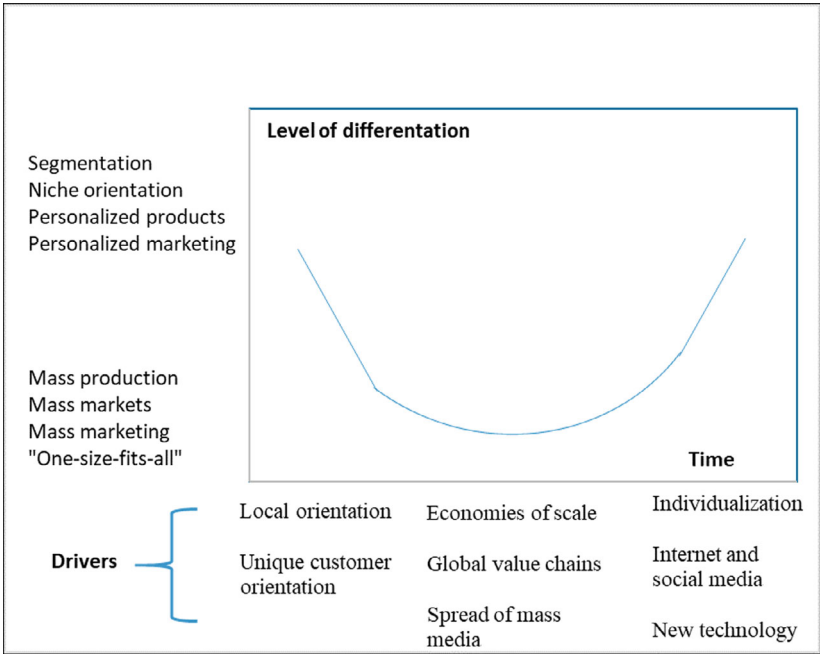


Fig. 8.28 Differentiation and segmentation: trends and drivers (*Source* Own presentation)

identified. As an example, Fig. 8.29 presents the number of new Danish beers launched on the Danish market since the beginning of the 2000s.

Furthermore, the number of microbreweries has also been increasing for a long time, cf. Fig. 8.30.

The changes witnessed in the brewing sector in recent years are very different from the general trend, which is characterized by consolidation and thus fewer companies. The increase can only be explained by the establishment of new microbreweries.

The competitiveness of microbreweries is closely linked to their production of specialty beer. From the beginning, specialty beer was considered to be differentiated because both the product and the brewery were different. The beer was not mainstream, and it was typically produced by a microbrewery with an alternative narrative.

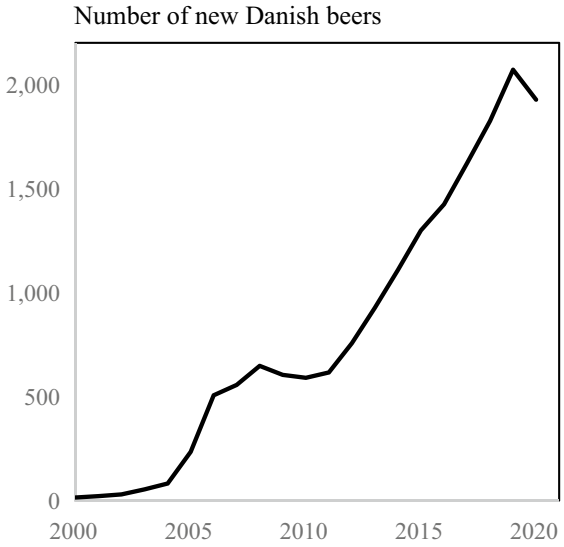
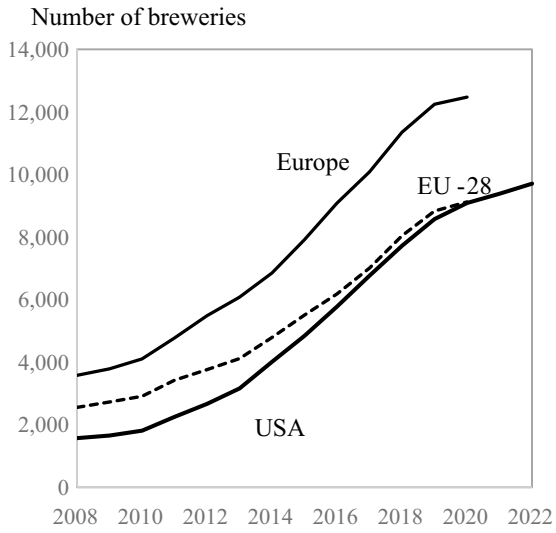


Fig. 8.29 Number of new Danish beers launched in Denmark, 2000–2023 (*Sources* Own presentations based on information from Danish Brewers' Association)

Fig. 8.30 Number of breweries in Europe, EU-28 and the USA (*Sources* Own presentations based on The Brewers of Europe [n.d.] and Brewers Association [n.d.])



8.12 Discount

Consumers' preference for cheap food manifests itself in several ways. For example, the growing prevalence of discount stores is a clear result of consumers' price awareness and demand for cheap food.

A discount store is simply a store that sells products at lower prices than normal. Furthermore the range of products offered, the level of service, the shopping experience, location, etc., also differ to that offered by more traditional retail outlets. However, in recent decades, the difference between discount stores and other retail stores has decreased. Discount stores may have widened their range and upgraded their store facilities.

The long-term trend toward an increase in the number of discount stores began to gain traction in the 1990s, especially in Germany with the Aldi and Lidl brands. The winning formula back then was to offer low prices on a targeted range of mostly private label products. During and after the financial crisis in 2008, discount stores again gained momentum.

Once the financial crisis and economic recessions were over and purchasing power had increased, the demand for food became less price elastic, which meant that discount stores' market share was under threat. Their response was to upgrade their stores with a broader range of products of higher quality and improve the shopping experience. The previous hard discount philosophy was in many cases redefined without reducing the price difference.

The result was that, in the 2000s, discount stores gained significant market shares in many Western countries, cf. Fig. 8.31.

The figure illustrates significant increases in market shares during the period. However, there are large differences between the countries, and both waves and trends characterize the changes in this period.

The longer-term trends and waves are made clarified in Fig. 8.32.

The figure presents market shares for discount stores in several countries, which are positioned in relation to the share (percent) of total square footage of sales area controlled by discounters. The countries can be divided into three groups: nascent, expanding and mature.

In some countries, the market share is 40–50 percent, and here the markets are apparently saturated. Other countries are in a phase of expansion with a rapidly increasing market share. Finally, there is a group in which the market share is relatively small—typically below 15 percent. In this group, the probability of expansion in the future is high assuming that the normal global pattern is followed.

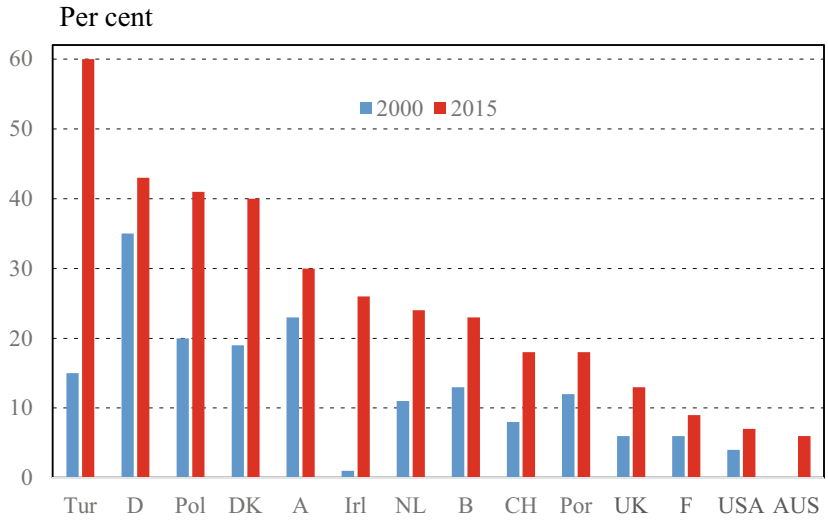


Fig. 8.31 Market shares for discount stores 2000 and 2015 in selected countries (*Source* Own presentation based on information from Boston Consulting Group [BCG])

From 2015 onwards, the development seems to continue. While there are large differences in the growth rates between countries and between continents, discount stores are increasing their global market share (Hodgson, 2019). The continued growth of discount stores is presented in Fig. 8.33.

Figure 8.33 is based on data from the world's top 250 retailers of which approx. 90 are termed super/hypermarkets and 20 are discount stores. The figure shows that the average annual growth between 2015 and 2020 was almost twice as high for discount stores as it was for super/hypermarkets. Discount stores' relatively rapid growth and increasing market share has occurred in a period of relatively favorable economic conditions. This suggests that purchasing power and economic conditions are not the only driving forces behind the growth of discount stores.

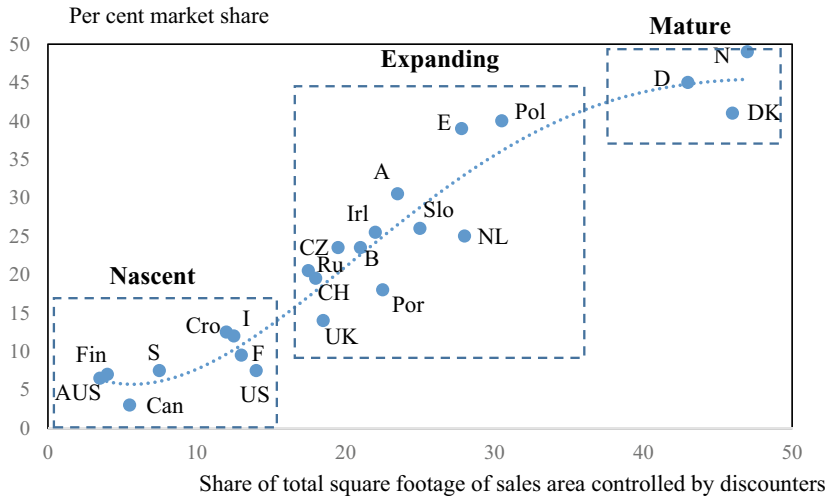


Fig. 8.32 Market shares for discount stores in 2000 and 2015 in selected countries (*Note* 4. order polynomial trend curve included. *Source* Own presentation based on information from Boston Consulting Group [BCG])

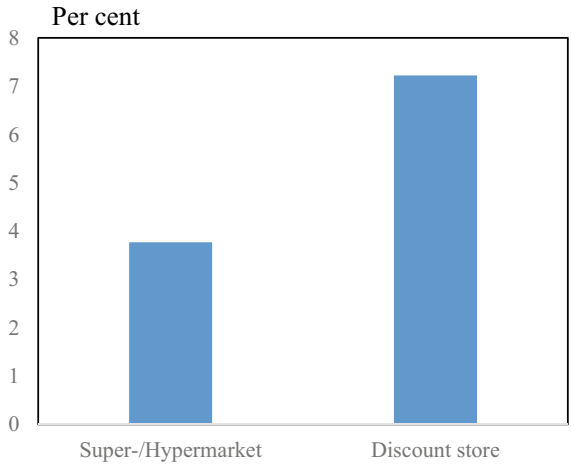


Fig. 8.33 FY2015–2020 retail revenue CAGR among 250 largest retail stores in the world (*Note* CAGR: Compound annual growth rate. *Source* Own calculations based on Deloitte [several issues])

References

Brewers Association. (n.d.). *National beer sales & production data*. Retrieved February 13, 2024, from https://www.brewersassociation.org/statistics-and-data/national-beer-stats/

Buchholz, K. (2022a). *Here's how attitudes to vegetarianism are changing around the world*. https://www.weforum.org/agenda/2022/11/vegetarianism-rise-fall-world-chart/

Buchholz, K. (2022b). *The rise (or fall?) of vegetarianism*. https://www.statista.com/chart/28584/gcs-vegetarianism-countries-timeline/

Cawthray, B., & Murphy, P. (n.d.). *COVID-19: More eating at home, but pressures on the personal care category*. https://www.kantar.com/inspiration/coronavirus/covid-19-more-eating-at-home-but-pressures-on-the-personal-care-category

Chrzan, J. (2019). *The global market for nutraceuticals set for robust growth*. https://www.healthcarepackaging.com/markets/neutraceuticals-functional/article/13296428/the-global-market-for-nutraceuticals-set-for-robust-growth

Copeland, L., & Boulianne, S. (2022). Political consumerism: A meta-analysis. *International Political Science Review, 43*(1), 3–18. https://doi.org/10.1177/0192512120905048

de Moor, J. (2017). Lifestyle politics and the concept of political participation. *Acta Politica, 52*, 179–197. https://doi.org/10.1057/ap.2015.27

Deaton, A., & Paxson, C. (1998). Economies of scale, household size, and the demand for food. *Journal of Political Economy, 106*(5), 897–930. https://doi.org/10.1086/250035

DMR. (n.d.). *McDonald's statistics and facts for 2024*. Retrieved February 13, 2024, from https://expandedramblings.com/index.php/mcdonalds-statistics/

Euromonitor International. (2020). *The rise of vegan and vegetarian food*. https://www.euromonitor.com/the-rise-of-vegan-and-vegetarian-food/report

European Commission. (2022). *Study on animal welfare labelling: Final report*. Publications Office of the European Union. https://doi.org/10.2875/676603

FAO & The World Bank. (2018). *Food data collection in household consumption and expenditure surveys: Guidelines for low and middle-income countries*. LSMS Guidebook April 2019. https://openknowledge.worldbank.org/bitstream/handle/10986/32503/ca1561en.pdf?sequence=4&isAllowed=y

Hodgson, A. (2019). *Megatrend: Middle class retreat*. https://www.euromonitor.com/video/megatrends-middle-class-retreat

Ichikawa, T. (1994). Functional foods in Japan. In I. Goldberg (Ed.), *Functional foods: Designer foods, pharmafoods, nutraceuticals* (pp. 453–467). Springer.

Kim, W. C., & Mauborgne, R. (2005). *Blue ocean strategy: How to create uncontested market space and make the competition irrelevant*. Harvard Business School Press.

Kirkova, D. (2013). *Time-poor Britons spend just 38 minutes cooking dinner... but Sunday roast is STILL the nation's favourite dish*. https://www.dailymail.co.uk/femail/article-2372431/Time-poor-Britons-spend-just-38-minutes-cooking-dinner-today-compared-hour-half-1960s.html

McRae, L. (2019). *Vegan, vegetarian, pescatarian, flexitarian and macrobiotic diets—What's the difference?* https://www.northshore.org/healthy-you/vegan-flexitarian

Micheletti, M., & Boström, M. (2014). Political consumerism: Consumer choice, information, and labeling. In P. B. Thompson & D. M. Kaplan (Eds.), *Encyclopedia of food and agricultural ethics* (pp. 1508–1515). Springer. https://doi.org/10.1007/978-94-007-0929-4_244

Ministry of Food and Drug Safety of South Korea. (2021). *Functional food production status*.

OECD. (2011). *Society at a glance 2011*. In *OECD social indicators*. OECD Publishing. https://doi.org/10.1787/soc_glance-2011-en

OECD and FAO. (2022). *OECD-FAO agricultural outlook 2022–2031*. OECD Publishing. https://doi.org/10.1787/f1b0b29c-en

Ortiz-Ospina, E., & Tzvetkova, S. (2017). *Working women: Key facts and trends in female labor force participation*. https://ourworldindata.org/female-labor-force-participation-key-facts

Pilkauskas, N. (2018). What's behind the dramatic rise in 3-generation households? *The Conversation*. https://theconversation.com/whats-behind-the-dramatic-rise-in-3-generation-households-104523

ReferenceForBusiness. (n.d.). *Burger King Corporation—Company profile, information, business description, history, background information on Burger King Corporation*. Retrieved February 13, 2024, from https://www.referenceforbusiness.com/history2/18/Burger-King-Corporation.html

The Brewers of Europe. (n.d.). *Beer trends/key figures*. Retrieved February 13, 2024, from https://brewersofeurope.org/eu-beer-trends/european-union/

Tudoran, A. A., Fischer, A. R., van Trijp, H. C., Grunert, K., Krystallis, A., & Esbjerg, L. (2012). *Overview of consumer trends in food industry*. RECAPT—Retailer and Consumer Acceptance of Promising Novel Technologies and Collaborative Innovation Management. https://pure.au.dk/ws/files/70401792/Overview_of_Consumer_Trends_in_Food_Industry.pdf

UBS. (2018). *Is the kitchen dead?* https://www.youtube.com/watch?v=1jixPRfafkc

UN. (n.d.). *Household size and composition—Database on household size and composition 2022*. https://www.un.org/development/desa/pd/data/household-size-and-composition

CHAPTER 9

Resources

9.1 Introduction

Agricultural and food production is fundamentally about exploiting natural resources. Therefore, conserving and renewing natural resources is largely in the interests of agriculture. Natural resources are natural assets (raw materials) that can be used for production or consumption.

Land, water and fertilizer are important natural resources in agriculture. Other resources such as technology, R&D, labor and other human resources are also important—and are perhaps becoming increasingly important.

Resource utilization in agriculture is especially important now and will continue to be in the future due to the scarcity of natural resources, which is why the bioeconomy, which involves using renewable natural resources, is high on the agenda.

Agricultural and food production utilize a large part of the world's total natural resources, cf. Table 9.1.

The table shows that the use of resources in agriculture varies significantly from input to input. When it comes to the use of capital in agriculture, it is relatively small compared to all sectors. However, with regard to natural resources, the share is much larger: Agriculture uses a relatively large share of the world's land and water, and also a relatively large share of the population is employed in agriculture or lives in rural areas.

H. O. Hansen, *Megatrends in Agriculture, Food Industry and Food Markets*, Palgrave Advances in Bioeconomy: Economics and Policies, https://doi.org/10.1007/978-3-031-58152-6_9

Table 9.1 Inputs and resources in global agriculture

Resource	*%*
Agricultural land, share of total land	36
Arable land, share of total land	11
Crop land, share of total land	12
Agricultural freshwater withdrawal, share of total	72
Employment in agriculture, forestry and fishing: Share of total employment	27
Rural population, share of total	43
Agriculture share of government expenditure	2.2
Credit to agriculture, forestry and fishing, share of total	2.4
Gross fixed capital formation (agr., forestry and fishing), share of total	2.6

Note 2021 or recent year with available information
Source Own calculations based on statistical data from FAO

9.2 Agricultural Land

Agricultural land is a crucial input in agriculture, the food chain and the entire food supply. Even if agricultural land is farmed even more intensively and vertical farming, artificial foods, etc., make agricultural land less essential, arable agricultural land will still be a crucial input and resource. Agricultural land is a scarce resource.

For many decades, growth in the global population has far outpaced the increase in agricultural land, which means that agricultural land per capita has been declining continuously, cf. Fig. 9.1.

As can be seen, agricultural land is becoming an increasingly scarce resource worldwide. This is primarily the case in the developing countries, where population growth is greatest. In 2050, only 0.1 ha of agricultural land is expected to be available per capita.

Furthermore, the developed countries will have 3–4 times as much agricultural land available per capita as the less developed countries. From a resource perspective—with agricultural land as a crucial resource—the developed countries have the best comparative advantages in terms of producing agricultural products. Consequently, the developed countries will continue to play a significant role in the production and export of agricultural and food products to the world's growing population assuming that the less developed countries are able to create competitive businesses and thereby sufficient income to buy and import the food.

The projection of the agricultural land per capita in Fig. 9.1 is based on the assumption that the total amount of agricultural land will not change

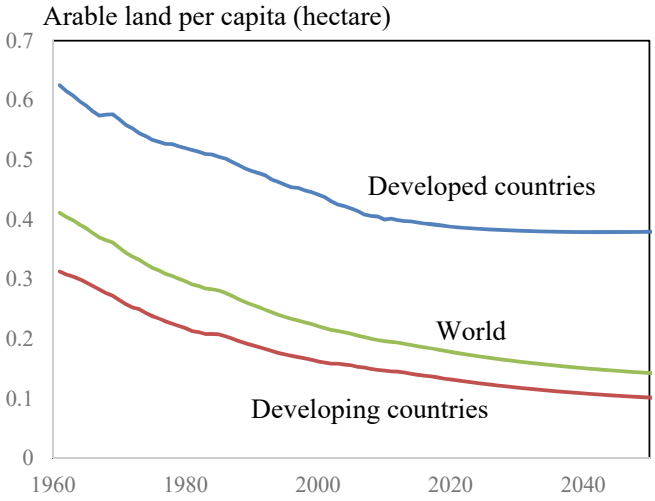


Fig. 9.1 Agricultural land per capita in selected regions (*Note* Developed countries: USA, Canada, Japan, Australia, New Zealand, Republic of Korea, EU-27, Norway, Switzerland, Iceland, the UK, the former Yugoslavian republics, Russia and the former Soviet republics. Developing countries: Rest. Predictions according to the source. *Source* Own calculations based on statistical data from FAO)

significantly in the coming decades. However, at the global scale, it is still possible to increase the area of agricultural land. To date, the net expansion has been relatively modest. Indeed, since the beginning of the 1960s, the world's total area of agricultural land has only increased by just under 7 percent. In the same period, global agricultural production has increased by 260 percent, and the population by almost 150 percent. cf. Fig. 9.2.

The figure illustrates that increasing productivity rather than an expansion of the agricultural area is the most important source of increased agricultural production.

Taking into account future demand for land for urban development, forests, infrastructure, climate protection, etc., and the lower value and suitability of new agricultural land, etc., FAO (2009) estimates that the total area of agricultural land will only have expanded by 5 percent by 2050. This figure is based on a projected increase of 120 million

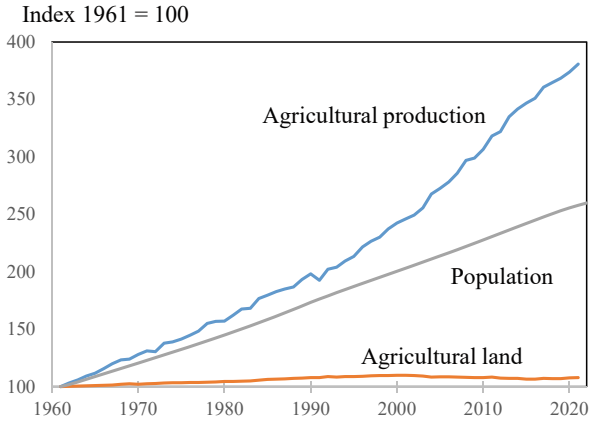


Fig. 9.2 Global agricultural land, agricultural production and population 1961–2021 (*Source* Own calculations based on statistical data from FAO)

hectares in the developing countries and a projected decrease of 50 million hectares in the developed countries. Expanding the agricultural area is thus not the only solution to the problem of feeding a growing global population. Increasing production on existing agricultural land is necessary, which demands a greater focus on resource utilization and increasing productivity.

The rather modest increase in the total area of agricultural land is in part due to the fact that some agricultural land must be completely or partially abandoned every year as a result of erosion, salt accumulation, desertification, etc., which means it can no longer be used for agricultural production. Such degradation reduces soil fertility and thus potential agricultural yields. However, in some cases, the fertility of the soil can be restored, so that several degrees of degradation can be identified.

Agricultural land is becoming an increasingly scarce resource due to the increasing global population, the fact that an increasing amount of agricultural land is being taken out of production to be used for other purposes, and because agricultural land is being seriously degraded in several parts of the world, particularly Asia and Africa.

UNCCD (2022) estimates that between 20 and 40 percent of the global land area has been degraded to a certain extent. If business as usual continues, the UNCCD projects that an additional area almost the size

of South America will be degraded by 2050. UNCCD (2022) also has a restoration scenario assuming the restoration of around 5 billion hectares (35 percent of the global land area). It is estimated that up to 12 million hectares of agricultural land are lost annually due to degradation.

Desertification is projected to increase across the world due to climate change. Droughts, climate change, land degradation and desertification are closely interrelated.

According to Braimoh (2015), every year, 12 million hectares of land are lost because of desertification and drought. Desertification could displace up to 135 million people by 2045, and degradation could also reduce global food production by up to 12 percent and push world food prices up by 30 percent.

According to IPBES (2018), by 2050, land degradation and climate change will have reduced crop yields by an average of 10 percent globally, and by up to 50 percent in certain regions. Furthermore, desertification is currently affecting more than 2.7 billion people.

The Sustainable Development Goals (SDGs) include the protection of the resource of agricultural land. Target 15.3 ("Life on Land") states the following: "by 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought, and floods, and strive to achieve a land degradation-neutral world" (UNDP, n.d.). This quote illustrates that the UN is taking the problem seriously and has taken concrete steps.

9.3 Water Resources—A Limiting Factor

Like agricultural land, water is a crucial input in agriculture and food production. With a growing population, increasing incomes and the more frequent occurrence of problems connected to climate change—all indisputable megatrends—securing access to sufficient water resources represents a serious challenge.

This challenge has been emphasized in several studies:

- In 2019, the World Economic Forum identified water crises as one of the largest global risks in terms of their potential negative impact in the coming decade. Water crises were defined as "a significant decline in the available quality and quantity of fresh water, resulting in harmful effects on human health and/or economic activity" (World Economic Forum, 2019).

- OECD (2021) emphasizes the fact that agriculture is in part responsible for water crises as, globally, farming accounts for more than 70 percent of all water withdrawals and up to 95 percent in some developing countries.
- OECD (2017) has a clear key message: due to a combination of climate constraints, current water uses, and increasing competition for water, it is predicted that, in many regions, agriculture will face multiple water risks that could negatively affect local, regional and global food production and food security. Water shortages, excessive water and water quality deterioration are projected to increase in some regions and will have an impact on agriculture production.
- 3.2 billion people live in agricultural areas with high to very high water shortages or scarcity of whom 1.2 billion people—roughly one-sixth of the world's population—live in severely water-constrained agricultural areas (FAO, 2020).
- According to FAO (n.d.), water use grew globally at more than twice the rate of population increase in the last century, and an increasing number of regions are reaching the limit at which water services can be sustainably delivered, especially in arid regions.
- Liu et al. (2022) emphasize that climate change is projected to have negative effects on water availability and will, consequently, seriously constrain food production in many areas of the world. More specifically, their study concludes that agricultural water scarcity will have intensified in more than 80 percent of global croplands by 2050.
- According to OECD (n.d.), climate change is projected to increase the fluctuations in precipitation and surface water supplies, reduce the size of snow packs and glaciers and affect the water requirements of crops.

As discussed, agriculture is the dominant user of water in the world, but several other users of water are important including:

- Industry
- Hydropower
- Municipalities (water provided by public networks mainly to households but also other urban services including stores, markets, tourism centers, and urban industry)
- Fishing (sports fishing in rivers, etc.)

- Nature (preservation or restoration of natural water courses).

The competition for access to water is likely to intensify in the future: Agriculture must significantly improve growing conditions in order to meet the demand for increasing productivity and crop yields. Industry is growing more rapidly than agriculture, and thus their relative share of water consumption will also increase—ceteris paribus. Hydropower is a fossil-free form of energy that can be stored for a short period and is valuable. Municipal water is becoming a more important resource and competitive factor during the countries' economic growth. Finally, sports fishing and interest in protecting the aquatic environment also gain increasing importance during economic growth.

Further visible evidence of the increasing competition for water sources is "water grabbing", which refers to situations in which powerful actors take control of or reallocate water resources for their benefit at the expense of previously (un)registered local users or the ecosystems on which those users' livelihoods are based (Hands off the Land Alliance, 2014). It involves the capturing of the decision-making power around water including the power to decide how the water resources are used now and in the future. Several studies have shown that water grabbing is occurring more frequently, cf. for example Rulli et al. (2013), and Dell'Angelo et al. (2018).

As mentioned above, because yields in agriculture must be almost doubled in the next 50 years to keep up with demand, the growth conditions (sun, nutrition, plant breeding and not least water) must be continually improved. Having access to sufficient water resources is considered to be a critical factor for food supply and food security in the future.

According to World Bank (2022), irrigated agriculture represents 20 percent of the total cultivated land and contributes 40 percent of the total food produced globally. On average, irrigated agriculture is at least twice as productive per unit of land as rainfed agriculture, which highlights the important role it plays in world food production.

The fact that water is becoming an increasingly scarce resource and, therefore, a limiting factor on production is both a megatrend and the result of several megatrends, above all increasing population.

For decades, agriculture and agricultural production globally has accounted for a declining share of total production and added value.

However, agriculture is still responsible for more than 70 percent of all water withdrawals, cf. Fig. 9.3.

In 2020, agriculture accounted for 72 percent of all water withdrawals, municipalities were responsible for 16 percent for households and services, while the share for industries was 12 percent (UN-Water, 2021). The long-term trend shows that global water withdrawals increased more rapidly than the growth in the world population. However, the figure also reveals that the growth in water withdrawals has slowed down in recent decades.

Figure 9.4 presents another example of global water scarcity.

Renewable internal freshwater resource flows refer to internal renewable resources (internal river flows and groundwater from rainfall) in the country. As can be seen, there is a clear trend toward decreasing fresh water resources per capita.

Irrigation in agriculture is the largest user of water, but it is also an important contributor to food production and food security. Globally, irrigation has increased annually during the last half century, cf. Fig. 9.5.

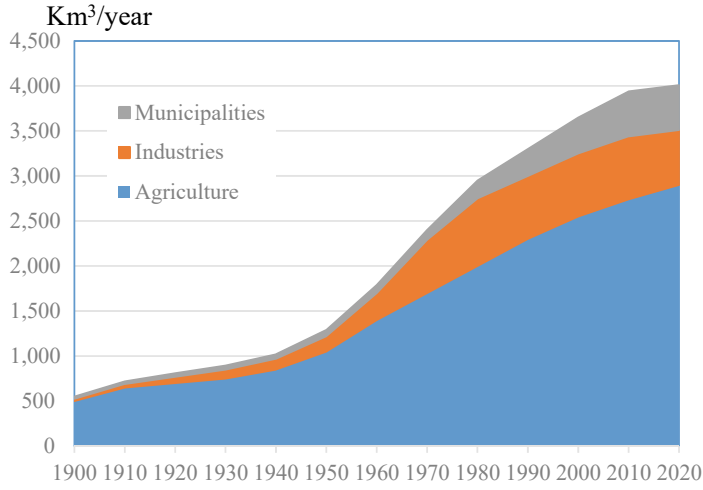


Fig. 9.3 Global water withdrawals for agriculture, industries and municipalities, 1900–2020 (*Source* Own presentation based on UNESCO [2020], UN-Water [2021], and statistical data from FAO and World Bank)

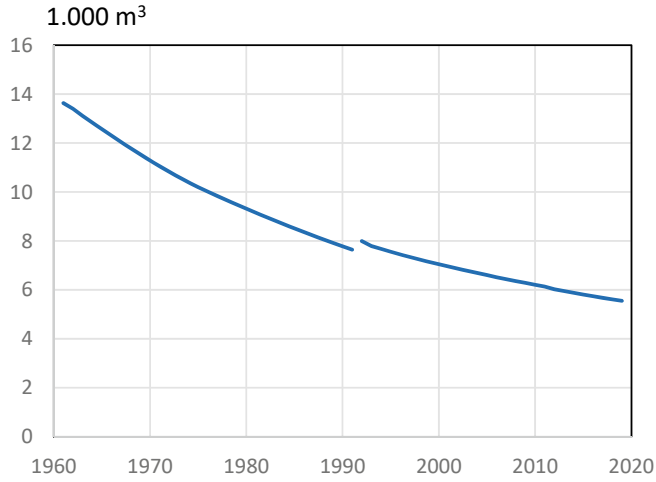


Fig. 9.4 Global renewable internal freshwater resources per capita (*Source* Own presentation based on statistical data from World Bank)

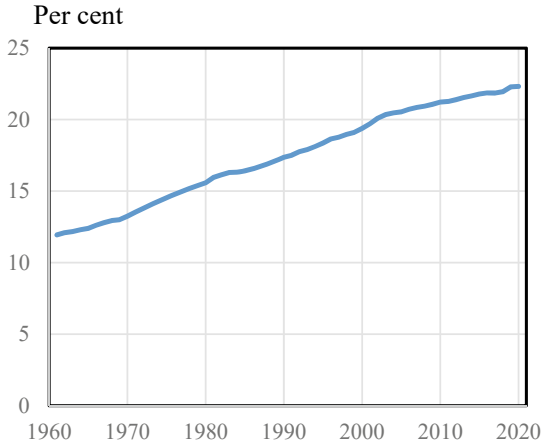


Fig. 9.5 Total irrigated land area as a share of total cropland, 1961–2020 (*Source* Own calculations and presentation based on statistical data from FAO)

Since the beginning of the 1960s, there has been an average annual increase in irrigated land of 1.3 percent. Due to increasing water scarcity, it is clear that the rate of increase in the amount of irrigated land that

the world has witnessed in the last 50 years cannot continue into the future. The result of growing water scarcity is both increased competition for water and reduced potential to increase global agricultural and food production.

9.4 Capital-Labor Substitution

The input factors in agriculture change over time in parallel with economic growth. Input factors usually include many different inputs such as labor, capital (including investments in buildings, land, machinery, livestock, etc.), fertilizer, seed, pesticides and management. An important and persistent characteristic is that capital replaces labor: Mechanization is increasing with machines such as tractors and combines largely replacing labor.

While the size of the labor force in agriculture has declined considerably, capital, investment, machinery and technology have increased. A classic substitution between labor and capital has been, and still is, occurring.

There are several reasons for this substitution:

- Technological progress makes it possible to replace manual labor with machines. Milking machines are a good example. Machines are more cost effective, which leads to a "push effect", whereby labor leaves agriculture.
- Labor costs (wages) increase with economic growth, which means that labor becomes less competitive, ceteris paribus, compared to capital, i.e., machines in this case. When agricultural sales prices decrease and the terms of trade deteriorate at the same time, farmers must seek technological solutions to maintain or strengthen their competitiveness.
- When demand for labor in other industries increases, labor is pulled away from agriculture and into industries (pull effect) because other industries can offer higher wages and better working conditions. This also strengthens mechanization in agriculture.
- Generally, economic growth is characterized by industrialization, commercialization and a business-oriented agriculture, which also implies more capital-intensive farms.

As an example of increasing mechanization, Fig. 9.6 illustrates the change in the number of tractors in selected countries and regions.

As can be seen in the figure, there was a clear increase in the number of tractors per unit of area. More recent data was unavailable, but it is likely that the curve will turn at some point: Tractors are increasing in size, which means that the number per unit of area will decrease. The decrease seen in Japan is probably an expression of this.

Substitution between capital and labor for all countries is illustrated in Fig. 9.7.

Figure 9.7 presents the use of tractors (capital) and labor in agriculture for all countries in relation to the countries' economic level in GDP per capita. The figure clearly shows that the use of capital is increasing while the use of labor is declining.

The substitution between labor and capital is illustrated in another way in Fig. 9.8.

The figure illustrates, for each individual country, the use of labor and capital—exemplified by the number of tractors. The countries have a significant use of either capital or labor.

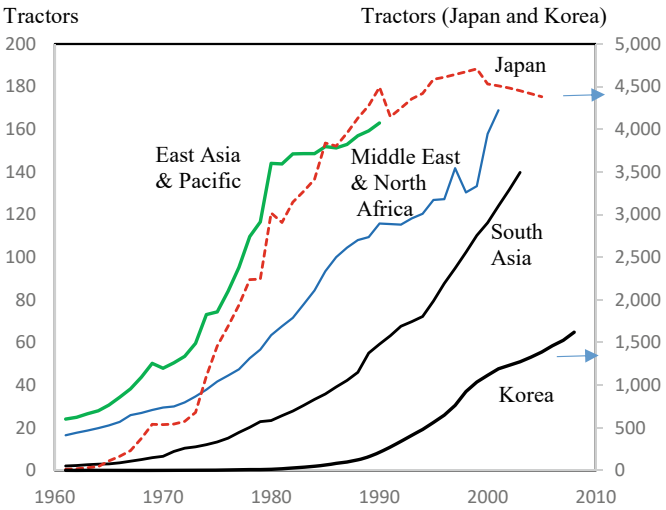


Fig. 9.6 Number of tractors per 100 sq. km of arable land (*Source* Own presentation based on statistical data from FAO and World Bank)

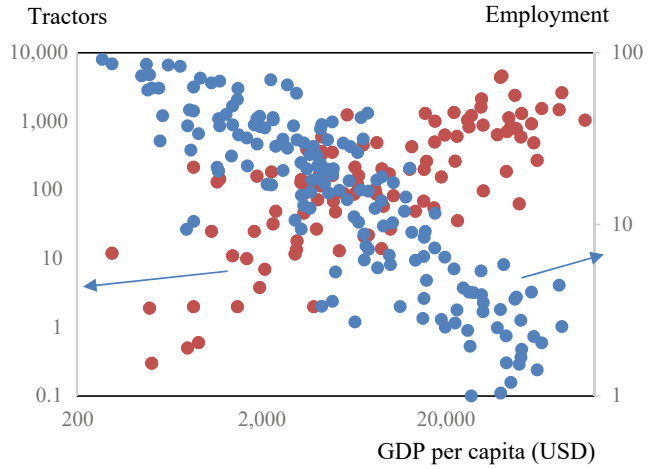
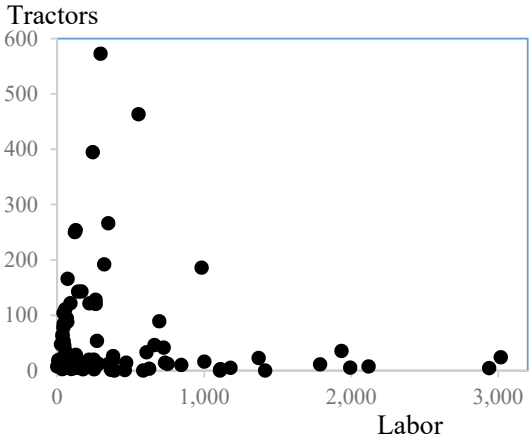


Fig. 9.7 Number of tractors and employment in agriculture as a function of GDP per capita (*Note* Number of tractors per 100 sq. km of arable land. 2008 or latest year with available data. Employment in agriculture: Percent of total employment. 2020. Logarithmic axes. *Source* Own presentation based on statistical data from FAO and World Bank)

Fig. 9.8 Use of labor and tractors in all countries (*Note* Number of people [labor] and tractors per 100 sq. km of arable land. 2008 or latest year with available data. *Source* Own presentation based on statistical data from FAO and World Bank)



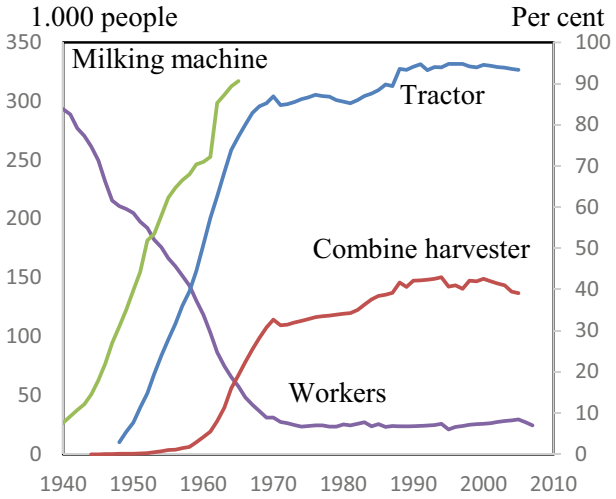


Fig. 9.9 Agricultural workers and number of farms (percent of total) with combine harvesters, tractors and milking machines in Denmark (Labor: Non-family workers. *Source* Statistical data from Statistics Denmark)

Finally, Fig. 9.9 presents a case of a substitution between labor and several different capital inputs in agriculture during a longer period.

Figure 9.9 illustrates that while the number of non-family workers has reduced by over 90 percent since the beginning of the 1940s, the number of tractors, combines and milking machines has increased. The proportion of agricultural holdings with these technical aids was very small at the beginning of the 1940s, but the proportion subsequently increased, thereby helping to replace a very large part of the agricultural workforce.

The substitution of labor with capital is quite clear and can be explained by stable driving forces with certain causal relationships. Therefore, the substitution of labor with capital is a global megatrend that is very likely to continue in the future.

9.5 Productivity (Output/Input)

Increasing productivity in agriculture is necessary to maintain or strengthen competitiveness. Increased productivity is often achieved by using new knowledge and technology, which makes it possible to produce

more with fewer inputs. The new technology may include a wide range of measures, e.g., large new larger machines, genetics, new cultivation methods, plant breeding, robots, etc.

Increasing productivity will be decisive in the future, and the underlying factors and driving forces are clear: In the coming years, the population will increase far more rapidly than the agricultural area. Therefore, more food will have to be produced, which will have to be achieved through increases in productivity.

Within plant breeding, it is estimated that 90 percent of the increase in production must come from increasing harvest yields and more intensive production (FAO, 2009).

For several decades, crop productivity has been increasing significantly in the Western World as a result of plant breeding, fertilization, improved management, etc. Even though there may be a biological limit to plant production, and environmental problems will present an obstacle, significant increases in productivity can still be achieved globally.

Productivity is usually calculated as output/input measures in quantities. In many cases, however, it is difficult to calculate all the inputs used in the production of a given output. The production of, e.g., 1 kg of wheat requires many different inputs such as fertilizer, seed, labor, capital and land, which is why the concept of partial productivity, in which output is calculated in relation to a single input, is used.

Increasing productivity is not necessarily beneficial. The financial cost of increasing the milk yield or achieving a higher yield per ha in plant production may be greater than the value of the increased production. Optimizing the value and not the volume is decisive. This sounds logical, and yet productivity is often expressed as a quantity because quantities are easier to calculate and compare. When operating with partial productivity (production per ha, per dairy cow, etc.), conclusions about the economic benefits must be drawn with caution. Ideally, all outputs and inputs (all production and all associated resources used) must be included.

As can be seen in Fig. 9.10, the change in agricultural productivity has several interesting characteristics: Productivity increases steadily from year to year, so there is a time dimension. Productivity also increases in line with increasing income, so there is also a dimension of economic development.

The figure shows that agricultural productivity correlates to a large extent with the level of the economic welfare in the individual countries (or income)—GDP per capita. The richer and more developed a

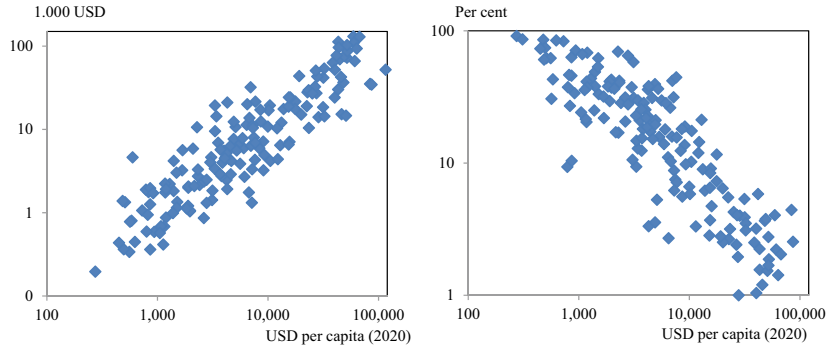


Fig. 9.10 Labor productivity (value added per agricultural worker) and agriculture's share of the countries' employment (as a percentage of total employment) as a function of GDP per capita (2020) (*Note* 2020 or latest year with available information. Logarithmic scales. *Source* Own calculations based on statistical data from FAO and World Bank)

country, the higher the agricultural productivity. The figure also shows agriculture's share of total employment as a function of GDP per capita. During economic growth, labor productivity increases while labor leaves agriculture.

The increase in labor productivity helps free up labor in agriculture, and this labor can then be used in other sectors, where wages are typically higher.

The same trend in terms of economic growth and productivity can be identified elsewhere, cf. Fig. 9.11.

The figure presents GDP per capita and the country's average milk yield per cow for all countries in the world. As can be seen, there is a clear correlation between productivity in the milk sector and a country's level of economic welfare.

The correlation between milk yield and GDP per capita is remarkable considering the fact that the countries' climate and natural conditions, which have an effect on milk yields, are so different. Nevertheless, income and the level of development seem to play a clear role.

The figure also reveals large differences in productivity, which are in part due to the varying intensity of production between the countries. The annual milk yield per cow ranges from around 100 kg to just under 13,000 kg.

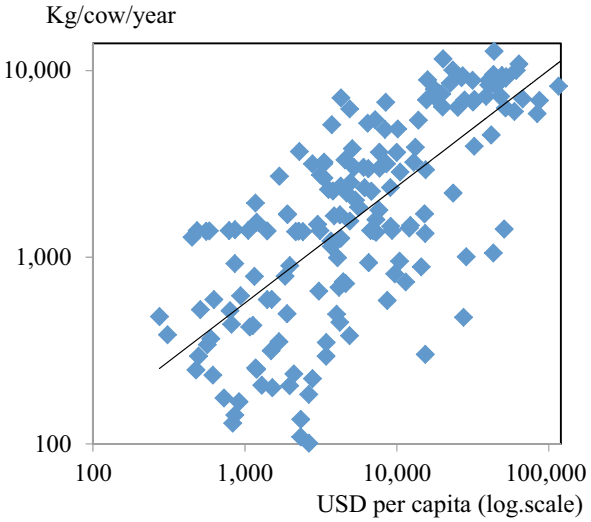


Fig. 9.11 Milk yield per cow per year (2020) as a function of the country's GDP per capita (2020) (*Note* Trend line is plotted. *Sources* Statistical data from FAO and World Bank)

With a clear correlation between a country's income and milk yield, the low milk yield in the developing countries is expected to increase as their level of economic welfare increases. Therefore, there is great potential for continuing increases in productivity in the future, mostly in the less developed countries.

The significant differences in productivity between the countries are also illustrated in Fig. 9.12, which presents the average milk yield for selected continents and country groups.

As previously discussed, productivity is related to both the level of economic development and time. In terms of the temporal aspect, a relatively clear correlation can also be observed: Historically, there has been an almost constant increase in productivity in the major agricultural sectors.

An example of an annual increase in agricultural productivity is presented in Fig. 9.13, which presents the long-term change in the average milk yield per dairy cow in the USA and Denmark. The figure

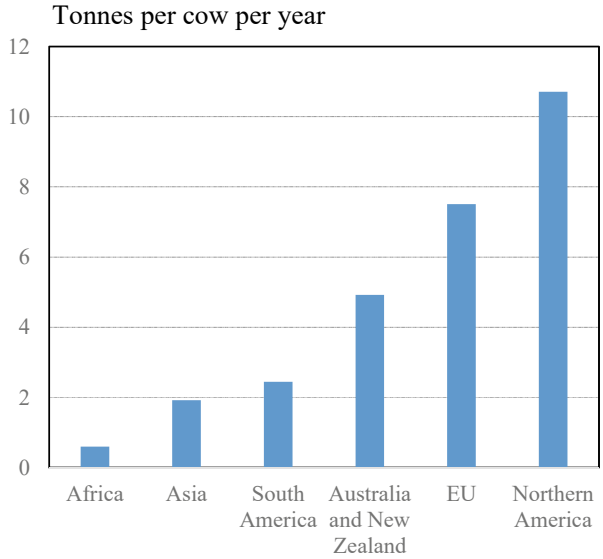


Fig. 9.12 Productivity in milk production (2022) (*Source* Own presentation based on statistical data from FAO)

illustrates an almost identical increase in the two countries despite significant differences in their structural conditions, agricultural policy and natural conditions.

A clear trend toward increasing productivity is also evident within crop production. As a result of plant breeding, fertilization, improved management, etc., crop yields have increased from year to year, starting around the time of the Second World War. As can be seen in Fig. 9.14, since then, wheat and corn yields in the USA have increased three to fivefold.

Looking at the very long-term development in the USA, despite some decreases in productivity in specific years, there is no indication that a major decrease in productivity will occur in the near future. However, at some point, productivity can be expected to level off once the limit to potential agricultural production has been reached. In the late 1960s, the annual average grain yield increased by around 3–4 percent. Since then, the increase in yields has been slowing, and in 2012–2022, the annual growth rate was between 1 and 2 percent for wheat and maize.

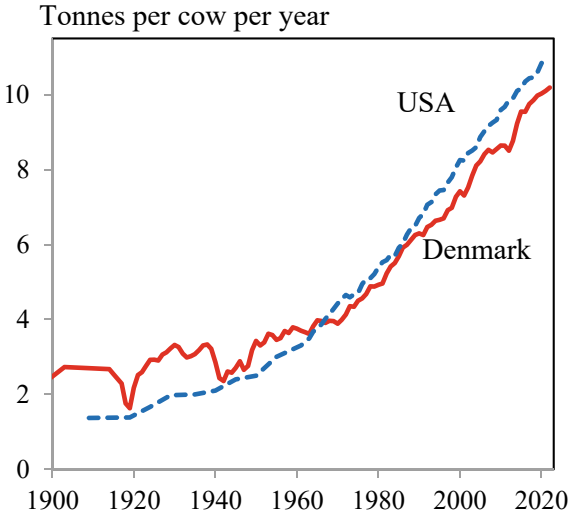


Fig. 9.13 Milk yield in Denmark and the USA: Long-term trend (*Source* Own presentation based on [USDA, several issues c], and statistical data from FAO and Statistics Denmark)

At the global level, crop yields have also been increasing in recent decades in most of the world, although growth in productivity has been slowing. In the 1980s, global grain yields increased by, on average, 2–3 percent per year. However, since then, the rate of increase has slowed, and in the past decade, growth was down to around 1–1.6 percent per year, cf. Fig. 9.15.

The increase in the last decade was mainly due to rising yields in America and Oceania, while Africa, mainly Northern and Middle Africa, experienced the smallest increase. This change demonstrates that the gap in yields between highly efficient countries and those that are not as efficient is increasing.

The figure also presents the annual increase in the global population. As a rule, food production should increase at the same rate as the growth in population in order to avoid increasing food scarcity—all other things being equal. With the size of the agricultural area remaining relatively constant, and because grain is a basic agricultural commodity in most of the world, the cereal yield is used as an indicator of food production. As

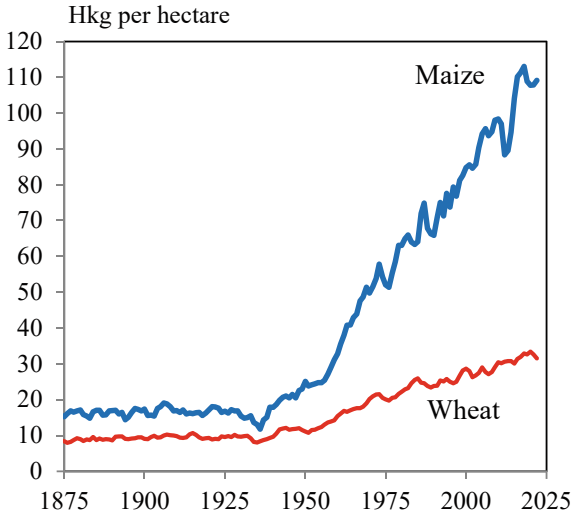
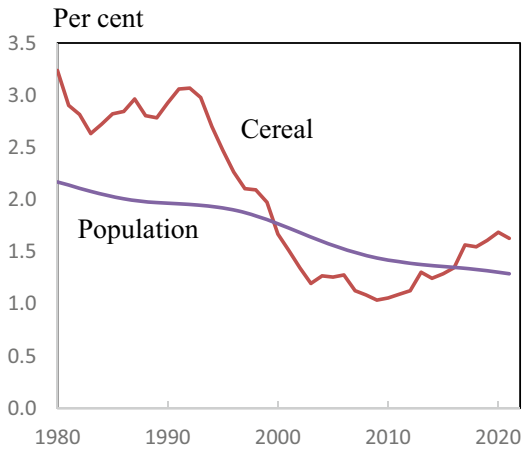


Fig. 9.14 Grain yields in the USA, 1855–2022 (*Note* 3-year moving average. *Source* Own presentation based on USDA [2022], and statistical data from FAO)

Fig. 9.15 Change in global cereal yields and population, 1980–2021 (*Note* For cereal, the annual increase is based on 10-year moving average. For example, 2021 means 2012–2021 compared with 2002–2011. *Source* Own calculations based on statistical data from FAO)



can be seen in Fig. 9.15, in general, grain productivity has been falling in recent decades, and it has been lower than population growth at times.

If the current trend continues, low growth in productivity will be a critical obstacle to producing enough food for the growing population. Increased productivity and yields are, therefore, essential for being able to feed the world's population in the future.

Achieving the necessary increases will involve:

- Ensuring sufficient and appropriate research and development, so that the latest knowledge is passed on to farmers.
- Targeting the resources so that increased productivity is achieved in the areas where the results are best compared to the effort.
- Achieving sustainable growth in productivity, i.e., the negative externalities of production are reduced as much as possible.
- Ensuring that increasing productivity creates increasing production to improve the global food situation.

In addition, the effects of climate change will increasingly have a negative impact on opportunities to increase crop yields. More extreme weather events and a higher risk of both droughts and flooding will make it more difficult to increase productivity in crop production.

9.6 The Agricultural Treadmill

The agricultural treadmill refers to the situation in which technological advances result in increasing productivity and innovation for the benefit of progressive farmers, but also result in increased supply, falling prices, economic problems for laggard farmers and thus the need for new progress in technology. The agricultural treadmill and its prerequisites are absolutely crucial for understanding the development—historically and in the future—of the agricultural and food industry.

The question is whether the agricultural treadmill will continue, and whether the underlying driving forces are persistent, or whether some factors will influence and change the development. A preference for less intensive agriculture, more income elastic demand, less price and productivity pressure, etc., may weaken the agricultural treadmill.

In order to understand the importance and consequences of the treadmill in terms of the development of agriculture in future, the model and

its prerequisites are presented and briefly discussed below, cf. Hansen (2019):

In 1958, the theory of the agricultural treadmill was presented by the American agricultural economist, Willard W. Cochrane, in the article "Farm Prices, Myth and Reality" (Cochrane, 1958). The concept of the agricultural treadmill is explained in detail in the following:

The treadmill begins when new technology is developed and implemented by those farmers who are the fastest to implement and utilize new knowledge. These farmers (early adopters) are able to gain an economic advantage as a result of the new technology because they can produce at a lower cost with an unchanged selling price. As the number of farmers who adopt the new technology increases, production increases and prices fall. Therefore, the economic advantage that had been gained by the early adopters disappears as it is counteracted by the falling prices.

The laggard farmers—or even the average farmers—who adopted the new technology at a later stage thus only experience the negative effects of technological development, i.e., the falling prices. At this stage of the treadmill, new technology is emerging, which will once again reduce costs or increase productivity and subsequently increase farmers' earnings. As before, only the progressive farmers (early adopters) will benefit, but only up to the point when the prices start to fall again.

Farmers trapped in the treadmill will always have to run faster by adopting new technology to offset the decline in real prices and terms of trade created by the new technology. The consumers, on the other hand, will benefit from the cheaper food.

The question then is why labor and other resources do not leave agriculture and move to other more profitable sectors. If the market worked perfectly, resources would move to the most attractive industries and away from low-profit industries. If resources moved away from agriculture, the supply would be reduced, and prices would fall less or not at all.

However, the market does not work perfectly, and labor and other resources do not leave agriculture because they are locked (fixed) in the sector; something which has been recognized for a long time (Johnson, 1958). If an asset is fixed, it means that it has a low alternative use and value in other industries. Therefore, the assets remain in the agricultural industry for a long time.

In addition, entry barriers are relatively low—also inside the agricultural industry: If attractive new production opportunities are created,

resources will move in order to exploit these new business areas without being hampered by prohibitive entry barriers.

The stages of the treadmill are outlined in Fig. 9.16.

The preliminary conclusion is that the drivers and mechanisms in the agricultural treadmill are consistent and persistent.

However, the question is whether other megatrends such as demand will have an influence on the treadmill, perhaps weakening it. The increasing demand for organic food, which is an example of a new consumer trend and a possible game changer, may affect the fundamental market conditions in terms of productivity as well as price and income elasticity. A further question is whether shifts created in the organic food market will affect the underlying mechanisms and megatrends and thus also the agricultural treadmill and whether such changes can be observed empirically. In other words, are conditions such as economies of scale, structural development, productivity pressures and real price declines, which are characteristics of the treadmill in conventional agriculture, significantly different in organic agriculture?

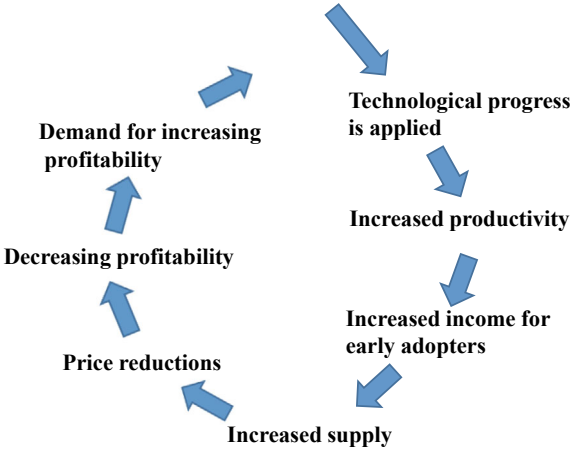


Fig. 9.16 The stages of the agricultural treadmill (*Note* The first three steps are taken by the progressive innovative farmers who achieve a financial gain as a result. As the average farmers also adopt the technology, supply increases further and prices fall accordingly [the last four steps]. *Source* Own presentation based on Cochrane [1958])

From a theoretical point of view, differentiated products such as organic products can only reduce or delay the conditions under which agriculture operates. This is mainly due to the following three factors:

First, organic farmers also mainly produce raw materials that are difficult to differentiate or develop into unique products. The majority of the added value is created in the processing and marketing industry in the downstream value chain, and the agricultural products are still standard commodities that can be mass-produced. It is difficult to create a "Blue Ocean" for organic agricultural products because the competition is too fierce, the new product could be easily copied and there are limited opportunities to add unique features.

Second, entry barriers are low. Although converting from conventional to organic farming takes time—often several years—and organic farming requires new specific skills and resources, farmers can switch from conventional to organic farming if it is economically attractive. This means that new producers are always attracted to organic production if they think that long-term earnings in organic farming are better than they are in conventional farming.

Third, organic production in agriculture will quickly face price and productivity pressures just like conventional production. Examples from Danish agriculture, where organic agricultural production is significant, illustrate that, in recent years, the change in prices, structure and productivity of organic products has largely developed in the same way as conventional products Hansen (2016, 2019). Figure 9.17 illustrates the change for milk production.

In the period shown, the yield—milk production per cow per year—is approximately 10–12 percent lower in organic production than it is in conventional production. However, the annual increase in productivity is marginally higher in organic production—1.8 percent compared to 1.7 percent in conventional production. The additional price (price premium) of organic milk was approx. 25 percent in the period, while the average annual price increase was almost zero. A significant real price decrease for both conventional and organic milk during the period can be observed. The price increase beginning in 2021 is probably just a temporary price bubble as a result of the global food crisis.

The example indicates that organic agricultural production is subject to the same market mechanisms as conventional agriculture, and that more organic agriculture will not prevent the treadmill from continuing. Therefore, more organic farming is hardly a game changer.

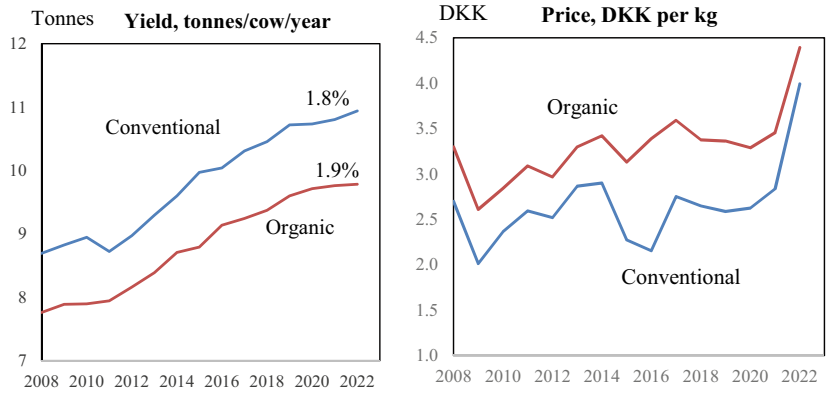


Fig. 9.17 Organic and conventional milk production in Denmark: Yield and price, 2008–2022 (*Source* Own presentation based on statistical data from Statistics Denmark)

Although the agricultural treadmill is a result of market mechanisms, it is often perceived as a problem as it may seem unfair and burdensome for the farmers who are trapped and are subject to persistent price and productivity pressures, which they cannot control or benefit from.

Furthermore, the treadmill helps to create a form of structural development which is undesirable for some individuals or groups. One possible scenario is that the treadmill or its consequences will be limited through political intervention.

There follows a list of the potential ways in which the treadmill could be changed, although in practice, implementing the measures is not straightforward for several reasons (Hansen, 2019):

- Research activities, which represent the foundation of technological development, could be limited. However, research and development takes place internationally, which means that such a measure would not be possible for an individual country or region.
- Similarly, the dissemination of knowledge from research to the agricultural industry, which is also important for the treadmill, could be limited. By prohibiting the use of technological development (e.g. GMO—genetically modified organisms) or by not supporting knowledge sharing and information, this knowledge dissemination

can be subject to restrictions. However, a global market for knowledge exists, and a country or region cannot control that market.

- Increasing productivity and earnings resulting in increased production is an important element of the treadmill. Thus, a significant price decrease as a result of new technology is almost inevitable. This is a natural consequence in a market economy. However, increasing production and supply can be avoided—at the local level—by imposing production restrictions such as quotas. If quotas are to effectively limit supply, import barriers are required, which is not a realistic solution in a time of increasing free trade, globalization and international cooperation.
- Farmers can respond to the improved productivity and earnings by producing higher quality and higher value products rather than producing greater quantities. This strategy is already possible, but there will always be a market for standard goods, low-price products, etc., and some countries and farmers will always be able to produce for this market. High-quality and high-value products cannot per se prevent the increasing pressure on price and productivity in agriculture.
- If farmers produce agricultural commodities for which demand is less price-sensitive (price inelastic demand), the pressure on price can be limited or even completely avoided. The long-term real price decrease, which would otherwise occur as a result of the treadmill, can thus be avoided. In practice, agricultural commodities are relatively homogeneous and are sold on competitive markets with many suppliers and intense price competition. Although processed foods are sold as branded products with high added value and at relatively high prices, it is difficult to differentiate agricultural commodities and make them unique in order to ensure a positive price trend for the farmers in the long term.
- From an agricultural policy perspective, the treadmill may be changed by introducing price support to avoid the real price decrease. Price support was a key element of agricultural policies for many years and in many countries. However, the experience from this shows that price support is not a sustainable solution in the long term, as price support creates other market, trade and economic problems. Price support is also in conflict with the way in which international agricultural policy has developed in recent decades.

- Strong structural development is also a part of—or a consequence of—the treadmill. If the treadmill turns quickly, the rate of structural development will increase. Legislation can be implemented to limit structural development and thus also the effects of the treadmill. However, such restrictions would damage the long-term international competitiveness of agriculture, so introducing a restrictive structural policy in order to solve treadmill problems is not an optimal solution.
- The emigration of labor from agriculture could be encouraged, which would solve some of the economic and social problems that the treadmill creates for the laggard farmers. For example, emigration could be encouraged by making labor more mobile. While such a measure may solve some of the social problems, the treadmill would not stop.
- Finally, laggard farmers could be trained to become early adopters through the provision of advisory services and education. However, this would not stop the treadmill either, although it would reduce the number of farmers trapped in the treadmill. This measure is one of the most aggressive options and while it may have some success in the host country, it would simply move the problem to farmers in other countries or regions.

The conclusion is that market forces will cause the agricultural treadmill to continue in the future, and that any political attempts to significantly weaken it will be futile and unsustainable in the long term.

9.7 Biotechnology

As previously discussed, increasing productivity in agriculture represents both an opportunity and a necessity in order to be able to maintain or strengthen competitiveness. Increasing productivity is achieved by new technology, which makes it possible to increase production with fewer inputs. The new technology may include new and larger machines, genetics, new cultivation methods, plant breeding, robots, etc.

When it comes to plant breeding, which makes a very important contribution to productivity growth, several technologies are available. "Traditional" plant breeding, which consists of crossbreeding, trials and tests, is still the most common method, but new biotechnological methods have been developed which are now widely used.

One of these new technologies is CRISPR (clustered regularly interspaced short palindromic repeats), which allows researchers to precisely alter the genes of various organisms at low cost. CRISPR cannot develop anything that cannot already be created with traditional breeding, but it can develop it faster.

Genetically modified organisms (GMOs) are living organisms whose genetic material has been artificially manipulated in a laboratory through genetic engineering. This creates combinations of genes from plants, animals, bacteria and viruses which do not occur naturally and which cannot be created through traditional crossbreeding methods.

The first genetically modified crops were grown in the USA in 1996, after which the total global area planted with GM crops grew rapidly, cf. Fig. 9.18.

The areas under organic production and those with GMOs both account for an increasing share of the world's total agricultural area. 1.6 percent of the areas are now organically farmed, while there are GMO

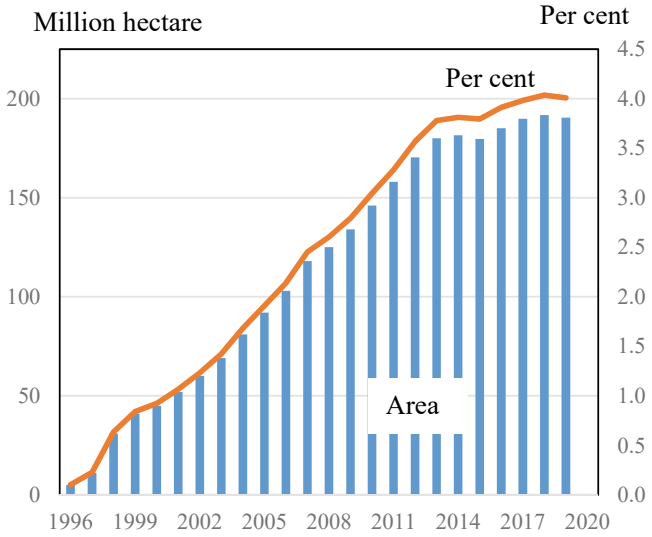


Fig. 9.18 Global area under GM crops and share of total agricultural land (*Source* Own calculation based on ISAAA [2017], ISAAA [2019], and statistical data from FAO)

crops on approx. 4 percent of the agricultural area. In both cases, there have been significant increases over the past 20–25 years from a low starting point in both cases.

The five countries with the largest GMO areas are the USA, Brazil, Argentina, Canada and India. GMO crops have been approved in approx. 70 countries, and GMO crops are grown commercially in approx. 30 countries. The most important GMO crops are soybeans, corn, cotton and canola.

The area with GMO crops increased by an average of approx. 8 percent per year between 2000 and 2019. Growth has slowed in recent years, which is because inter alia almost all areas in the USA (90–95 per cent) planted with soybeans, corn and cotton have been cultivated with GMO crops for several years, which is why the potential for further growth in this area are limited.

In many ways, the USA is a frontrunner in the development of GMOs and was able to introduce and use GM crops very quickly, cf. Fig. 9.19.

The figure shows that the introduction and adoption phases were relatively short in the USA. After a few years, the market share was over 50.

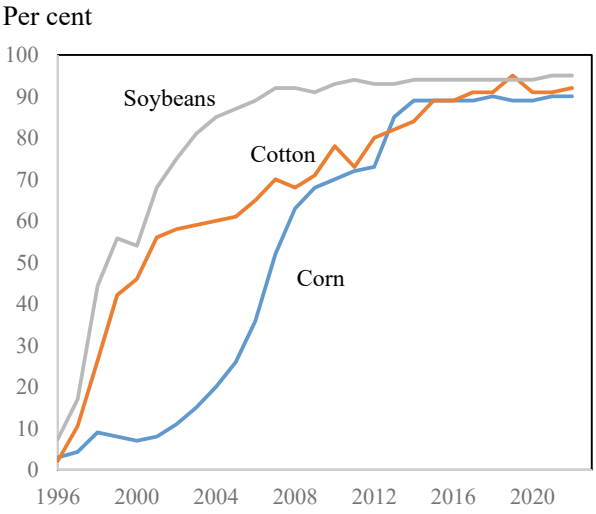


Fig. 9.19 Adoption of genetically engineered crops in the USA, 1996–2022 (*Source* Own calculation based on statistical data from USDA)

As of around 2015, the GM market share of soybeans, cotton and corn was around 90 or more.

The use of GM has faced both barriers and opportunities in the past and will continue to do so in the future:

On the one hand, the need to increase productivity and yields in plant breeding is enduring and urgent, which encourages the utilization of all technological tools.

On the other hand, market barriers are important. Legislation and consumer resistance are limiting the growth of the global spread of GM.

9.8 Organic Agriculture

The total global area under organic agriculture exhibits a rapidly increasing trend as it more than doubled in the years 2013–2021, cf. Fig. 9.20.

The figure presents the world's total organic agricultural area in hectares and as a percentage of the total agricultural area. The average annual increase in the organic area was approx. 10 percent—albeit from a relatively low level.

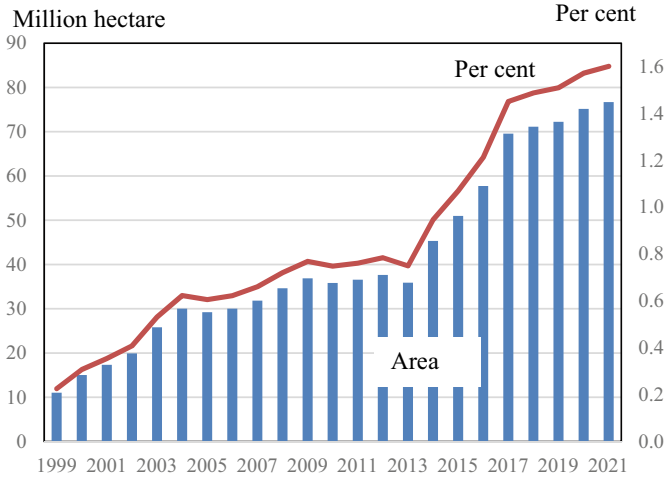


Fig. 9.20 Organic share of agricultural land: World total (*Source* Own calculation based on statistical data from FAO and FiBL)

Production is most widespread in the Western countries, and organic agricultural production seems to be a welfare phenomenon in that both production and consumption increase with increasing welfare. As can be seen in Fig. 9.21, there is a very clear correlation between economic welfare and the share of organic agricultural land.

Figure 9.22 illustrates the distribution of organic agriculture on the world's continents.

Australia accounts for almost all of Oceania's close to 50 percent share of the world's total organic agricultural area. Since 2000, the organic agricultural area in Australia has grown by 16.5 percent per year, so that now, almost 10 percent of the total agricultural area is organic.

The organic share of agricultural land varies widely between continents, but Oceania has the largest share, while Africa and Asia have the smallest shares, cf. Fig. 9.23.

FAO registers organic agricultural land in approx. 175 countries. The positive correlation between the relative importance of organic land

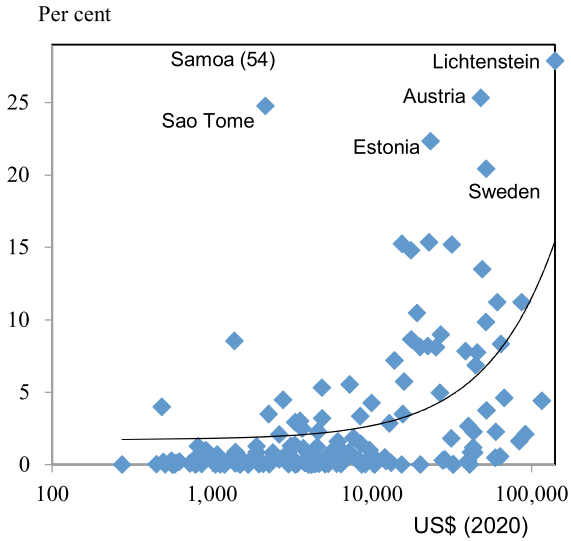


Fig. 9.21 Share of organic agricultural land (percent of total agricultural land) as a function of GDP per capita (2020) (*Note*. 2020 or latest year with available data. Trendline included. *Source* Author's calculations based on statistical data from FAO and World Bank)

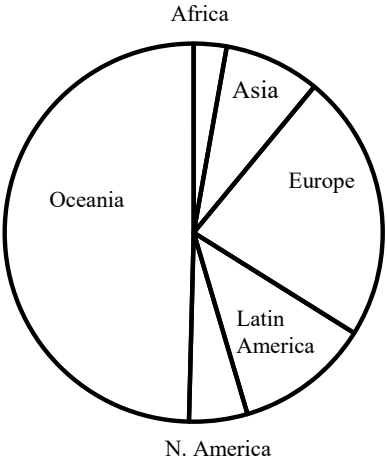


Fig. 9.22 Organic agricultural land: Share of world total (2020) (*Source* Own calculation based on statistical data from FAO and FiBL)

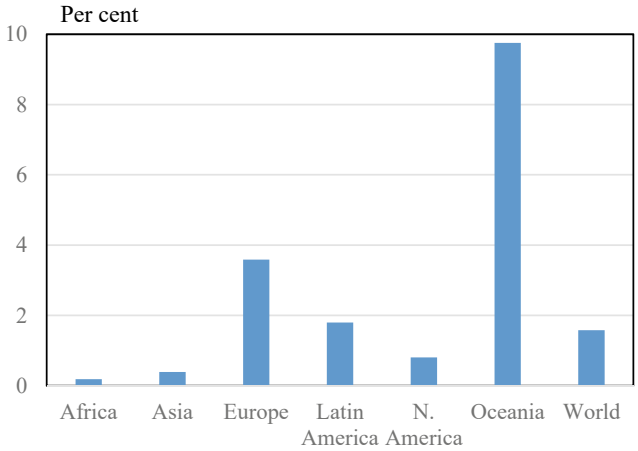


Fig. 9.23 Organic share of agricultural land: Regions (2020) (*Source* Own calculation based on statistical data from FAO and FiBL)

and the countries' economic growth indicates that continued economic growth will stimulate both the supply of and demand for organic food.

Both market-based demand and governmental support have stimulated this development, and both these driving forces are expected to continue

in the future. In addition, research, development and added value can contribute to higher productivity and increasing production, which may also increase the organic share of total agricultural production.

Finally, other major trends such as sustainability, animal welfare, environmental policy, etc., will also support the organic demand and production.

9.9 Food Loss and Food Waste

Food loss and waste, i.e., a decrease in the quantity or quality of food along the food supply chain, has appeared on the global agenda in the past decade.

Food loss and food waste is a problem because it represents the waste of natural resources, which are not used optimally. In a world with increasing scarcity of resources and increasing demand, reducing food loss and food waste is a potential opportunity to improve resource availability and the pressure on natural resources.

A few key figures illustrate the challenge with regard to food loss and food waste:

- In 2011, the FAO estimated that roughly one-third of all food produced for human consumption globally is lost or wasted every year (Gustavsson et al., 2011).
- The aim of Sustainable Development Goal 12.3 is to halve food waste and reduce food loss by 2030. To provide baselines for SDG 12.3, more precise estimates have been carried out by the FAO and UNEP:
  - Around 14 percent of food produced globally undergoes quantitative food loss between the post harvest and retail stages of the food supply chain (FAO, 2019).
  - Around 17 percent of total global food production ends up as food waste (UNEP, 2021).

The goal of halving food waste and reducing food loss by 2030 is ambitious and requires significant changes.

In a global context, distinguishing between food loss and food waste is important as two concepts are quite different.

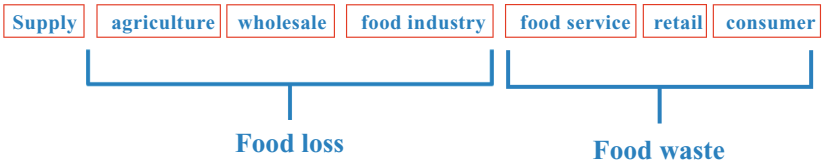


Fig. 9.24 Example: Food loss and food waste in a food value chain (*Source* Own presentation)

- Food loss is the decrease in quantity or quality of food resulting from decisions and actions by food supply chain actors from the primary production stage up to, but excluding, retailers, food service providers and consumers.
- Food waste is the decrease in the quantity or quality of food resulting from decisions and actions by retailers, food service providers and consumers.

In a value chain context, the definitions of food loss and food waste are illustrated in Fig. 9.24.

Therefore, food loss results from the upstream activities, while food loss results from the downstream activities.

Food loss and food waste have only recently appeared on the agenda. It is difficult to quantify food loss and waste—especially on an aggregate or global level—because the empirical basis is either non-existent or too uncertain. As a result, long-term time series and global trend series do not exist.

However, dynamic interpretations can be made based on relatively reliable data from the most recent years. The prevalence of food loss and waste depends on the income level of countries, and the assumption is that a dynamic development takes place when the countries' income increases. Figure 9.25 illustrates a relatively clear correlation between the percentage of food loss and a country's level of income.

The figure reveals a trend: the percentage of food loss decreases with increasing income.

Figure 9.26 presents the differences in food loss and food waste in North America & Oceania and North Africa & West and central Africa at different stages of development.

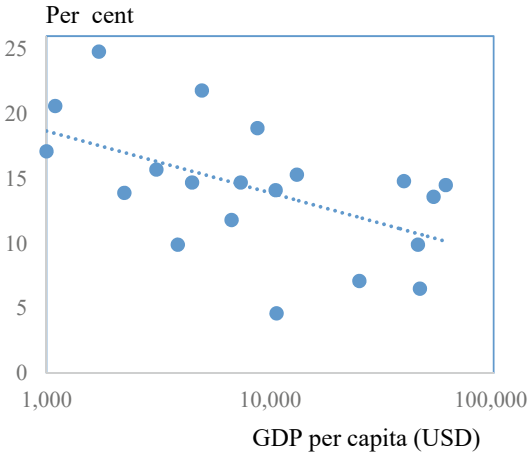


Fig. 9.25 Percentage food loss for regions as a function of GDP per capita (2020) (*Note* Geographical division where all countries are included such as Southern Europe, Northern America, Northern Africa, Eastern Asia, etc. *Source* Own calculations based on statistical data from FAO and World Bank)

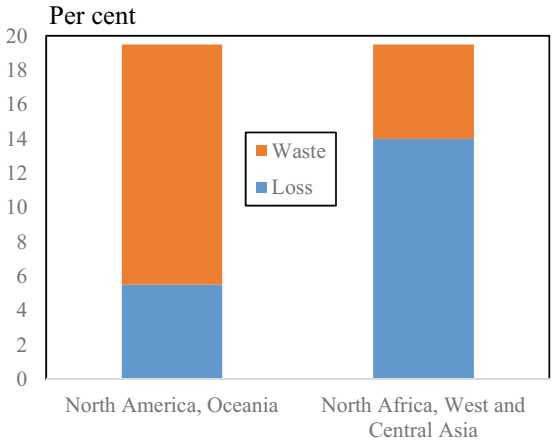


Fig. 9.26 Food loss and food waste in high- and low-income regions (2020) (*Note* Loss: Production + Postharvest + Processing. Waste: Distribution + Consumption. *Source* Own presentation based on Njie [2022])

As can be seen, the total loss plus waste is the same for the two regions, but the composition is very different: Loss is low among developed countries and high among less developed countries, while the opposite is the case for food waste. In less developed countries, food loss is a problem in agriculture, logistics and processing, while in developed countries, food waste is a problem in retail and households.

The pattern is shown schematically in Fig. 9.27.

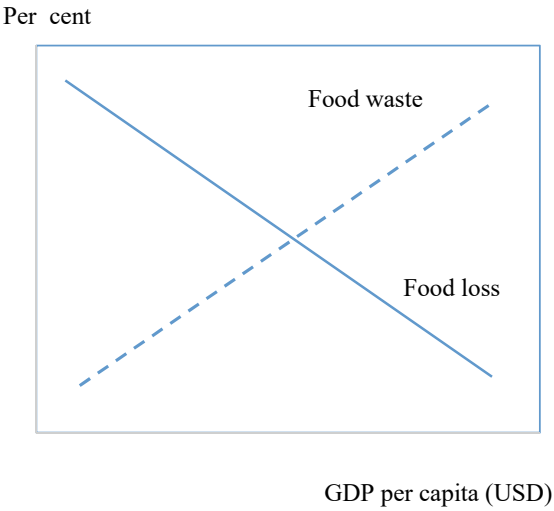


Fig. 9.27 Food loss and food waste during economic growth (schematic) (*Source* Own presentation)

The pattern and trends indicate that the total food loss and food waste are relatively constant during economic growth: Food loss decreases, but food waste increases.

References

Braimoh, A. (2015). *To fight desertification, let's manage our land better*. World Bank Blogs. https://blogs.worldbank.org/voices/fight-desertification-and-land-degradation-lets-manage-our-land-better?CID=EXT_TWBN_D_EXT

Cochrane, W. W. (1958). *Farm prices, myth and reality*. University of Minnesota Press.

Dell'Angelo, J., Rulli, M. C., & D'Odorico, P. (2018). The global water grabbing syndrome. *Ecological Economics, 143*, 276–285. https://doi.org/10.1016/j.ecolecon.2017.06.033

FAO. (2009). *How to feed the world in 2050*. https://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf

FAO. (2019). *The state of food and agriculture 2019: Moving forward on food loss and waste reduction*. FAO. https://www.fao.org/3/ca6030en/ca6030en.pdf

FAO. (2020). *The state of food and agriculture 2020: Overcoming water challenges in agriculture*. FAO. https://doi.org/10.4060/cb1447en

FAO. (n.d.). *Water scarcity*. Retrieved February 14, 2024, from https://www.fao.org/land-water/water/water-scarcity/en/

Gustavsson, J., Cederberg, C., Sonesson, U., van Otterdijk, R., & Meybeck, A. (2011). *Global food losses and food waste: Extent, causes and prevention*. Food and Agriculture Organization of the United Nations (FAO). https://www.fao.org/3/i2697e/i2697e.pdf

Hands off the Land Alliance. (2014). *The global water grab: A primer*. https://www.tni.org/en/publication/the-global-water-grab-a-primer

Hansen, H. O. (2016). Landbrugets trædemølle – gælder den stadig? [The agricultural treadmill—Does it still apply?]. *Tidsskrift for Landøkonomi, 202*(3), 241–251.

Hansen, H. O. (2019). The agricultural treadmill—A way out through differentiation? An empirical analysis of organic farming and the agricultural treadmill. *Journal of Tourism, Heritage & Services Marketing, 5*(2), 20–26. https://doi.org/10.5281/zenodo.3601667

IPBES. (2018). *The assessment report on land degradation and restoration*. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). https://zenodo.org/record/3237393#.Y9HGPnZBw2x

ISAAA. (2017). *Global status of commercialized biotech/GM crops in 2017: Biotech crop adoption surges as economic benefits accumulate in 22 years*. ISAAA. International Service for the Acquisition of Agri-biotech Applications (ISAAA). https://www.isaaa.org/resources/publications/briefs/53/download/isaaa-brief-53-2017.pdf

ISAAA. (2019). *Brief 55: Global status of commercialized biotech/GM crops: 2019*. https://www.isaaa.org/resources/publications/briefs/55/default.asp

Johnson, G. L. (1958). Supply function—Some facts and notions. In E. O. Heady, H. G. Diesslin, H. R. Jensen, & G. L. Johnson (Eds.), *Agricultural adjustment problems in a growing economy* (pp. 74–93). Iowa State College Press.

Liu, X., Liu, W., Tang, Q., Liu, B., Wada, Y., & Yang, H. (2022). Global agricultural water scarcity assessment incorporating blue and green water availability under future climate change. *Earth's Future, 10*, e2021EF002567. https://doi.org/10.1029/2021EF002567

Njie, D. (2022). Food loss and waste—A global challenge. In *Sustainable food systems: Resource efficiency, food loss and food waste*.

OECD. (2017). *Water risk hotspots for agriculture*. OECD. https://doi.org/10.1787/9789264279551-en

OECD. (2021). *Sustainable management of water resources in agriculture*. OECD. https://doi.org/10.1787/9789264083578-en

OECD. (n.d.). *Managing water sustainably is key to the future of food and agriculture*. https://www.oecd.org/agriculture/topics/water-and-agriculture/

Rulli, M. C., Saviori, A., & D'Odorico, P. (2013). Global land and water grabbing. *Proceedings of the National Academy of Sciences, 110*(3), 892–897. https://doi.org/10.1073/pnas.1213163110

UNCCD. (2022). *The global land outlook—Land restoration for recovery and resilience* (2nd ed.). United Nations Convention to Comat Desertification (UNCCD). https://www.unccd.int/sites/default/files/2022-04/UNCCD_GLO2_low-res_2.pdf

UNDP. (n.d.). *The SDGs in action: What are the Sustainable Development Goals?* https://www.undp.org/sustainable-development-goals

UNEP. (2021). *Food Waste Index Report 2021*. United Nations Environment Programme. https://www.unep.org/resources/report/unep-food-waste-index-report-2021

UNESCO. (2020). *The United Nations world water development report 2020: Water and climate change*. https://unesdoc.unesco.org/ark:/48223/pf0000372985

UN-Water. (2021). *Summary progress update 2021: SDG 6—Water and sanitation for all*. UN-Water. https://www.unwater.org/sites/default/files/app/uploads/2021/12/SDG-6-Summary-Progress-Update-2021_Version-July-2021a.pdf

USDA. (2022). *Crop production. Historical track records: April 2022*. USDA, National Agricultural Statistics Service. https://www.nass.usda.gov/Publications/Todays_Reports/reports/croptr22.pdf

World Bank. (2022). *Water in Agriculture*. https://www.worldbank.org/; https://www.worldbank.org/en/topic/water-in-agriculture

World Economic Forum. (2019). *The global risks report 2019: 14th Edition*. World Economic Forum. https://www3.weforum.org/docs/WEF_Global_Risks_Report_2019.pdf

CHAPTER 10

Food Supply

10.1 Introduction

The topic of "food supply" gives rise to many questions, but few precise answers. While economists and other experts generally agree about demand, i.e., how many people will need to be fed in the coming decades, they disagree about the supply side, i.e., by how much agricultural production and supply will have to increase in the future.

An important question is whether access to food will be a limiting factor for the world's development and population growth. This question has been debated for several centuries—at least since Malthus first presented his theories on population growth in the late 1700s.

Who will feed the world, and do we have enough resources to meet the increasing demand resulting from population growth? Furthermore, we have the paradox that we have both hunger and an abundance of food at the same time. More people die from diseases connected to obesity than from starvation.

Additionally, food crises, which are further exacerbating the food situation, not least in the less developed countries, are occurring more frequently: Is this a wake-up call and a warning that food supply may be uncertain in the future?

Or will the world's population gradually move further up Maslow's pyramid of needs because the basic need for food has been met?

H. O. Hansen, *Megatrends in Agriculture, Food Industry and Food Markets*, Palgrave Advances in Bioeconomy: Economics and Policies,
https://doi.org/10.1007/978-3-031-58152-6_10

Or is it more a question of purchasing power that is the challenge rather than the availability of food? Calculated in calories, there is enough food in the world to feed everyone.

Should the less developed countries increase their food supply and food export, and what is the future role of different countries and regions regarding the global food supply in the future?

Will new green revolutions be able to boost the supply of food to such an extent that production is able to keep pace with population growth? There is no doubt that technology will play a crucial role in terms of solutions to food scarcity in the future. Technology in the form of plant breeding, mechanization, innovation and knowledge sharing will be absolutely necessary. Plant breeding was behind the green revolution in the 1960s, which reduced hunger and famine in large parts of Asia. A new green technological revolution that addresses the issues of sustainability and food safety is probably needed.

As previously discussed, in the future, food production will have to increase in line with population growth to make it at least possible to feed everyone. However, the likelihood of this occurring may be seriously hampered by, e.g., the adverse effects of climate change, biodiversity loss and the destruction of habitats.

Achieving an adequate food supply is a challenge both globally and locally: Globally because food crises, pandemics or insufficient food stocks result in expensive food and locally because poor growth or a poor economy and purchasing power lead to hunger. Global and local foods each have their own advantages, and the question is whether they can coexist and if so how.

10.2 World Market Shares: Developed and Developing Countries

The supply of agricultural products and food from developing and less developed countries is changing, and their role on the world market is following a fairly stable trend.

Developing countries are mainly agricultural countries as the agricultural and food sectors account for a large proportion of total production, value added and exports. Furthermore, in several developing countries, the agricultural sector accounts for over half of the total employment and exports, while approximately 75% of poor people worldwide live in rural areas with the majority of them being dependent on agriculture.

In general, the extent to which a country or region contributes to the global supply of agricultural products and food depends on many factors, which may be linked or counteract each other:

- Comparative advantages including land, water and the climate are basic resources that have a significant influence on a country's capacity for international trade.
- Agricultural and trade policy can restrict or support exports.
- The countries' economic and technological development is important. With increasing economic growth in a country, the relative importance of agricultural production and agricultural exports will diminish.
- Supply and demand are important factors as, e.g., high domestic demand will limit exports.
- Good infrastructure and access to markets are important prerequisites for the capacity to export. By the same token, their absence often limits less developed countries' capacity to export.
- A well-functioning international market for agricultural and food products is also an important prerequisite for exploiting production and export potential. To a certain extent, the presence of a market system based on the international division of labor is necessary.

Some of these factors suggest that exports of agricultural and food products from developing countries will rise, while others suggest the opposite.

On the one hand, a relative decline in the export of agricultural and food products may be the result of developing countries seeking to promote the industrialization process. Developing countries' desire to encourage industrialization at the expense of agricultural and food production may be due to, e.g., limited access to exports and a deterioration in the terms of trade. Developing countries can encourage industrialization by moving resources (labor, capital, research, etc.) from the agricultural and food sectors to industrial sectors, which will result in a reduction in agricultural and food production.

Developing countries' limited export potential is also, to a large extent, a consequence of their agricultural policy. A relative decline in agricultural and food exports may also be the result of an increase in domestic demand due to increasing prosperity and purchasing power.

On the other hand, some conditions imply that developing countries should increase their agricultural production and exports. Agricultural and food production is often one of the few comparative advantages possessed by developing countries. To ensure maximum international competitiveness, it is necessary to focus on the sectors with the greatest comparative advantage.

Developing countries also need to develop exports to gain access to foreign currency to pay for the imports that are needed.

Based on these considerations, it is striking that the developing countries' share of global food exports has been falling for a long time, but has increased recently (see Fig. 10.1).

The figure shows that, in the late 1900s, the developing countries' market share in terms of food exports reached its lowest point. This was especially the case for the least developed countries, where exports ceased almost entirely. From the early 1960s to the early 1990s, the developing countries' total market share fell by more than 50%; from 22 to 10%. Subsequently, their market share increased, which may have been

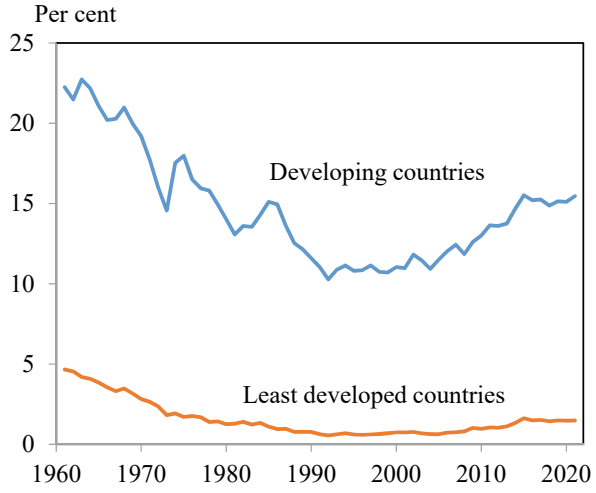


Fig. 10.1 Developing countries' share of total food exports, 1961–2021 (*Note* Based on the FAO's definitions of developed and developing countries. *Source* Author's calculations based on statistical data from FAO)

due to the WTO negotiations regarding the liberalization of trade in the agricultural and food sectors.

The fluctuation in the developing countries' market share is the result of several factors; factors related to the specific products, or related to competitive conditions in specific countries.

Figure 10.2 presents two examples of less developed countries increasing their world market share, i.e., taking market share from high-income countries, in the agricultural and food segment.

Green beans are an example of labor-intensive vegetable production, and they are increasingly being produced in less developed countries and exported as fresh products to high-income countries. Countries in Africa and Asia, in particular, have increased their production in recent decades. A list of the most important export countries, in decreasing order of importance, is given in the notes to Fig. 10.2.

Low labor costs, year-round production and well-developed logistics are important factors behind this increase in agricultural production in several less developed countries. In many cases, retail chains in high-income countries drive and control the value chains through backward integration in that they set the quality standards and regularly check the

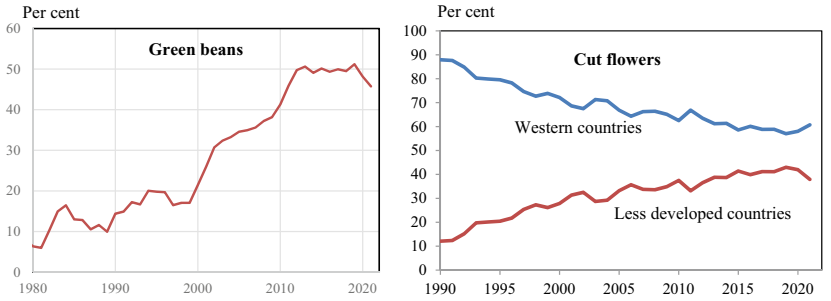


Fig. 10.2 Developing countries' share of the world market (export) for green beans and cut flowers (*Note* (i) Green beans—Less developed countries: Morocco, Guatemala, Kenya, Senegal, Egypt, Malaysia, Botswana, Ethiopia, Oman, Rwanda, Myanmar, Dom. Rep., Tanzania, Indonesia and Uganda. (ii) Cut flowers—Less developed countries: Columbia, Ecuador, Kenya, Ethiopia, Malaysia, Vietnam, Thailand, Costa Rica, Guatemala, India, Nigeria, Zambia, Tanzania, Zimbabwe and Egypt. *Source* Own calculations based on statistical data from FAO and UN Comtrade)

quality of the products in all links of the value chain. The size and market share of the retail chains in relation to their suppliers in the value chain confirms that market power is indeed concentrated in the retail chains.

In terms of cut flowers, there has been a global trend for several: The production of cut flowers has moved from high-income countries in the West to Africa, South America and Asia, which reduces energy and labor costs. Thanks to the well-developed tourism and aviation industries, it was relatively easy and cheap to send the flowers to high-income countries by plane—often in the cargo hold of passenger planes. Investors, mainly from the Netherlands, established large horticultural companies in the low-cost countries. Environmental legislation was more lenient in these countries, which is another reason for the increase in offshoring to these countries.

Figure 10.2 presents the change in the developing countries' share of the world market (export) for cut flowers from the beginning of the 1990s, which is when the less developed countries began to take an increasing share of world trade from countries in the West.

The increase now seems to have stopped: less developed countries and low-cost countries such as Colombia, Ecuador and Kenya account for approx. 40% of the exports, while western countries, especially the Netherlands, account for 60%. This distribution has been stable in recent years. From the start of 2020 to the end of the period shown, exports from less developed countries fell slightly, which was primarily a consequence of the Covid-19 pandemic.

Looking forward, the trend of a declining market share for the developing countries that began in the late 1900s will not return. Instead, the subsequent trend of an increasing share of the world food market for the less developed countries is likely to continue: An efficient international division of labor and an increasingly globalized world will strengthen the foundation for these countries to achieve an increasing share of the world market for food in the coming years.

10.3 Malthus and Food Supply

It is often debated whether we have reached the point at which food production can no longer keep up with population growth. The recent food crises with sharply rising agricultural and food prices make it relevant to ask this question. The discussion concerns the long-term global food supply and whether we will be able to feed an ever-increasing population. The balance between food production and population growth was

discussed for the first time several centuries ago, and one of the first theories in this area was put forward by Malthus.

Thomas Robert Malthus (1766–1834) was an English economist who was best known for his pessimistic view of the relationship between population growth and food supply. According to Malthus, the amount of food available is decisive for population growth. The population will always have to live on a subsistence minimum because if they got more than this, population growth would just accelerate thereby reducing the amount of food available and forcing the population to live on the subsistence minimum again.

Malthus assumed that food production increases linearly, while population grows exponentially when food is not a limiting factor. According to Malthus, population growth and food production were on a collision course, and an equilibrium would emerge at a level at which the amount of food produced determined the size of the population. Food production per capita will remain constant and the population will live on a subsistence minimum. Malthus's assumptions are illustrated in Fig. 10.3.

According to Malthus, food production is a limiting factor for the population. Malthus's theory was formulated in the book "An Essay on

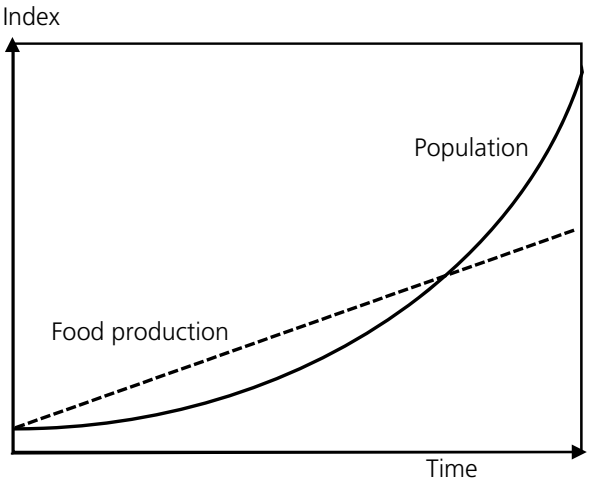


Fig. 10.3 Malthus's assumption about growth in food production and population (*Source* Own production)

the Principle of Population from 1798". Malthus's assumption is still relevant—more than 200 years later, cf. Box 10.1.

Box 10.1 Malthus is Still Relevant—200 Years After His Theory was Published

Was Malthus right?

The answer: He might be, if we don't get our act together... If we don't pay more attention to our farmers, Malthus might come back to haunt us.

(Schuman, 2011)

Malthus foiled again and again

Agriculture has repeatedly met Malthusian watersheds — and has overcome them.

(Trewavas, 2002)

Could Malthus be right after all?

Will Land Degradation Prove Malthus Right After All?

(Wiebe, 2003)

Was Malthus completely wrong?

Malthus was wrong in the Eighteenth Century, and his followers are wrong today

(villysgaard, 2015)

Malthusianism in the twenty-first century

Malthusian theory has not expired and still makes sense …

(Montano & García-López, 2020)

Do Thomas Malthus's words still hold water?

Do we need another green revolution to boost food production and save us from Thomas Malthus's prophesy?

(Gera, 2022)

This time is different! Or is it? Neo-Malthusians and environmental optimists in the age of climate change

Not limited to the food supply, neo-Malthusianism focuses on a wide set of scarcities arising from increased resource consumption and depletion.

(Gleditsch, 2021)

It is fairly easy to show whether the situation in recent decades matches Malthus's predictions about food production and population: The population is increasing at a faster rate than agricultural and food production. Figure 10.4 presents the change in the global population and agricultural and food production in total and per capita since 1961.

The figure clearly shows that the world's total production of both agricultural and food products has increased far more than the world's total population. The production per capita increased by almost 50% from 1961 to 2019.

At the global level, to date, food production has been able to keep pace with population growth. The world has never before produced as much food per capita as it does today. In the years 1961–2010, the average supply of food per person has increased from 2.200 calories per day to over 2.960 calories per day, cf. Fig. 10.5.

As can be seen in Fig. 10.5, food production has kept up with population growth in the last 40–50 years. It is particularly noteworthy that Asia has witnessed such a significant increase, which is due, among other things, to the green revolution that started in the mid-1960s, when new varieties and production methods were developed and introduced. The new types of crops were wheat, rice and corn. In general, East Africa experienced a very slow increase in food supply during the period, although the increase became more rapid from around 1990 onwards.

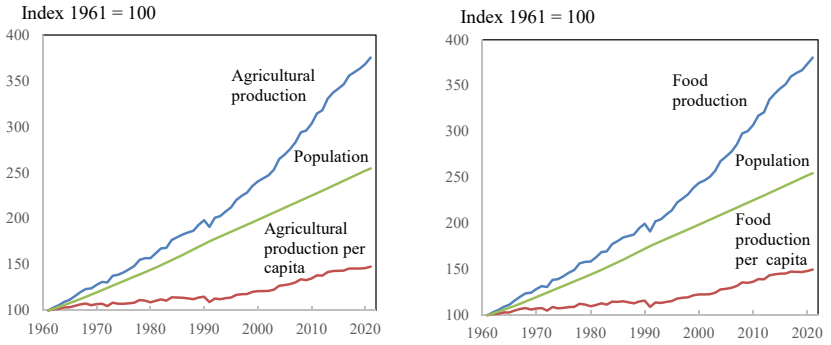


Fig. 10.4 Change in global population and agricultural and food production in total and per capita (*Source* Own calculations based on statistical data from FAO)

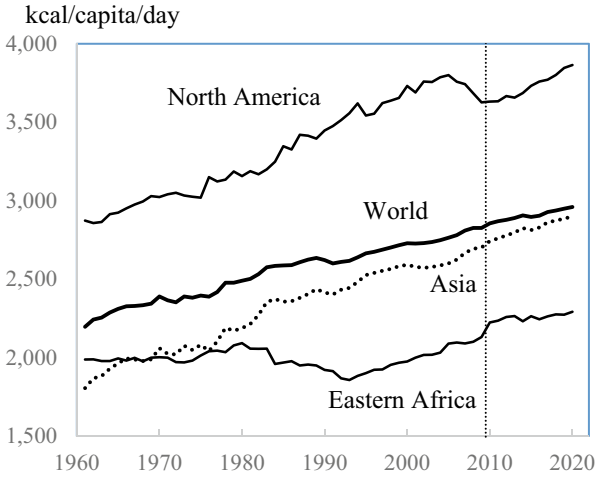


Fig. 10.5 Food supply: Daily calories per capita 1961–2020 in selected regions (*Note* Lack of data continuity in 2009–2010. *Source* Own calculations based on statistical data from FAO)

North America experienced the largest increase in food supply from a level that was already high.

Therefore, it seems that Malthus was wrong—at least for now—although there is no indication that he will be proved right in the near future either. Malthus was unable to explain or predict the future relationship between food supply and population growth due to his two basic assumptions.

Firstly, Malthus assumed that population growth was exponential, but this is not the case as there is a correlation between economic growth and population growth. In the short term, increased income leads to accelerated population growth due to improved health and reduced mortality in the population. However, in the longer term, increased income reduces the number of births, which results in a significant deceleration in population growth.

As can be seen in Fig. 10.6, the number of births decreases with increasing income, and the birth rate has, in general, been continuously falling in the world for the last 60 years.

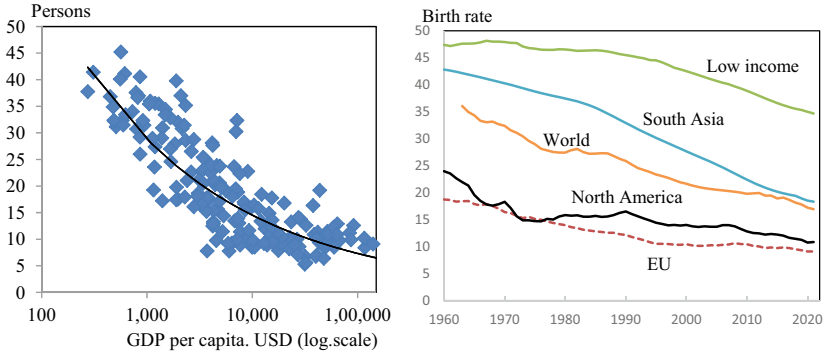


Fig. 10.6 Birth rate, income and trends (*Note* Birth rate: The annual number of live births per 1.000 population. *Source* Own presentation based on statistical data from World Bank)

Figure 10.6 illustrates a significant correlation: the number of births, and thus the population, declines in line with increasing economic welfare (GDP per capita). The figure also shows that the global birth rate halved, on average, during the period. The trend is the same in the five selected regions, but the birth rate is still high in low-income countries.

Similarly, Fig. 10.7 shows that the fertility rate decreases with increasing income, and that the fertility rate is, in general, decreasing worldwide.

Figure 10.7 shows a clear correlation between the fertility rate (number of births per woman) and a country's economic development (GDP per capita) in that the fertility rate decreases with increasing economic development. The figure also shows the point at which the fertility rate = 2, i.e., the point where the population remains constant. In North America and the EU, the fertility rate is below 2, but in these regions, immigration is likely to result in a constant or increasing population.

Another factor that Malthus did not take into account is technological development, which has spurred strong growth in agricultural productivity. Fertilizers, pesticides, plant breeding, economies of scale, advisory services, training, etc., have been significant drivers of increasing production. When Malthus was alive, an individual needed an area of approx. 20.000 m^2 to produce enough food to feed one person (Evans, 1998), today, only 1.800 m^2 is needed (Sect. 9.2), which clearly illustrates the

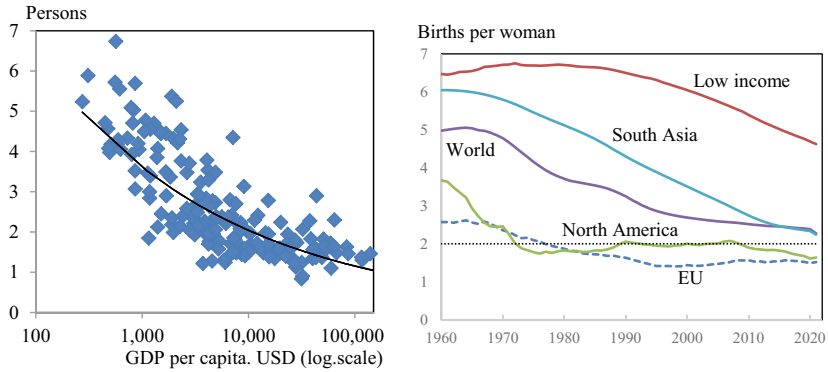


Fig. 10.7 Fertility rate, economic welfare and trends (*Note* Fertility rate: The number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with age-specific fertility rates of the specified year. *Source* Own presentation based on World Bank [2022])

significant progress in agricultural productivity that has been made thanks to technological advances in agriculture since Malthus's time.

The improved food situation in recent decades has largely been achieved by increasing productivity. Since 1961, the world's total grain production has increased by almost 250%. In the same period, the grain area has increased by approx. 15%, which means that the increase in productivity (measured as grain production per hectare) is 200% cf. Fig. 10.8.

The figure indicates that increasing productivity has been decisive in terms of being able to feed a rapidly increasing population in recent decades. As discussed in Sect. 9.5, increasing agricultural productivity can be considered a megatrend.

Because the underlying factors that contradict Malthus's assumptions are relatively stable and persistent, Malthus will probably not be right in the future either. However, as previously discussed there is still some disagreement about the future global food situation, and whether Malthus's prediction will soon be fulfilled is disputed.

Economists and other experts generally agree about demand, i.e., how many mouths will need to be fed in the coming decades. On the other hand, they disagree about the supply side, i.e., by how much agricultural

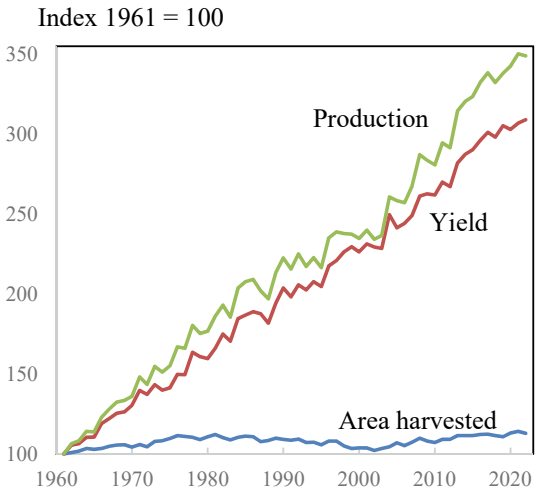


Fig. 10.8 Change in the world's total grain production, area and productivity (*Source* Own presentation based on statistical data from FAO)

production and supply will have to increase in the future. There are many unanswered questions about future food production including whether there is a limit to production and what effect further technological progress will have on our capacity to produce.

As previously discussed, land is a limited resource. Although unexploited agricultural land still exists in the world, technical, economic and environmental barriers will limit the potential to expand the agricultural area. At the same time, urban development, etc., will limit the agricultural area. Increasing productivity is key when assessing the potential for feeding an ever-increasing global population.

Productivity growth will, at some point, slow down as there is some upper limit to how many agricultural goods can be produced on earth. However, several opportunities for increasing food production exist, especially through the transfer of knowhow to developing countries. Improving cultivation methods in the developing countries would facilitate an increase in productivity.

On the other hand, several conditions can/will limit productivity growth in the future such as high input prices, water shortages, the degradation of soil or groundwater, legislation regarding the use of fertilizers, pesticides, biotechnology, etc., and other similar interventions.

High productivity can also lead to harmful environmental externalities as, e.g., fertilizers and pesticides can pollute water resources, reduce biodiversity, etc.

Four types of constraints on productivity growth exist: economic, technical, environmental and legislative.

Overall, the conclusion is that the food situation has improved in recent decades as the average food produced per person has increased worldwide. The prerequisites for increasing the average food produced per capita in the coming years are also present. A continued increase in and dissemination of knowledge in plant breeding, livestock breeding, productivity growth, agricultural management will contribute to increasing agricultural production at a faster rate than population growth.

However, new megatrends and, not least, disruptions such as climate change may be decisive game changers that could make Maslow's predictions more realistic.

Malthus's pessimistic predictions can probably be avoided, but it will require the continual development of efficient and sustainable technologies that can increase the world's total agricultural and food production. It also presupposes the fair dissemination of technological progress and distribution of economic welfare if local or regional examples of the Malthusian theory are not to become reality.

10.4 Food Security

Food security has been defined by the FAO (2008) as follows: "people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life".

Food security encompasses the following four dimensions (FAO, 2008):

- Food availability: The availability of sufficient quantities of food of appropriate quality, supplied through domestic production or imports. Involves the "supply side" of food security. Whether a sufficient amount of food is available is determined by the level of food production, stock levels and net trade.

- Food access: Individuals having access to adequate resources, so they can acquire appropriate foods for a nutritious diet. Involves incomes, purchasing power, expenditure, markets and prices.
- Utilization: How food is utilized through adequate diet, clean water, sanitation and health care, so the individual achieves nutritional well-being, whereby all their physiological needs are met. This emphasizes the importance of non-food inputs in food security.
- Stability: Populations, households and individuals having access to adequate food at all times. This stability is not undermined by sudden shocks such as food crises, unemployment, adverse weather conditions or political instability.

For food security to be realized, all the above four dimensions must be fulfilled.

In recent decades, the level of food security—calculated as the prevalence of malnourishment in the world—has improved. As can be seen in Fig. 10.9, the share of people in the world who are malnourished decreased from 13% in 2000 to 8% in 2018, when it started to increase and reached close to 10% by the end of the period shown. The increase after 2018 was due to the food crisis and an increase in the price of food, which began in mid-2020, extreme weather conditions and drought, and conflicts. In 2021, almost 800 million people were suffering from malnutrition.

Parallel to this, obesity has increased cf. Fig. 10.9.

Obesity is a growing problem in almost all countries. Although it is most serious in the richest countries (America and Europe), it also occurs in some regions of Africa. The connection between income and obesity is far from clear. However, the increase in both malnutrition and obesity in recent years is a paradox.

Ensuring food security in the future will depend on many factors that have an effect in the short or long term. Food security for example depends on the presence of the following biological, technological, economic and political conditions:

- Increasing and improved agricultural and food production achieved through increased productivity, extension services, education, etc.
- Ensuring the construction of adequate infrastructure, value chains, market access, and reducing food loss and waste

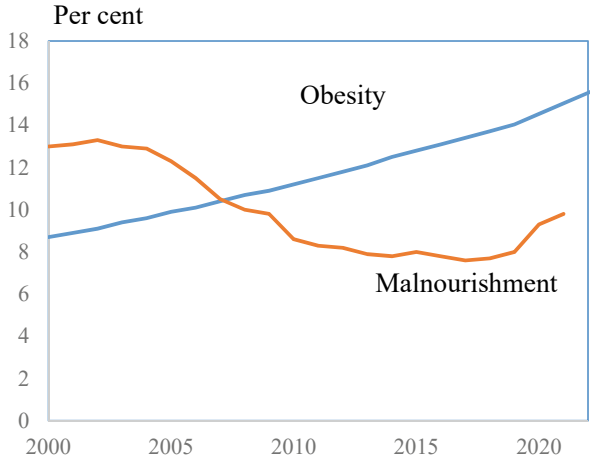


Fig. 10.9 Prevalence of malnourishment and obesity in the world (percent) (*Source* Presentation based on World Obesity Federation [2023], and statistical data from FAO)

- Purchasing power
- Income differences within and between countries
- Food crises and market instability
- International food aid and aid organizations
- International trade and agricultural policy
- Climate change
- Population growth

Population growth is, of course, a significant factor in any assessment of whether food security will exist in the future. Population growth is expected to continue until the 2080s, when the world's population is expected to be just under 10.5 billion, after which a gradual decline is expected. However, the rate of change will differ greatly between continents, cf. Fig. 10.10.

The figure illustrates that the largest increase in population will occur in Africa. By the end of the 21st Century, almost 40% of the world's population will be living in Africa compared to 13% at the beginning of this century.

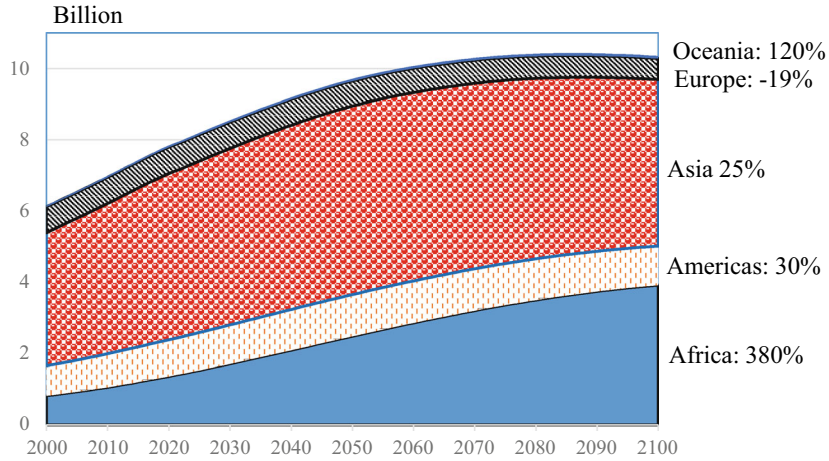


Fig. 10.10 Population growth in 21st Century according to the UN (*Source* Own presentation based on statistical data from FAO)

From a food security perspective, the fact that population growth is so unevenly distributed and is so rapid in Africa is problematic. A major increase in population in regions with a high level of malnourishment is critical for the food security.

Africa's share of the total number of malnourished people in the world increased from 25% in 2000 to 36% in 2021. However, Africa is home to 18% (2021) of the world's population, so the malnutrition challenge is significant in Africa.

In general, future population growth is expected to take place in regions that currently have a high level of malnourishment, cf. Fig. 10.11.

Figure 10.11 illustrates a correlation between the expected growth in population up to 2050 and the level of malnourishment in 2021. The population growth is especially occurring in East, Middle and West Africa, while East and Middle Africa, in particular, have a high level of malnourishment. This correlation, which may encompass several interrelated factors, does not bode well for future food security.

As previously mentioned, increasing production and productivity will play an important role when it comes to future food security. Also in this context, unfortunate correlations can be identified: population growth is especially occurring in areas with low productivity, cf. Fig. 10.12.

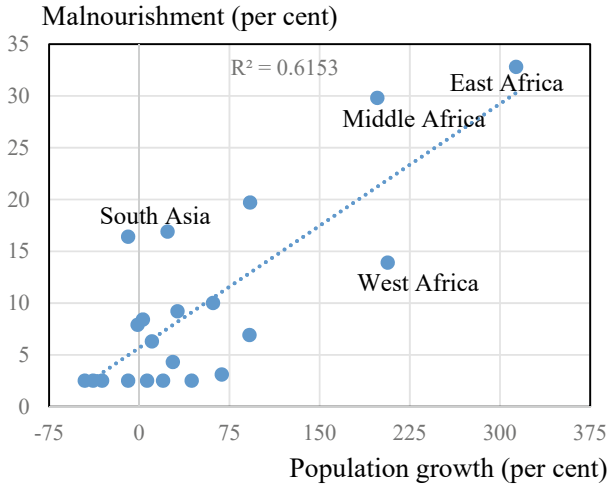


Fig. 10.11 Projected population growth and malnourishment (*Note* Projected population growth [2022–2250] and malnourishment [2021, percent]. *Source* statistical data from FAO)

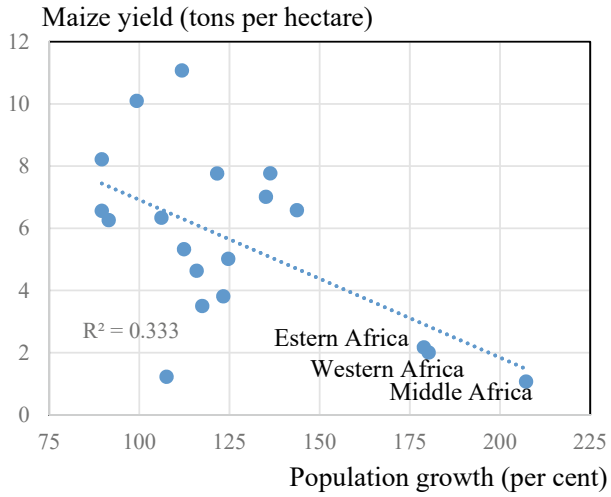


Fig. 10.12 Projected population growth and productivity in maize production (2021) (*Source* Own presentation based on statistical data from FAO)

The low yields may indicate that there is unexploited potential for future increases, or they may be the manifestation of relatively poor conditions for crop production in both the short and long terms. The unexploited potential is probably significant from a purely biological point of view, but exploiting the potential will require significant measures and resources.

10.5 Food Crises

Food crises—in this context, defined as short-term periods of rapidly rising global prices for basic agricultural raw materials—have played a major role in food supply and in the global security of supply. Food crises contribute to hunger, food insecurity and market turbulence. Farms, food companies and other companies in the food cluster will also often be affected by the volatility and unpredictability that follows in the aftermath of a food crisis.

Food crises cannot be characterized as decidedly stable or predictable trends. Nor are food crises systematic fluctuations—cycles—which often occur in agricultural markets.

Food crises are primarily the result of temporary shocks (drought, rising energy prices, etc.), and long-term market conditions (increasing consumption, productivity growth, etc.). These shocks are often exogenous to the agricultural and food sectors, which means that food crises are difficult to predict, as is any longer-term trend.

Despite this unpredictability, it seems likely that food crises will occur again in the future: the question is, therefore, whether food crises are isolated cases, or are there repeated cases where underlying driving forces also in the future will create continuous food crises? If the latter is the case, food crises are likely to also occur in the future, and we will have to adapt to a world with future but often unpredictable food crises.

As can be seen in Fig. 10.13, there have been three serious food crises so far this millennium.

For many decades, the USA has been the most important marketplace for commodities including grains. Therefore, the price change in the USA is considered to be indicative of an international price or a world market price.

The figure presents the change in the price of wheat, which is one of the most important agricultural products for international production and international trade. According to the figure, 4–5 dramatic increases

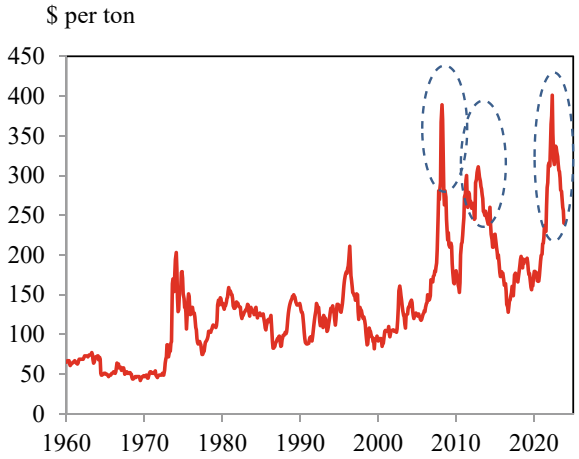


Fig. 10.13 Historical food crises: Wheat prices in the USA, 1960–2023 (*Note* Weighted averages for all types of wheat. Shown as monthly averages in current prices. *Source* Own presentation based on statistical data from USDA)

in price, or food crises, have occurred in the past 50 years. The price increases were relatively short-term, often a maximum of 1–2 years, after which the markets stabilized, so a sustained increase in the price did not occur. Thus, the previous food crises are so-called price bubbles.

In order to understand the emergence and development of food crises, a better understanding of the complexity of price formation and its underlying factors is necessary. For this purpose, the drivers can be divided into five categories depending on the way in which they influence the price. The five categories are as follows: Supply, demand, uncertainty, automatic stabilizers and self-reinforcing conditions (see Fig. 10.14).

As the figure shows, many factors, which may be interrelated or endogenous or exogenous in relation to the agricultural and food sector, may affect the price of agricultural and food products. Drought will typically affect both supply and productivity, and in this case, sustained increases are necessary to meet increasing demand. Some conditions affect prices in an upward direction, others in a downward direction. For a more detailed discussion of the individual points, see Hansen (2013).

In a food crisis situation, drivers in all five categories will play a role. The drivers "stock changes", "bioenergy", "export restrictions", "oil

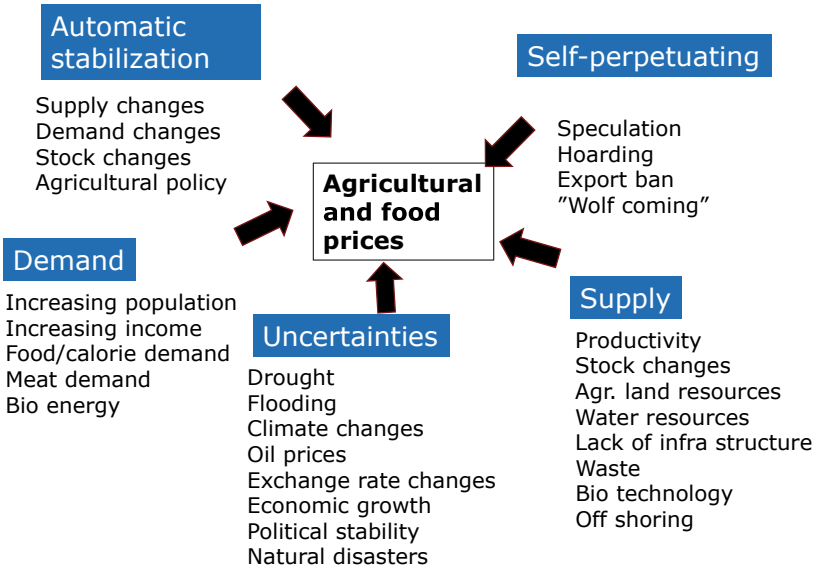


Fig. 10.14 Drivers behind the change in international prices for agricultural and food products (*Source* Own presentation)

prices" and "productivity" are all very important, and their impact on markets and on prices is briefly discussed below.

The size of grain stocks is a very important explanation for the change in the price of grain. To a large extent, the future grain prices can be predicted based on current stocks.

Since the beginning of the 1980s, there has been a clear correlation between the size of grain reserves and international grain prices (see Fig. 10.15).

Stocks are the world's total grain stocks as a percentage of consumption. The price is a weighted average for the USA.

During the food crises (2007–2008 and 2010–2011), grain reserves were very low or declining and only amounted to approximately 17–20% of world consumption. When reserves are low, as they were during the recent food crises and during a period in the mid-1990s, the grain price is typically high.

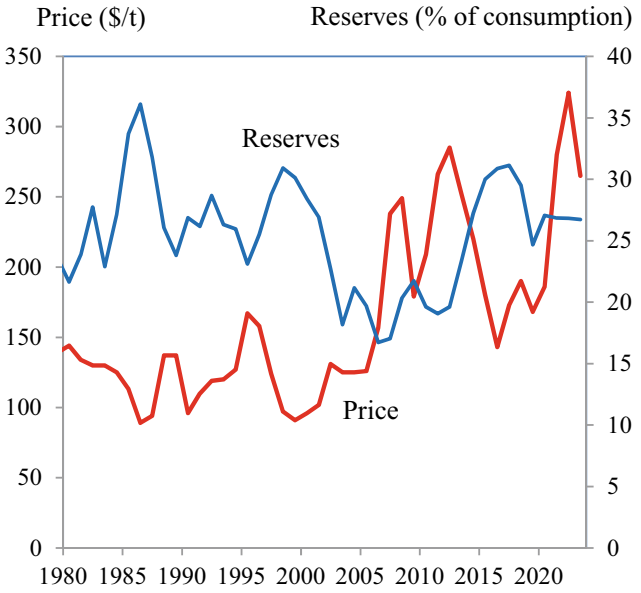


Fig. 10.15 Change in the size of grain reserves and international grain prices (*Note* Reserves: Wheat and coarse grain, Price, Wheat. *Source* Author's calculations based on statistical data from USDA)

Production of bioenergy, or biofuels, which primarily consist of ethanol and biodiesel, was one of the major reasons for the increases in grain price that occurred during the 2007–2008 food crisis.

Bioenergy may also contribute to relatively high grain prices in the future: Biofuels use, to a varying extent, agricultural products as raw materials or compete, at least, with agricultural products for agricultural land. Therefore, there is a close interaction between biofuels, grain prices and food crises.

The production of biofuels has increased significantly since the beginning of the 2000s, and a major share of, e.g., corn production in the USA is now used for energy, cf. Figs. 10.16 and 10.17.

The increase in the total global production of biofuels will probably continue in the future. Even though uncertain factors such as prices for oil, energy and grain have a major influence on the profitability of bioenergy production and despite many political agendas, there is general

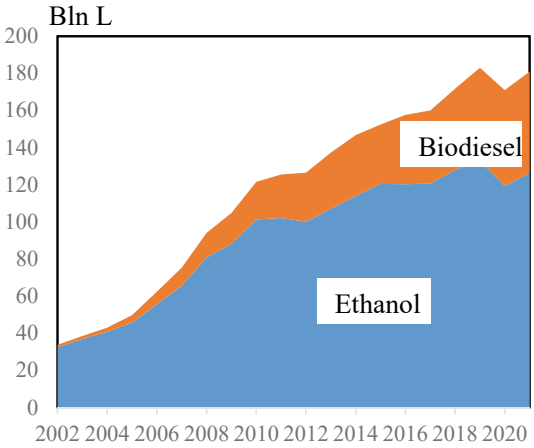


Fig. 10.16 World production of biofuels (*Source* Own presentation based on (OECD & FAO, 2022), and statistical data from USDA)

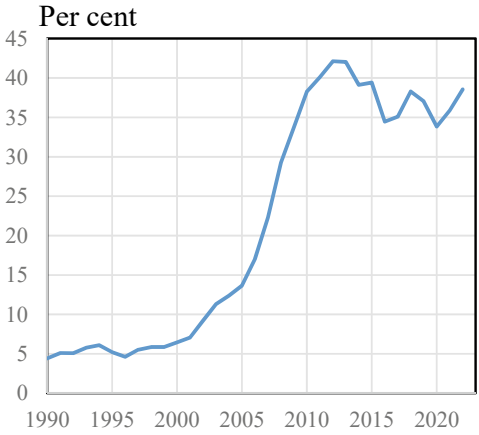


Fig. 10.17 Share of total corn used for ethanol in the US (*Source* Own presentation based on OECD & FAO [2022], and statistical data from USDA)

agreement that bioenergy will continue to have a role in the overall energy supply. This means that bioenergy production will remain a potential driver behind future food crises.

The introduction of export restrictions will also potentially affect prices and thus contribute to a food crisis. Export restrictions may have several purposes and also several consequences for the international agricultural and food markets (OECD, 2010):

- Improving the terms of trade
- Contributing to food security and the stabilization of final consumption price
- Stabilizing intermediate consumption price and developing processing industries
- Increasing public receipts
- Redistributing income
- Stabilizing export earnings

Most importantly, food security and the stabilization of food prices are the specific objectives of export restrictions.

As shown in Fig. 10.14, export ban belongs to the group of self-perpetuating measures, which reinforce the price effects of a food crisis: export restrictions simply reduce the supply on the world market, which pushes prices upwards. At the same time, the normal market mechanism, which usually results in an automatic price stabilization, is decoupled, which results in both higher and more volatile prices on the world market. Conversely, export restrictions can contribute to lower and more stable domestic prices to the advantage of some and to the disadvantage of others.

Studies have shown that export restrictions on agricultural goods became more widespread during the food crises of 2007–2008 and 2020–2011, cf. WTO (2019), WTO (2020). The WTO (2020) concludes that, among other things, export restrictions may increase considerably in times of crisis in the food sector. The data also seem to suggest that some of these restrictions may remain in place for long periods of time even continuing after the period of crisis has ended.

Even though export restrictions go against WTO principles, they are introduced nevertheless, which indicates that the WTO—despite more widespread liberalization and an increasing number of member countries—is unable to prevent the use of export restrictions during food crises. We can expect that export restrictions will also be used in the future, and that they will exacerbate future food crises with increasing and more volatile world market prices.

Oil prices—or more generally energy prices—also have an impact on the prices of agricultural products, especially grain. The prices of oil and wheat follow each other, cf. Fig. 10.18.

For a long period, the correlation between the price of oil and the price of wheat is clear and significant. There are several explanations for

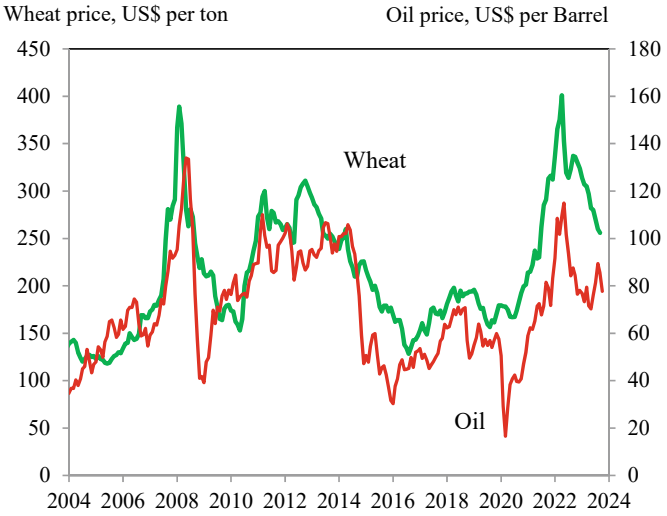


Fig. 10.18 Prices of crude oil and wheat (*Source* Own presentation based on statistical data from FRED and USDA)

the fact that oil and grain prices are connected, and that the correlation has become stronger in recent years:

Firstly, agricultural production is relatively energy intensive. When energy prices rise, the costs of, for example, grain production will also rise, and sooner or later this will result in rising grain prices.

Secondly, grain is also used for energy production. With rising energy prices, it will be more attractive to produce bioenergy based on, e.g., grain. Therefore, the demand for—and thus also the price of—grain will increase when the energy price rises.

"Productivity", which is an important factor and creator of increased production, is a longer-term driver that can also create or prevent food crises. The most recent food crises since 2000 have occurred after a year in which the demand for wheat exceeded the supply, cf. Fig. 10.19.

The figure presents the world's total supply and consumption of wheat. While supply may vary significantly from year to year, demand is more constant. In order to meet increasing consumption—and thus avoid or limit future food crises—increasing production is necessary. With a

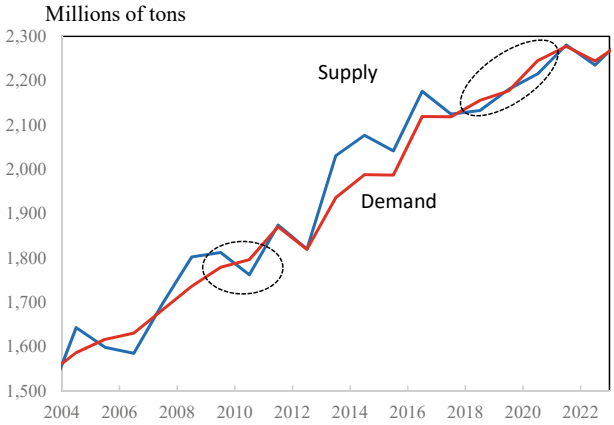


Fig. 10.19 World supply and demand for wheat (*Source* Own presentation based on statistical data from USDA)

relatively constant agricultural area, productivity increases are crucial to ensure increasing production year after year.

Productivity growth thus has two significant effects: Firstly, it contributes to a long-term real price decline for wheat. Secondly, annual changes in productivity—years with falling or sharply increasing harvest yields—will in the short term affect price levels and thereby increasing the likelihood of food crises, cf. Fig. 10.20.

Figure 10.20 illustrates this inverse long-term relationship between price and productivity with wheat production in the USA. A short-term correlation can also be seen where productivity changes—especially declining productivity—affect the price. This indicates that sustained productivity growth is necessary to reduce the risk of short-term price increases and food crises.

In conclusion, assessing the probability of food crises in the longer term is complicated as many factors influence market conditions and the formation of prices for agricultural products. Several of the most important driving forces such as those that helped create the recent food crises are, however, relatively persistent and consistent. Therefore, the probability of more food crises in the longer term is high.

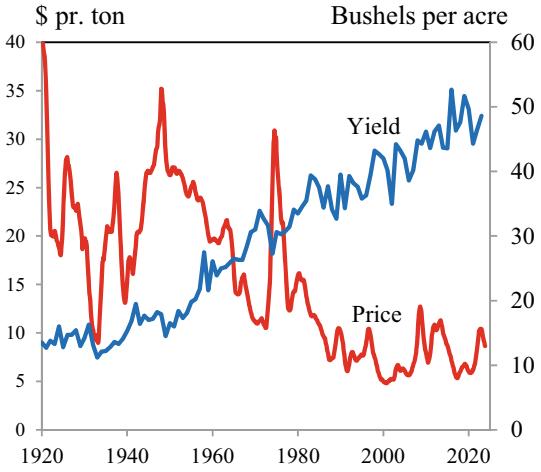


Fig. 10.20 Wheat: Long-term real price change and yield in the USA (*Note* Price is 12-month moving average and deflated with inflation. *Source* Own presentation based on statistical data from USDA)

10.6 Local and Global Food Supply

Agricultural and food markets are evolving and there are many trends some of which counteract each other. New consumer segments are emerging and growing, inspiration from foreign food cultures is creating new demand, and international marketing are also having an effect on the markets.

Two opposing trends have emerged in the agricultural and food markets in recent years: On the one hand, there is a clear trend toward more globalization, liberalization and more similar international consumer demands are increasing. Globalization implies greater international trade, larger transnational companies and more movement across national borders in terms of capital, labor, knowledge, etc.

With globalization, the raw materials will be bought in whichever country they are cheapest, and thus the localness will be diluted or disappear. In this way, producers and consumers can "shop around" and find the cheapest or best goods from anywhere in the world.

A distinct trend is that the foods must be of uniform quality everywhere in the world, and they must fit into the food industry's or retail's global brand strategy. The focus is on large-scale operations with marketing via global advertising and global branded goods. Technological

development and mass communication make it easier to market products on international markets, which means we get more uniform products.

Retail trade is also becoming increasingly international with an increasing share of their turnover taking place in foreign countries. Although some adaptation of the product range occurs in response to the demand of the individual countries, in general, the food supply will be characterized by uniformity due to the internationalization of the retail trade.

The increasing global supply can be easily demonstrated empirically as it is illustrated by the growth in international trade, the internationalization of retail chains, etc.

On the other hand, a number of market and consumer trends toward a greater focus on the local, close and original are becoming increasingly important. Some consumers are demanding food that is produced and sold in the local area. This is not a new trend, but it has intensified in recent years.

The growing awareness of local food is an international trend, although it is generally a niche segment.

The demand for local food may be a counter reaction to the increasingly globalized and industrialized food supply. The demand for local food encompasses a desire to get back to the roots. This new trend is also closely related to consumers' desire for traceability in that some consumers prefer to be able to trace their food back to the individual farmer who produced it.

Some characteristics of the local and global food supply are illustrated in Fig. 10.21.

Global foods	**Local foods**
Exotic foods	Traceability
Processed foods and convenience	Origin
Long value chains	Fresher, more flavorful food
Global sourcing and marketing	Eating more seasonally
Globalization	Concern for local community
Global producers and retailers	Short value chains, reduce "food miles"
Low prices	Farm shops
	Political consumers
	Willingness to pay

Fig. 10.21 Some characteristics of the local and global food supply

Many retail chains have adopted this trend: They try to profile themselves in this segment, and they get access to more unique products than perhaps their competitors have. At the same time, the retailers place themselves in a stronger market position: Whereas they previously depended on a few large food suppliers, they now have access to several smaller suppliers, which gives the supermarkets a much stronger position in the value chain. Therefore, the supermarket chains strengthen their negotiating position and gain greater market power by increasing their focusing on local food.

Several studies have demonstrated an increasing trend with regard to local and regional food, farm shops, local sourcing, consumer preferences for locally produced food, etc., cf. Low et al. (2015), Hestermann and Horan (2017), Martinez (2021) and Sindal (2019). However, empirical analyzes of the change in the demand for local food are scarce because local foods are not particularly well defined. National and local foods are often equated, while in other cases, in order that a product may be labelled local food, the producer must demonstrate that there is a close connection and short geographical distance from the site of production to the location of the sale. Finally, the food supply will in many cases be local or national without there being an explicit preference or demand for local food.

Also on the supply side, initiatives that increase the focus on local products have been developed: Small local dairies and microbreweries are often established based on a local identity. The producers have attempted to differentiate their products from the large global brands, and have placed greater emphasis on proximity to the manufacturer, local characteristics, etc. The products may partly meet local demand, but they may also be sold on international markets with a "local identity or history" or a regional label. Therefore, local products are sold internationally.

Farmers' direct sales to consumers via, among other things, farm shops is also an indicator of preferences for local supply. According to Augère-Granier (2016), on average, around 15% of EU farmers sell more than half of their production directly to consumers. However, this mainly applies to small holdings. There are significant differences between countries: the share of holdings involved in direct sales is almost 25% in Greece, 19% in Slovakia and around 18% in Hungary, Romania and Estonia, but it is less than 5% in Malta, Austria and Spain.

The major differences between countries indicate that the viability of selling directly to consumers is influenced by several factors: during

economic growth and industrialization of the value chains, central distribution centers, retail chains and international trade become more important. As a result, farmers' direct sales to consumers are less significant. At a later stage, the demand for a local identity, traceability and close proximity becomes increasingly important—cf. Maslow's pyramid of needs—and thus preferences for local foods increase.

Factors other than economic growth are also important including the industrialization of agriculture, cultural conditions, infrastructure, etc.

However, there are examples of governments or producers arguing for local food and shorter value chains in an attempt to protect domestic agricultural production and domestic farmers, but this is just protectionism and not in itself an argument for local food.

With regard to predicting how the trend for local food will develop in the future, the starting point is to recognize that the trend toward a greater focus on local food is one of several trends, and that it is probably only a niche. Some farmers may increase their profitability by switching to local production in collaboration with food companies or retail chains. The question is, however, whether such partnerships are equal and sustainable in the long term.

Problems connected to climate change will probably be an even stronger driver in the future, and they may spur the development and reinforce the demand for local food due to reduced transportation costs and negative effects on the climate.

Local and global food supply can easily coexist, and it is not a question of either one or the other. Both local and global supply meet a demand, and both will be present in the future. The question is what the balance between local and global food supply will be in the future.

The balance will depend on both the supply and demand side:

On the supply side, the extent to which the supply of foreign goods is limited on domestic markets will depend on the number of technical, economic and political trade barriers in place.

On the demand side, the extent to which consumers have a preference for local food will be decisive. Sometimes anti-globalization waves or backlashes occur whereby consumers seek out food with greater traceability and transparency regarding the underlying production process. This demand is also supported by widespread national marketing in which food produced on the domestic market is given a special status and value. If the anti-globalization wave is long-lasting and intensifies, it can

be expected to spur the demand for local food. Finally, the geopolitical situation will also be a significant factor in this connection.

References

Augère-Granier, M.-L. (2016). Short food supply chains and local food systems in the EU (Briefing PE 586.650). European Parliamentary Research Service. European Parliament. https://www.europarl.europa.eu/RegData/etudes/BRIE/2016/586650/EPRS_BRI(2016)586650_EN.pdf

Evans, L. T. (1998). *Feeding the ten billion: Plants and population growth*. Cambridge University Press.

FAO. (2008). *An introduction to the basic concepts of food security*. https://www.fao.org/3/al936e/al936e00.pdf

Gera, I. (2022, May 27). Do Thomas Malthus's words still hold water? Business Standard. https://www.business-standard.com/podcast/economy-policy/do-thomas-malthus-s-words-still-hold-water-122052700061_1.html

Gleditsch, N. (2021). This time is different! Or is it? NeoMalthusians and environmental optimists in the age of climate change. *Journal of Peace Research, 58*(1). https://doi.org/10.1177/0022343320969785

Hansen, H. O. (2013). *Food economics: Industry and markets*. Routledge.

Hestermann, O. B., & Horan, D. (2017). *The demand for 'local' food is growing—Here's why investors should pay attention*. https://www.businessinsider.com/the-demand-for-local-food-is-growing-2017-4?r=US&IR=T

Low, S. A., Adalja, A., Beaulieu, E., Key, N., Martinez, S., Melton, A., Perez, A., Ralston, K., Stewart, H., Suttles, S., & Jablonski, B. B. (2015). Trends in U.S. local and regional food systems. USDA, Economic Research Service. https://www.ers.usda.gov/publications/ap-administrative-publication/ap-068

Martinez, S. (2021). Local food sales continue to grow through a variety of marketing channels. USDA, Economic Research Service. https://www.ers.usda.gov/amber-waves/2021/october/local-food-sales-continue-to-grow-through-a-variety-of-marketing-channels/

Montano, B., & García-López, M. (2020). Malthusianism of the 21st century. *Environmental and Sustainability Indicators, 6*, 100032. https://doi.org/10.1016/j.indic.2020.100032

OECD and FAO. (2022). OECD-FAO agricultural outlook 2022–2031. *OECD Publishing*. https://doi.org/10.1787/f1b0b29c-en

OECD. (2010). The economic impact of export restrictions on raw materials. *OECD Publishing*. https://doi.org/10.1787/9789264096448-en

Schuman, M. (2011, July 15). Was Malthus right? *Time Business*. https://business.time.com/2011/07/15/was-malthus-right/

Sindal, H. (2019). *Lokale varer: Nærheden er lige til at spise*. https://samvirke.dk/artikler/lokale-varer-naerheden-er-lige-til-at-spise

Trewavas, A. (2002). Malthus foiled again and again. *Nature, 418*, 668–670. https://www.nature.com/articles/nature01013.pdf
villysgaard. (2015). *Was Malthus completely wrong?* https://mereconomics.com/2015/12/07/was-malthus-completely-wrong/
Wiebe, K. (2003). Will land degradation prove Malthus right after all? USDA, Economic Research Service. https://www.ers.usda.gov/amber-waves/2003/june/will-land-degradation-prove-malthus-right/
World Bank. (2022). *Water in agriculture*. https://www.worldbank.org/en/topic/water-in-agriculture
World Obesity Federation. (2023). World Obesity Atlas 2023. World Obesity Federation. https://data.worldobesity.org/publications/WOF-Obesity-Atlas-V5.pdf
WTO. (2019). World Trade Report 2019. The future of services and trade. World Trade Organization. https://www.wto.org/english/res_e/booksp_e/00_wtr19_e.pdf
WTO. (2020). *WTO report finds growing number of export restrictions in response to COVID-19 crisis*. https://www.wto.org/english/news_e/news20_e/rese_23apr20_e.htm

CHAPTER 11

Disruptive or New Potential Trends

11.1 Introduction

In this book, approx. 80 megatrends have been identified. Most of them can be shown empirically, and it has been possible to make fairly confident predictions about whether they will continue in the future. However, some are more difficult to document statistically, although the underlying drivers can be identified and explained. Others are cyclical or come in waves. In many cases, economic theories, e.g., supply and demand and economics of scale can be applied to support the assertion that they are stable trends that will continue.

All the identified megatrends will continue as long as no major unforeseen disruptive events occur. Unexpected game changers can alter the course and direction of historical megatrends.

Finally, new megatrends will probably emerge, i.e., future global trends with no long-term historical roots.

H. O. Hansen, *Megatrends in Agriculture, Food Industry and Food Markets*, Palgrave Advances in Bioeconomy: Economics and Policies,
https://doi.org/10.1007/978-3-031-58152-6_11

This chapter discusses selected and potential future disruptions, i.e., incidents which may destroy or fundamentally change previous mega-trends. Disruptions can be divided into the following categories:

- Economic-political
- Trade-based
- Technological
- Nature-based

Economic-political disruptions include relations between countries which are self-created and which can be controlled and influenced. In extreme cases, disruptions may include or create geopolitical conflicts such as war or the threat of war in parts of the world.

Trade-based disruptions involve fundamental changes to the current international trading system resulting in globalization in the form of trade between countries being significantly reduced. Countries and regions are becoming more self-sufficient, and in this respect, agriculture and food play a central role. Fundamental changes to the international trading system are often the consequence of economic, political or natural disruptions.

Technological disruptions include advances in technology. New and more efficient ways of producing agricultural and food products may be developed, thereby making traditional production systems redundant. Disruptions may also take the form of changes in resource allocation such as robotics, artificial intelligence (AI), value chain integration, blockchain, etc. Technology may replace and reduce the use of labor—mostly unskilled labor—and agricultural land.

Environmental disruptions include natural disasters, pandemics, climate change, etc., which means they are primarily external and cannot be prevented—at least not in the short term.

The scope and the potential impact of the disruptions presented above may vary widely.

11.2 The End of Globalization?

Are we facing the end of globalization? This question has been asked many times recently, cf. for example Box 11.1.

Box 11.1 Statements and assessments regarding the future of globalization

The end of globalization? Business leaders face significant risks if the world becomes more fragmented (Girod, 2016)	Globalization is not slowing or stalling. Rather, it is evolving, driven by trade in human skills, knowledge and ingenuity (WTO, 2019)
It's the End of Globalization as We Know It (and That's Probably Fine), But it doesn't mean we're entering an era of deglobalization (Lincicome, 2022)	**There are strong signals that the era of globalization is coming to an end** (Keller & Marold, 2023)
Deglobalization is a short-term trend, we will get back to our old numbers Virtual roundtable speakers are optimistic about our global future but say it will take on a different form (Bris, 2020)	**Is globalization dead?** If World War One didn't stop globalization, if World War Two didn't stop globalization, what makes you think the war between Ukraine and Russia is going to stop globalization? (Friedman, 2022)

Source Selected headlines and extracts from cited sources

The simple answer to the question is that there are no clear signs of declining globalization in the agricultural and food industry: international trade in agricultural goods is on the increase while agricultural support in the OECD is on the decline and is now at its lowest level since 1986—both of which are important factors in supporting globalization when it comes to agriculture, the food industry and food markets, cf. Fig. 11.1.

The figure reveals two trends:

International trade in agricultural goods (measured as a percentage of total agricultural production) is increasing from year to year. The long-term trend is relatively clear, although a decline occurred in some years. For example, international trade decreased in 2020, which was largely due to the Covid-19 pandemic and the resulting disruption to the global transportation of goods. However, the long-term development indicates that the share of the world's agricultural production that is traded on an international market will increase.

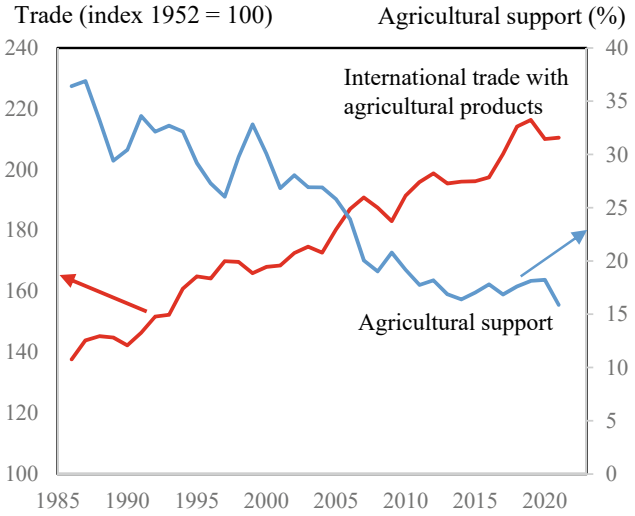


Fig. 11.1 Agricultural support and international trade in agricultural products, 1986–2021 (*Source* Own presentation based on statistical data from OECD and WTO)

Agricultural support in the Western World has exhibited a downward trend in recent decades. In 2022, agricultural support amounted to, on average, just under 13% of total agricultural turnover, which is the lowest level in the period shown and is less than half the level it was in 1986. Low agricultural support and trade liberalization strengthens the conditions for international trade and means that globalization is likely to increase.

Globalization includes more than just international trade. Foreign direct investments are also part of globalization, and despite the occurrence of annual fluctuations, which are often the result of macroeconomic or political instability, they are also increasing in agriculture and the food industry and indeed in all industries combined.

Although the trends indicate continued globalization in the future, the following political conditions may limit or reverse globalization in the short or long term:

- Tension between current and potential superpowers increases uncertainty and risk in international trade and especially in investments abroad.
- Food crises, expensive food and sometimes a lack of food encourage politicians and others to push for for greater self-sufficiency and protectionism.
- The climate crisis may make international trade over long distances less attractive.
- Higher energy prices, which are likely to be a long-term condition, will favor local sales and inhibit international trade.

Considered over a very long-time horizon, the extent and importance of globalization have varied significantly. During economic recession, world wars and global crises, globalization decreases in terms of the importance of international trade. After World War II, production, economic activity and international trade increased. The end of the Cold War and the fall of the Berlin Wall, increasing trade liberalization and an increase in the number of market economies in the 1990s gave further impetus to globalization.

In contrast, in this millennium, the financial crisis, pandemics, wars and increasing protectionism have dampened globalization. The various phases of globalization are outlined in Fig. 11.2.

The figure indicates that whether globalization including increased international trade and cooperation will continue in the future is not a foregone conclusion. Deglobalization, slowbalization or reduced globalization occurred after the financial crisis, and the geopolitical situation, the extent of protectionist interventions, etc., may further reduce globalization in the coming years.

The overall assessment is that "the end of globalization scenario" would be extremely disruptive and would interfere with many existing political and market megatrends. However, as liberalization and increasing international trade contribute to greater economic welfare, no country will have an economic incentive to change the trend. Nevertheless, there is always the possibility that political interests will lead to changes, cf. Sect. 11.2.

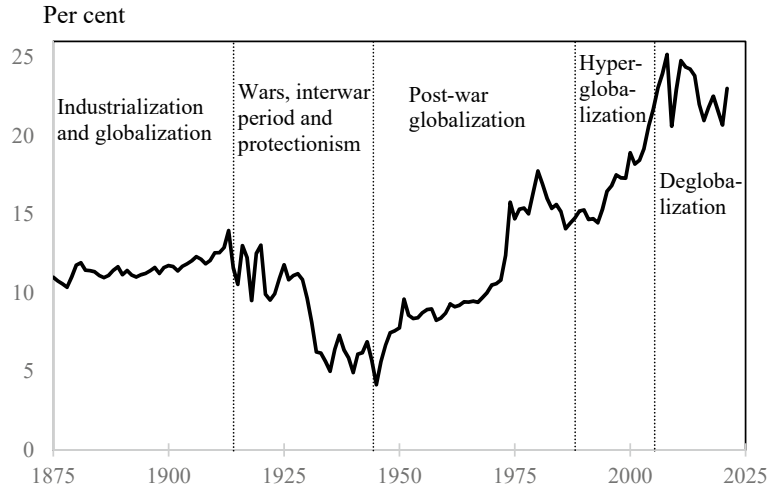


Fig. 11.2 Value of exported goods as share of GDP, 1875–2022 (*Source* Own presentation based on Fouquin and Hugot [2016], Keller and Marold [2023] and statistical data from FAO and World Bank)

11.3 Geopolitical Instability and Disruptions

The current geopolitical situation is typically considered when companies analyze the attractiveness of markets. The presence of political instability including political interventions and barriers may be decisive for a company's decision about whether to export to or invest in a country.

Political conditions, including geopolitical conditions and disruptions, are important for agriculture, the food industry and food markets. The following two factors are especially important:

- Food is a very basic necessity, which means that access to markets, supply chains and infrastructure is crucial for daily deliveries of food—and thus crucial for people's survival. Geopolitical instability and disruptions can destroy these supply chains.
- Political trade barriers, protectionism and national interests in the security of supply are likely consequences of geopolitical instability.

Therefore, geopolitical instability is both a likely and an effective disruption, which will affect megatrends in agriculture, the food industry and food markets.

Quantifying, comparing and not least predicting geopolitical instability and disruptions is a difficult task. The degree of instability is often a subjective assessment, and the factors behind instability may be random or irrational. However, Fig. 11.3 indicates that instability—calculated as deaths in state-based conflicts around the world—has been decreasing in recent decades.

The figure shows that since the Second World War, there have been three peaks in war deaths: the Korean War (early 1950s), the Vietnam War (around 1970) and the Iran–Iraq and Afghanistan wars (1980s). The 1990s and 2000s witnessed relatively few war deaths. However, there has been a recent increase in war deaths as a result of conflict in the Middle East, particularly in Syria, Iraq and Afghanistan. Russia's invasion of Ukraine resulted in a large increase, although the real numbers are uncertain.

When certain time periods are examined in more detail, some interesting patterns can be identified.

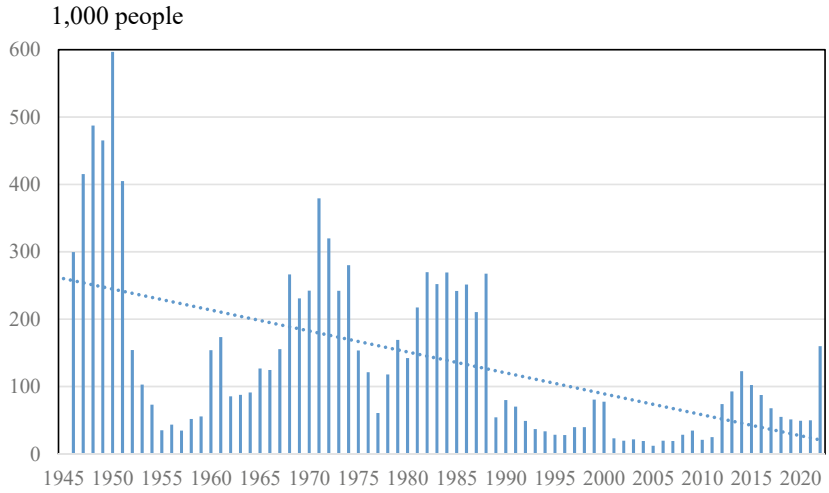


Fig. 11.3 Deaths in state-based conflicts in the world (*Source* Own presentation based on Herre et al. [n.d.] and own estimates for 2021 and 2022)

The 1990s witnessed relatively few war deaths, and it was also a geopolitically relatively stable decade with no major international conflicts, despite the fact that some major changes occurred. The Berlin Wall had just fallen and Germany was reunited. The former Eastern European countries were democratized and integrated into international trade. However, the decade was also characterized by war in the former Yugoslavia. More than 150,000 people were killed, many more injured and millions of people displaced from their homes in the wars from 1991 to 1999. However, these were primarily local wars which did not involve any significant interference from the major powers.

The EU was enlarged from 12 to 15 members. China began a period of great economic growth. Offshoring from the West to Asia, especially China, reduced costs and inflation was low. IT development and digitization created further growth.

Regarding agriculture and food, a continued increase in trade liberalization and increasing international trade was evident. In 1994, NATO confirmed that other European countries could join the alliance, and over the next 10 years, 7 new European countries became NATO members. This expansion and subsequent negotiations with former Soviet Republics affected the balance of power, strengthened the US's position as a superpower, but also probably contributed to subsequent geopolitical instability starting with Russia's invasion of Crimea in 2014.

Therefore, the 1990s were a stable decade. However, in retrospect, it was not a new normal situation in balance. The following years were characterized by international terrorism, wars and a change in the balance of power. Several observers even predict that the coming decades also will be characterized by increasing international instability and turbulence, cf. for example Zeihan (2022) and Turchin (2016).

With the development in recent decades, the general expectation is that the distribution of power between nations is changing: We are in a transition from what was a more or less unipolar world to a much more bi- or multipolar world. Figure 11.4 presents a schematic and simplified illustration of the current distribution of power in recent decades.

The figure shows that the USA's position as the sole superpower ended in the 2010s. What had previously been a unipolar system was initially replaced by a bipolar system, which may develop into a multipolar system.

Unipolarity means that one single nation is superior to the others in terms of power as it possesses a significant share of global resources. In a bipolar system, two superpowers compete, while in a multipolar system,

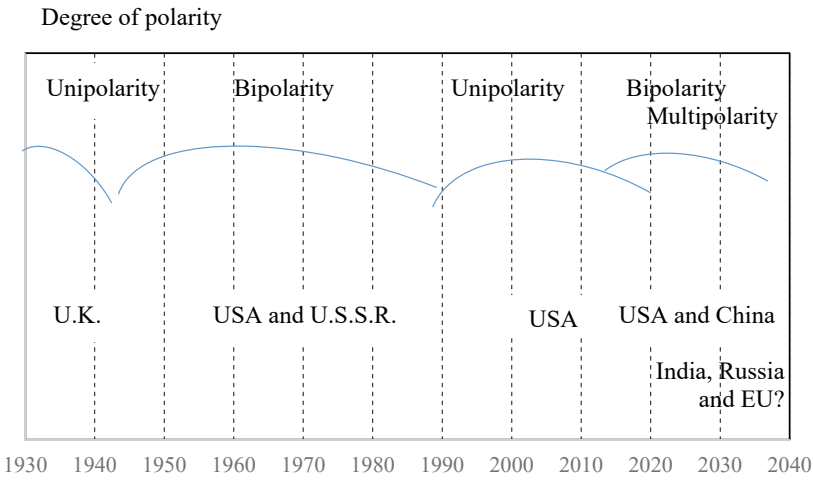


Fig. 11.4 Power distribution among states and polarity: Schematic and simplified illustration (*Source* Own presentation)

three or more almost equal superpowers compete. Multipolarity means a balance between several powers, none of which manages to dominate the others. In such a situation, countries will theoretically strive to achieve a dominant role. However, the degree of superpower is always discussed and cannot be objectively determined.

Being a superpower means that the country is able to influence the actions of other countries or regions. This ability, hegemony, is the result of several strengths:

- Economic: Large GDP, large share of international trade and investments
- Political: Strong leadership, credibility and influence
- Military: Military expenses, army size
- Cultural: Dominance of media and cultural products
- Technological: Engineering, IT, artificial intelligence
- Demographic: Population
- Natural Resources: Land, energy, minerals
- Alliances: Membership of economic, political or trade alliances

The strengths listed above are very different and can be difficult to quantify, compare and, not least, balance. However, any potential change in the balance of power and a possible transition from a unipolar to a bipolar or multipolar system can be inferred by comparing economic, military and trade key figures:

In 2017, China overtook both the USA and the EU in terms of gross domestic product (GDP) calculated as purchasing power parity (PPP). China has the world's largest economy, and the gap between both the USA and the EU has subsequently increased considerably, cf. Figure 11.5. China's economic size implies that the country can influence the world economy through its economic growth, consumption, foreign investment, etc.

In terms of military strength, which is also an important characteristic of a superpower, the USA is dominant. The US's total military expenditures are almost 3 times as large as China's, which has the world's second largest military expenditures, cf. Figure 11.6. Military expenditure does not say anything definitive about, e.g., the military's effectiveness, number of soldiers, superiority or alliance cooperation, but it is nevertheless an important indicator. It is worth noting that China's military expenditures have increased significantly since the early 2000s.

Foreign direct investments (FDIs) may also reinforce the position of a superpower. Through FDIs, a country can influence the development of foreign companies and countries. Small countries will typically have a relatively large number of FDIs, while large countries will have relatively few.

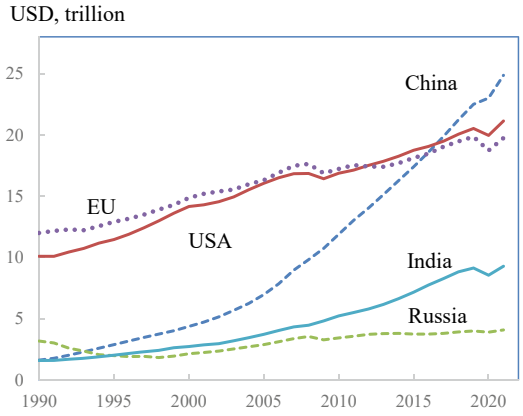


Fig. 11.5 GDP, PPP (constant 2017 international USD) (*Source* Own presentation based on statistical data from World Bank)

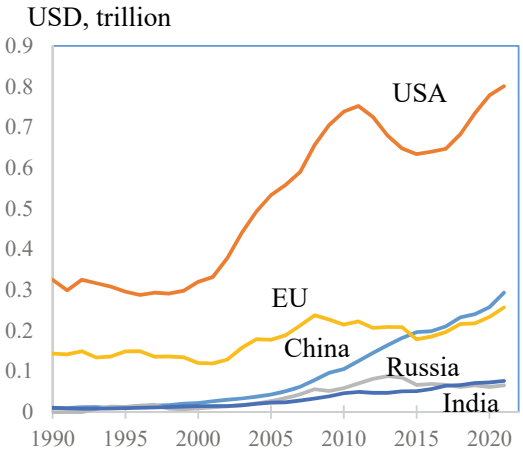


Fig. 11.6 Military expenditure (current USD) (*Source* Own presentation based on statistical data from World Bank)

Therefore, collectively, the EU countries have a relatively large number of FDIs, although many are located in other EU member states. In terms of FDIs, China has experienced major growth in recent years, and the number of FDIs is now approaching the level of the USA, cf. Fig. 11.7.

The external balance on goods and services is a key figure, which indicates the economic maneuverability of countries. Developments in recent decades reveal two trends in the world's largest economies: China

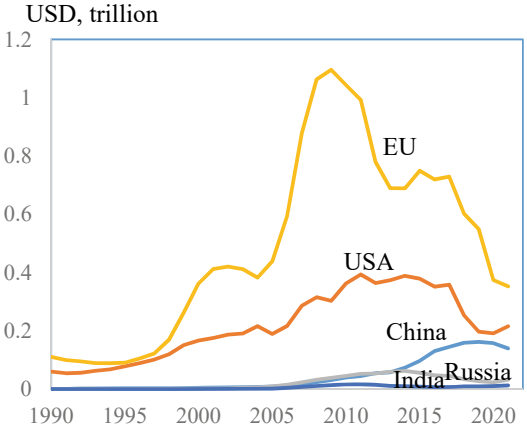


Fig. 11.7 FDIs, net outflows (BoP, current US$) (*Source* Own presentation based on statistical data from World Bank)

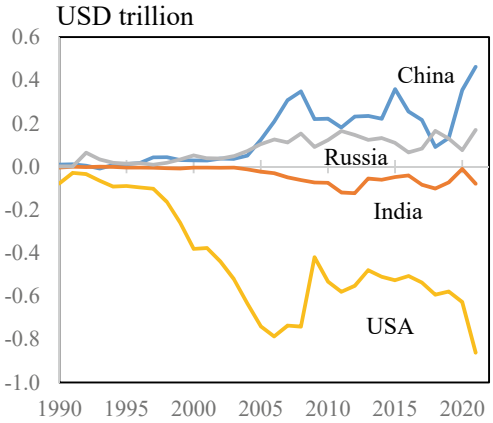


Fig. 11.8 External balance on goods and services (current US$) (*Source* Own presentation based on statistical data from World Bank)

is increasing its trade surplus, while the USA is increasing its trade deficit, cf. Fig. 11.8. The trade between the two countries is the main reason for the different developments in the two countries, which leads to the following conclusions:

- In general, China is the most internationally competitive of the two countries.
- The USA and China are highly dependent on each other when it comes to trade.
- The USA rather large trade deficit must be seen in the context of the free trade agreements that the USA has entered into—and will enter into in the future.
- Large differences in the countries' trade balances may contribute to instability in the world economy.

China's role in international trade has also increased significantly in recent decades: As early as 2006, China overtook the USA as the world's most significant player in international trade cf. Fig. 11.9. China now accounts for almost 20% of the world's total imports and exports, and the country is the world's largest importer and exporter. This situation is a consequence of China's strong international competitiveness, and it strengthens China's role and importance in the world market and when it comes to international trade policy.

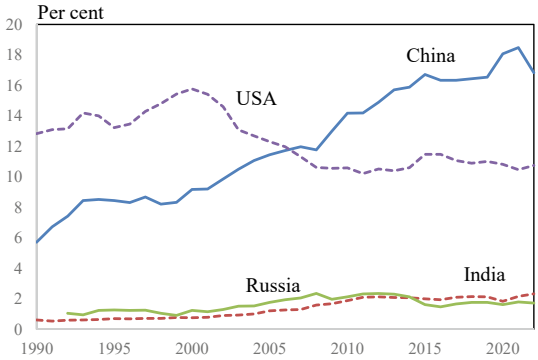


Fig. 11.9 Share of total world trade (export + import) (*Source* Own presentation based on statistical data from FAO)

With regard to international food trade, the USA and the EU are the largest players with almost the same share of the world market, but with a slightly decreasing or stagnant share of the world market. China is the third largest player in the world food market, but its world market share is increasing rapidly, cf. Fig. 11.10. China has changed from being a net exporter to a net importer of food (2004), and in 2021, the country was the world's largest importer and net importer of food.

This means that China has a great interest in maintaining a stable and well-functioning world market: Firstly, because China is the world's leading exporter and importer, the country is dependent on international trade. Secondly, China has a great economic and political interest in

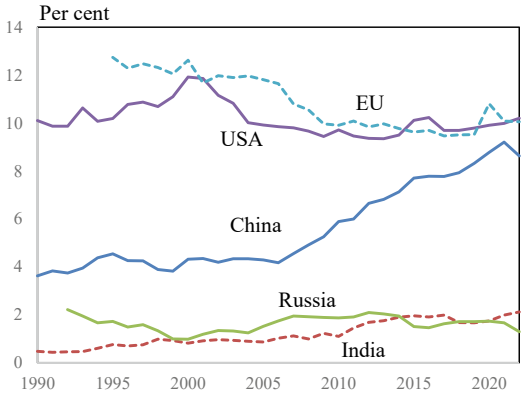


Fig. 11.10 Share of total world food trade (export + import) (*Note* EU is extra-EU trade. *Source* Own presentation based on statistical data from FAO)

ensuring access to a well-functioning international food market that can meet its import needs.

Predicting the future geopolitical power balance is difficult, as many factors contribute to the development of a superpower. Historically, power balances have changed continuously, and the development so far indicates changes in both the short and long term. Several countries are challenging the hitherto unipolar world system: Countries such as China, Russia, India and Turkey want to increase their geopolitical role, and China is considered a superpower parallel to the USA. The BRICS alliance (Brazil, Russia, India, China and South Africa) is building increasing political and financial platforms and aims to provide an alternative to Western leadership. The political, military and economic role of the EU is also increasing.

This means that a long-term period of geopolitical stability without disruption, which we experienced from the beginning of the 1990s until the beginning of the 2000s, is not expected in the future.

Instability and disruptions can also be considered a dynamic development, so it can be both positive and negative—depending on one's role and position. Ongoing changes to the hierarchy and the balance of power are natural events. It is unfortunate that such shifts in power may lead to economic, political or military disruptions to the detriment of humanity as a whole.

11.4 From Retail to E-Commerce

As discussed in Sect. 4.8, substantial structural changes and waves have occurred in food retail, and they can be expected in the future. One potentially significant wave is already in its infancy: e-commerce, or e-trade or online trade, whereby trading in large parts of the value chain—including the present retail link—takes place electronically. If this wave continues to grow and perhaps becomes dominant, it will disrupt the entire value chain.

Box 11.2 Definitions
Retail is the sale of goods at a physical location, where the seller and the buyer meet in person.

E-commerce is the buying and selling of goods on the Internet, so it includes a broad set of activities such as e-tail, electronic financial services, mobile commerce, etc.
E-tail or e-tailing is an abbreviation of electronic retailing and refers to selling retail products and services on the Internet.

If this does occur, the importance of retail trade as physical logistical centers where customers physically turn up to buy food will decline. Instead, digital companies such as Alibaba and Amazon will expand and change the retail landscape.

The significance of e-commerce is increasing and will continue to increase in the future according to the studies that have been carried out. The extent of the growth varies between countries, but the trends are relatively uniform.

E-commerce is especially important when it comes to B2B, while B2C in the food and beverage categories is low. However, the Covid-19 pandemic did result in changes and strong growth in online grocery retailing, from which there seems to be no turning back, cf. for example McKinsey (2022).

Data from the USA illustrates these trends and patterns, cf. Figs. 11.11 and 11.12.

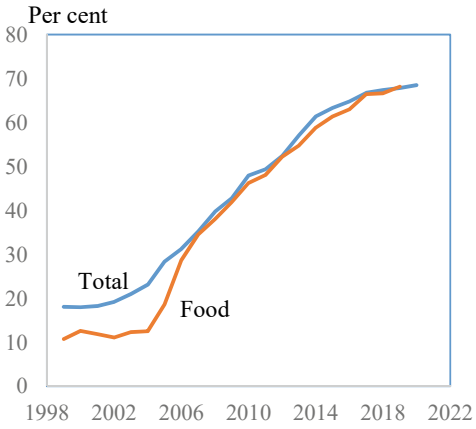


Fig. 11.11 Food and total E-commerce (food and total manufacturing) as a share of total sales: US Manufacturing Shipments (*Source* Own calculations based on statistical data from the United States Census Bureau)

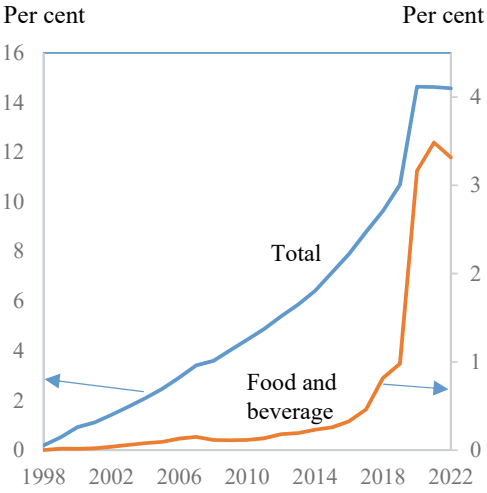


Fig. 11.12 Food and total E-commerce (food and total manufacturing) as a share of total sales: Retail (*Source* Own calculations based on statistical data from the United States Census Bureau)

The figures show that e-tail accounts for rather small market shares compared to manufacturing shipments, but high growth and increasing market shares are apparent in both cases. Food and beverages account for a low market share of e-tail, but the share increased from 2016 to 2019, while the share increased significantly from 2020. In 2022—a post-pandemic year—the level was high compared to the pre-pandemic years.

The figure confirms that food is a special case when it comes to e-tail: The increase in online sales of fresh produce is much slower as many consumers want to select the products themselves. According to Mascaraque (2021), globally, the packaged food industry is one of the FMCG industries (fast-moving consumer goods) with the smallest penetration in terms of e-commerce.

The long-term perspectives are far-reaching: the trend toward more e-commerce at the expense of retail is complicated—or reinforced—by the increasing role of food services. As discussed previously, consumers are demanding more leisure time, which means less time is spent in the kitchen, while the amount of time spent on traditional shopping in supermarkets will probably be reduced in step with increasing welfare.

E-commerce and e-tail will change the food value chain—the question is just how much and how fast. The existing food value chain will definitely continue, but the digital players will supplement the existing system and/or be the main players.

E-commerce will have an impact on agriculture, the food industry and food markets. The fight for dominance in the value chain will continue. Who will be the strong link between the food industry and the consumer, and how will they be connected?

The traditional food retail industry may suffer in two ways: E-commerce may make physical supermarkets redundant, and food services, catering, takeaways, etc., may also reduce physical supermarkets' sales and activities. Supermarkets must transform themselves so that they are also logistical centers and food service units if they want to secure their position in future food value chains.

Amazon, Alibaba and similar online stores will probably move further into food retail as younger generations, who are more motivated and prepared for e-tail, become more important target groups.

11.5 Artificial Meat

Artificial meat is a potential technological disruption that may have a major impact on the entire food system.

Artificial meat has many different names: lab-grown, in vitro, cultivated, cultured, cell-based, cell-grown or non-slaughter. Artificial meat is real meat that has been grown directly from animal cells, but it is produced without living animals, so the products are not vegan, vegetarian or plant based.

The production of artificial meat starts by taking a sample of cells from a live animal via a small biopsy, or from a fertilized chicken egg. The meat cells are then grown in bioreactors in a special solution that includes amino acids, glucose, vitamins, inorganic salts, proteins and other and other nutrients that stimulate growth. The cells double every 24 hours, approximately, and it normally takes 2–8 weeks to produce the meat depending on what kind of meat is being cultivated.

According to scientists from Oxford University and the University of Amsterdam, artificial meat involves approximately a 7–45% reduction in energy use, a 78–96% reduction in greenhouse gas emissions, a 99% reduction in land use and a 82–96% reduction in water use compared

to conventional meat production depending on the type of meat being produced.

According to David Kaplan, a professor of biomedical engineering at Tufts University (Rogers, 2023), the artificial meat industry is about 10 years old, "so the products are still a few years away from being commercially available in grocery stores or restaurants—and maybe up to 20 years out from replacing a substantial portion, or all, of the traditional meat industry".

However, several significant barriers to the upscaling and production of artificial meat production have been identified cf. Humbird (2020), Fassler (2021), Chriki and Hocquette (2020): Low production growth rates, inefficiency in production, lack of profitability and delays have been highlighted as significant problems. Furthermore, consumer acceptance is a potential market problem (IPCC, 2022).

The development and commercialization of artificial meat is driven by the following factors:

- Reduction of methane emission from livestock
- Reduction of land for production of feedstuff for livestock
- Potential reduction of demand for water
- Animal welfare
- Waste reduction
- Food security and food safety might be improved

If artificial meat at some point becomes a realistic technological and economic alternative to conventional meat, it will disrupt the livestock industry and the entire integrated value chain. It would mean that swathes of agricultural land could be used for other purposes. However, the time horizon, scope, economic attractiveness and technological barriers still represent significant uncertainties.

11.6 Vertical Farming

Vertical farming is an alternative system for cultivating crops, whereby production takes place indoors, in several layers and under controlled conditions, often with artificial light and no soil. Instead, the plants are planted in a water-based nutrient solution. The advantages of vertical farming are that it is not affected by the vagaries of weather, it requires

less water and much less land, the leaching of nutrients into the environment is dramatically reduced and the need for pesticides is potentially eliminated. The fact that the growing conditions can be controlled to such a great extent means that it is possible to grow plants of a uniformly high quality, although this requires close monitoring of the micro-climate and the efficient use of resources.

The concept of vertical farming was developed because it had the potential to provide large urban populations with locally grown food. The main objective of vertical farming is to maximize yields with the minimal use of natural resource. The small amount of land needed for vertical farms means food can be grown in cities. Singapore, Dubai and Riyadh, which are characterized by a high population density and poor natural conditions for traditional agricultural production, are examples of cities where large-scale vertical farming has been established.

Vertical farming has the potential to contribute to a more stable and resource-efficient food production in a world characterized by climate change and limited access to both agricultural land and water. The food is produced locally, and both food safety and food security will probably be improved.

However, several unresolved issues regarding long-term advantages and disadvantages make the business case uncertain.

Utilizing resources efficiently and reducing the carbon footprint are still challenges in vertical farming as the amount of energy needed for heating, ventilation and light is in many cases higher than it is in traditional production. In many cases, the electricity used to run vertical farms is still derived from fossil fuels, which means total greenhouse gas emissions may be far higher than they are in traditional farming. Switching to renewable energy sources would be one way of reducing the carbon footprint.

Furthermore, identifying the plant species that are suitable for vertical farming requires further research and innovation, cf. for example Park (2023) and University of Copenhagen (n.d.). Several advantages and disadvantages of vertical farming have been identified, cf. for example University of Copenhagen (n.d.) and Senmatic (n.d.), and they are presented in the boxes below:

Potential advantages

Reduced use of land and water
High productivity
Increased food security
Reduced waste
No use of pesticides
Independent of natural conditions
Local production, reduced transportation
Year-round production

Potential disadvantages

High energy consumption
Consumer/market skepticism
Limited number of suitable crops
Large upfront capital investment
Demanding management
New technology
Effect on sustainability is uncertain

On the one hand, vertical farming has the potential to solve several megatrend problems. At the micro level, the use of resources such as water and land is relatively limited, and the same applies to pesticides. As the production systems are closed, waste regarding fertilizer use is also limited. In general, waste can be reduced considerably, as losses due to pests, adverse weather, long transportation, etc., can be eliminated or significantly reduced.

On the other hand, several technological, market and economic challenges limit the potential for scaling up. Vertical farming may be an excellent local solution, but vertical farming is unlikely to significantly affect the existing megatrends within agriculture, the food industry and food markets.

11.7 From Agriculture and Farms to Bio-Industrial Companies

Traditional agriculture has largely remained unchanged for millennia. Agricultural production has been based on utilizing soil, water, photosynthesis, nutrients and livestock. Production has taken place on relatively small, often family-owned units, agricultural holdings, spread over large areas. Development has taken the form of gradual industrialization in most developed countries, while the majority of agriculture worldwide remains subsistence farming.

In the future, agricultural development is likely to remain highly polarized between developed and developing countries, and also between industrialized agriculture and part-time agriculture in most countries. Market diversity will probably increase, and the market segments for organic, vegetarian and local food, etc., will remain and probably become more important.

However, radical changes can be expected in the next century. In the most advanced countries, agriculture will become a bio-industrial industry, which means that traditional agriculture will become redundant to a certain extent. In particular, traditional animal production will be replaced by biotechnological production in the Western world.

This change is driven by both supply and demand:

On the supply side, such a change is driven by continuous biotechnological advances. As discussed in Sect. 11.5, if artificial meat becomes technologically feasible and competitive with traditionally produced meat, it may well disrupt the existing food system. In the longer term, technology may become even more important in both animal and plant-based agriculture.

On the demand side, consideration of climate change, natural resource protection, animal welfare, the spread of livestock diseases, vegan and vegetarian trends and food safety will support this development.

Will we be more dependent on food that has been produced in a laboratory in the near future? Will biotechnological factories to some extent outcompete current agriculture, so that we can buy cheaper synthetic food which involves the limited use of resources? If so, we may well be able to produce food with fewer inputs, reduced waste, reduced CO_2 emissions, improved animal welfare, while at the same time freeing up agricultural land for nature, forests and energy? Can we to a certain extent

and in particular parts of the world "bypass" the existing and traditional agriculture?

The greatest uncertainty—but also the greatest potential—is probably to be found on the supply side. A number of new technological disciplines and breakthroughs have been developed or can be expected to happen within a period.

Synthetic biology is a new albeit poorly defined field of research, which is based on many scientific techniques and approaches. The main goal of synthetic biology is to create fully operational biological systems from the smallest possible components including DNA, proteins and other organic molecules. The creation of artificial life is one of the goals of synthetic biology.

Synthetic biology is also the basis of cellular agriculture, the aim of which is to develop new methods for producing food and other products that would otherwise be produced by traditional agriculture, most notably proteins and fats for food products.

In any case, the extent of the impact of biotechnology on agricultural production in the future will depend on the outcome of the debate concerning the ethical implications of the technology. However, the question is whether the development of biotechnology can be limited to specific geographical regions when we live in a globalized world. The application of biotechnology in one part of the world will put competitive pressure on the rest of the world. Therefore, biotechnology will become a necessary part of agriculture throughout the world, and biotechnology will just add further momentum to the agricultural treadmill.

References

Bris, A. (2020). Deglobalization is a short-term trend, we will get back to our old numbers. IMD Research & Knowledge. https://www.imd.org/research-knowledge/videos/deglobalization-a-short-term-trend/

Chriki, S., & Hocquette, J.-F. (2020). The myth of cultured meat: A review. *Frontiers in Nutrition, 7*(7). https://doi.org/10.3389/fnut.2020.00007

Fassler, J. (2021). Lab-grown meat is supposed to be inevitable. The science tells a different story. https://thecounter.org/lab-grown-cultivated-meat-cost-at-scale/

Fouquin, M., & Hugot, J. (2016). Two centuries of bilateral trade and gravity data: 1827–2014. CEPII Working Paper, CEPII. http://www.cepii.fr/PDF_PUB/wp/2016/wp2016-14.pdf

Friedman, T. (2022). Is globalization dead? Author and columnist Thomas Friedman in conversation at Davos 2022. https://www.weforum.org/agenda/2022/06/thomas-friedman-is-globalization-dead-davos-2022-agenda-dialogues/

Girod, S. J. (2016). *The end of globalization?* https://www.imd.org/research-knowledge/articles/part-1-the-end-of-globalization/

Herre, B., Rodés-Guirao, L., Roser, M., Hasell, J., & Macdonald, B. (n.d.). *War and Peace*. https://ourworldindata.org/war-and-peace

Humbird, D. (2020). Scale-up economics for cultured meat. Techno-economic analysis and due diligence. DWH Process Consulting LLC, San Francisco.

IPCC. (2022). Climate change 2022. Mitigation of climate change. Intergovernmental Panel on Climate Change. https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_FullReport.pdf

Keller, C., & Marold, R. (2023). Deglobalisation: What you need to know. World Economic Forum. https://www.weforum.org/agenda/2023/01/deglobalisation-what-you-need-to-know-wef23/

Lincicome, S. (2022, March 30). It's the end of globalization as we know it (and that's probably fine). *The Dispatch*. https://www.cato.org/commentary/its-end-globalization-we-know-it-thats-probably-fine-part-1

Mascaraque, M. (2021). E-commerce moves front for food industry business strategies. Euromonitor International. https://www.euromonitor.com/article/e-commerce-moves-front-for-food-industry-business-strategies

McKinsey. (2022). *The next horizon for grocery e-commerce: Beyond the pandemic bump*. https://www.mckinsey.com/industries/retail/our-insights/the-next-horizon-for-grocery-ecommerce-beyond-the-pandemic-bump/

Park, W. (2023). How far can vertical farming go? BBC Future Planet. https://www.bbc.com/future/article/20230106-what-if-all-our-food-was-grown-in-indoor-vertical-farms

Rogers, K. (2023). *Eating meat without slaughtering animals may be in our future*. https://edition.cnn.com/2022/06/06/health/lab-grown-meat-pros-cons-life-itself-wellness-scn/index.html

Senmatic. (n.d.). *Vertical farming*. https://www.senmatic.com/horticulture/solutions/vertical-farming

Turchin, P. (2016). *Ages of discord: A structural-demographic analysis of American history*. Beresta Books.

University of Copenhagen. (n.d.). Vertical farming. Urban Farming Science. https://urbanfarming.ku.dk/english/research/alternative-cultivation-practices/

WTO. (2019). World Trade Report 2019. The future of services and trade. World Trade Organization. https://www.wto.org/english/res_e/booksp_e/00_wtr19_e.pdf

Zeihan, P. (2022). *The World is just the beginning. Mapping the collapse of globalization*. Harper Business.

Bibliography

ABARES. (n.d.). Farm share and price spread. Australian Government. Department of Agriculture, Fisheries and Forestry. https://www.agriculture.gov.au/abares/research-topics/agricultural-forecasting/farm-share-price-spread

Altman, S. A., & Bastian, C. R. (2022, May 31). Trade regionalization: More hype than reality? *Harward Business Review*. https://hbr.org/2022/05/trade-regionalization-more-hype-than-reality

Amador, J., & Cabral, S. (2016). Global value chains: A survey of drivers and measures. *Journal of Economic Surveys, 30*(2), 278–301. https://doi.org/10.1111/joes.12097

Antràs, P. (2020). Conceptual aspects of global value chains. *The World Bank Economic Review, 34*(3), 551–574. https://doi.org/10.1093/wber/lhaa006

Augère-Granier, M.-L. (2016). Short food supply chains and local food systems in the EU (Briefing PE 586.650). European Parliamentary Research Service. European Parliament. https://www.europarl.europa.eu/RegData/etudes/BRIE/2016/586650/EPRS_BRI(2016)586650_EN.pdf

Baker-Smith, K., & Attila, S. (2016). What is land grabbing? A critical review of existing definitions. Eco Ruralis. https://www.farmlandgrab.org/uploads/attachment/EcoRuralis_WhatIsLandGrabbing_2016.pdf

Balcombe, K. (2009). The nature and determinants of volatility in agricultural prices. An empirical study from 1962–2008. Munich Personal RePEc Archive (MPRA Paper No. 24819). https://mpra.ub.uni-muenchen.de/24819/1/MPRA_paper_24819.pdf

BarthHaas. (2022). *BarthHaas Report 2021/2022*. https://www.barthhaas.com/resources/barthhaas-report

H. O. Hansen, *Megatrends in Agriculture, Food Industry and Food Markets*, Palgrave Advances in Bioeconomy: Economics and Policies,
https://doi.org/10.1007/978-3-031-58152-6

Bjørn, C. (1982). Dansk Mejeribrug: 1882–2000. De danske Mejeriers Fællesorganisation.

Blayney, D. P., & Manchester, A. C. (2000). Large companies active in changing dairy industry. *Food Review, 23*(2), 8–13. https://doi.org/10.22004/ag.econ.205539

Boesler, M. (2014). How the global beer industry has consolidated over the last 10 years in two charts. Business Insider. https://www.businessinsider.com/global-beer-industry-consolidation-2014-2?r=US&IR=T

Bottenberg, K., Tuschke, A., & Flickinger, M. (2017). Corporate governance between shareholder and stakeholder orientation: Lessons from Germany. *Journal of Management Inquiry, 26*(2), 165–180. https://doi.org/10.1177/1056492616672942

Braimoh, A. (2015). To fight desertification, let's manage our land better. World Bank Blogs. https://blogs.worldbank.org/voices/fight-desertification-and-land-degradation-lets-manage-our-land-better?CID=EXT_TWBN_D_EXT

Brewers Association. (n.d.). *National beer sales & production data*. Retrieved February 13, 2024, from, https://www.brewersassociation.org/statistics-and-data/national-beer-stats/

Bris, A. (2020). Deglobalization is a short-term trend, we will get back to our old numbers. IMD Research & Knowledge. https://www.imd.org/research-knowledge/videos/deglobalization-a-short-term-trend/

Buchholz, K. (2022a). Here's how attitudes to vegetarianism are changing around the world. World Economic Forum. https://www.weforum.org/agenda/2022/11/vegetarianism-rise-fall-world-chart/

Buchholz, K. (2022b). *The rise (or fall?) of vegetarianism*. https://www.statista.com/chart/28584/gcs-vegetarianism-countries-timeline/

Bunte, F., van Galen, M., de Winter, M., Dobson, P., Bergès-Sennou, F., Monier-Dilhan, S., Juhász, A., Moro, D., Sckokai, P., Soregaroli, C., Van der Meulen, B. M. J., & Szajkowska, A. (2011). The impact of private labels on the competitiveness of the European food supply chain. *Publications Office of the European Union*. https://doi.org/10.2769/11911

Business Roundtable. (2019). Corporate governance: Business roundtable redefines the purpose of a corporation to promote 'An economy that serves all Americans'. Business Roundtable. https://www.businessroundtable.org/business-roundtable-redefines-the-purpose-of-a-corporation-to-promote-an-economy-that-serves-all-americans

Cawthray, B., & Murphy, P. (n.d.). *COVID-19: More eating at home, but pressures on the personal care category*. https://www.kantar.com/inspiration/coronavirus/covid-19-more-eating-at-home-but-pressures-on-the-personal-care-category

Cho, S., & Chung, C. Y. (2022). Review of the literature on merger waves. *Journal of Risk and Financial Management, 15*(10), 432. https://doi.org/10.3390/jrfm15100432

Chriki, S., & Hocquette, J.-F. (2020). The myth of cultured meat: A review. *Frontiers in Nutrition, 7*(7). https://doi.org/10.3389/fnut.2020.00007

Chrzan, J. (2019). *The global market for nutraceuticals set for robust growth*. https://www.healthcarepackaging.com/markets/neutraceuticals-functional/article/13296428/the-global-market-for-nutraceuticals-set-for-robust-growth

Cigna, S., Gunnella, V., & Quaglietti, L. (2022). Global value chains: Measurement, trends and drivers. European Central Bank (ECB). https://doi.org/10.2866/33149

Cochrane, W. W. (1958). *Farm prices, myth and reality*. University of Minnesota Press.

Cogeca. (2015). Development of agricultural cooperatives in the EU 2014. European agri-cooperatives (Cogeca). https://www.europarl.europa.eu/meetdocs/2014_2019/documents/agri/dv/copa-cogecareport_/copa-cogecareport_en.pdf

Copeland, L., & Boullianne, S. (2022). Political consumerism: A meta-analysis. *International Political Science Review, 43*(1), 3–18. https://doi.org/10.1177/0192512120905048

Crawford, J.-A., & Fiorentino, R. V. (2005). The changing landscape of regional trade agreements. World Trade Organization. https://www.wto.org/english/res_e/booksp_e/discussion_papers8_e.pdf

DairyNZ. (several issues). New Zealand Dairy Statistics. Livestock Improvement Corporation Limited & DairyNZ Limited. Dairynz. https://www.dairynz.co.nz/publications/dairy-industry/new-zealand-dairy-statistics-2020-21/

Danish Brewers' Association. (1999). Bryggerne og de tre store udfordringer. Danish Brewers' Association.

Dansk Landbrug. (several issues). Landøkonomisk Oversigt. Dansk Landbrug.

de Moor, J. (2017). Lifestyle politics and the concept of political participation. *Acta Politica, 52*, 179–197. https://doi.org/10.1057/ap.2015.27

Deaton, A., & Paxson, C. (1998). Economies of scale, household size, and the demand for food. *Journal of Political Economy, 106*(5), 897–930. https://doi.org/10.1086/250035

Deconinck, K. (2021). Concentration and market power in the food chain. *OECD Publishing*. https://doi.org/10.1787/3151e4ca-en

Dell'Angelo, J., Rulli, M. C., & D'Odorico, P. (2018). The global water grabbing syndrome. *Ecological Economics, 143*, 276–285. https://doi.org/10.1016/j.ecolecon.2017.06.033

Deloitte. (several issues). Global powers of retailing. Deloitte Global. https://www2.deloitte.com/global/en/pages/consumer-business/articles/global-powers-of-retailing.html

Demko, I. (2018). *Trends of U.S. agricultural cooperatives (1913–2016)*. CFAES Center for Cooperatives.

Díaz-Bonilla, E. (2016). Volatile volatility: Conceptual and measurement issues related to price trends and volatility. In M. Kalkuhl, J. von Braun, & M. Torero (eds.), *Food price volatility and its implications for food security and policy*. Springer Open. https://doi.org/10.1007/978-3-319-28201-5_2

Dikler, J. (2021). Reshoring: An overview, recent trends, and predictions for the future. *KIEP Research Paper, World Economy Brief, 11*(35). https://doi.org/10.2139/ssrn.3916557

DMR. (n.d.). *McDonald's statistics and facts for 2024*. Retrieved February 13, 2024. https://expandedramblings.com/index.php/mcdonalds-statistics/

Dobson, P. W. (2002). *Retailer buyer power in European markets: Lessons from grocery supply*. Loughborough University.

Dobson, P. W., & Chakraborty, R. (2015). Assessing brand and private label competition. *European Competition Law Review, 36*, 76–81.

Doğan, B. (2022). Does FDI in agriculture promote food security in developing countries? The role of land governance. *Transnational Corporations Journal, 29*(2). https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4203590

EEA. (2016). Transnational land acquisitions. The European Environment Agency. Retrieved February 13, 2023, from https://www.eea.europa.eu/data-and-maps/figures/transnational-land-deals-1

EESC. (2015). Opinion of the European Economic and Social Committee on "Land grabbing—a warning for Europe and a threat to family farming". *Journal of the European Union* (C 242/15). https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014IE0926&from=SK

ESPAS. (2019). Welcome to 2030: The mega-trends. In *ESPAS, Global trends to 2030: Challenges and choices for Europe* (pp. 7–21). European Strategy and Policy Analysis System (ESPAS). https://doi.org/10.2872/074526

Espitia, A., Rocha, N., & Ruta, M. (2020). Covid-19 and food protectionism: The impact of the pandemic and export restrictions on world food markets. World Bank. https://documents1.worldbank.org/curated/en/417171589912076742/pdf/Covid-19-and-Food-Protectionism-The-Impact-of-the-Pandemic-and-Export-Restrictions-on-World-Food-Markets.pdf

Euromonitor International. (2020). The rise of vegan and vegetarian food. Euromonitor International. https://www.euromonitor.com/the-rise-of-vegan-and-vegetarian-food/report

European Commision. (2009). Historical price volatility. European Commision, Directorate L. Economic analysis, perspectives and evaluations. https://agrigionieuropa.univpm.it/sites/are.econ.univpm.it/files/volatility_en.pdf

Commission, E. (2022). Study on animal welfare labelling: Final report. *Publications Office of the European Union*. https://doi.org/10.2875/676603

European Commission. (n.d.). EU FORESIGHT: What is the Megatrends Hub: How to use megatrends to make your work future-proof. Megatrends Hub. Retrieved February 8, 2024, from, https://knowledge4policy.ec.europa.eu/sites/default/files/what_is_the_megatrends_hub_and_how_to_use_it.pdf

European Commission. (several issues). The agricultural situation in the European Union. Office for Official Publications of the European Communities.

European Parliament. (2007). *Strategy for a strengthened partnership with the Pacific Islands: Resolution*. https://www.europarl.europa.eu/doceo/document/TA-6-2007-0022_EN.html?redirect

Eurostat. (2016). Agriculture, forestry and fishery statistics: 2016 edition. Publications Office of the European Union. https://doi.org/10.2785/917017

Eurostat. (2018). Agriculture, forestry and fishery statistics. 2018 edition. Publications Office of the European Union.https://doi.org/10.2785/340432

Eurostat. (2022). Farms and farmland in the European Union—statistics. Eurostat. https://ec.europa.eu/eurostat/statistics-explained/SEPDF/cache/73319.pdf

Eurostat. (several issues). *Agriculture: Statistical yearbook*. Luxembourg and Bruxelles.

Evans, J., Bridson, K., Byrom, J., & Medway, D. (2008). Revisiting retail internationalisation: Drivers, impediments and business strategy. *International Journal of Retail & Distribution Management, 36*(4), 260–280. https://doi.org/10.1108/09590550810862679

Evans, L. T. (1998). *Feeding the ten billion: Plants and population growth*. Cambridge University Press.

EY. (2015). Reshoring manufacturing—Time to seize the opportunity. Ernst & Young LLP. https://www.criticaleye.com/inspiring/insights-servfile.cfm?id=4282

EY. (2022). Megatrends that will shape our future. Global Management Forum. https://www.globalgovernmentforum.com/megatrends-that-will-shape-our-future/

Fan, S., Brzeska, J., Keyzer, M., & Halsema, A. (2013). From subsistence to profit: Transforming smallholder farms. *International Food Policy Research Institute (IFPRI)*. https://doi.org/10.2499/9780896295582

FAO. (2001). Supplement to the Report on the 1990 World Census of Agriculture—International comparison and primary results by country (1986–1995). FAO. Food and Agriculture Organization of the United Nations. https://www.fao.org/3/y2816e/y2816e.pdf

FAO. (2008). *An introduction to the basic concepts of food security*. https://www.fao.org/3/al936e/al936e00.pdf

FAO. (2009). *How to feed the world in 2050*. https://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf

FAO. (2010). *Price volatility in agricultural markets: Evidence, impact on food security and policy responses*. https://www.fao.org/3/am053e/am053e00.pdf

FAO. (2013). 2000 world census of agriculture. Analysis and international comparison of the Results (1996–2005). Food and Agriculture Organization of the United Nations (FAO). http://www.fao.org/fileadmin/templates/ess/ess_test_folder/World_Census_Agriculture/Publications/WCA_2000/Census13.pdf

FAO. (2019). *The state of food and agriculture 2019: Moving forward on food loss and waste reduction*. https://www.fao.org/3/ca6030en/ca6030en.pdf

FAO. (2020). *The state of food and agriculture 2020: Overcoming water challenges in agriculture*. https://doi.org/10.4060/cb1447en

FAO. (2022). The state of agricultural commodity markets 2022. The geography of food and agricultural trade: Policy approaches for sustainable development. https://doi.org/10.4060/cc0471en

FAO and OECD. (2011). Price volatility in food and agricultural markets: Policy responses. Policy Report by FAO, IFAD, IMF, OECD, UNCTAD, WFP, the World Bank, the WTO, IFPRI and the UN HLTF. https://www.fao.org/fileadmin/templates/est/Volatility/Interagency_Report_to_the_G20_on_Food_Price_Volatility.pdf

FAO and The World Bank. (2018). Food data collection in household consumption and expenditure surveys: Guidelines for low and middle-income countries. LSMS Guidebook April 2019. https://openknowledge.worldbank.org/bitstream/handle/10986/32503/ca1561en.pdf?sequence=4&isAllowed=y

FAO. (n.d.). *Water scarcity*. Retrieved February 14, 2024, from: https://www.fao.org/land-water/water/water-scarcity/en/

Fassler, J. (2021). Lab-grown meat is supposed to be inevitable. The science tells a different story. https://thecounter.org/lab-grown-cultivated-meat-cost-at-scale/

Fouquin, M., & Hugot, J. (2016). Two centuries of bilateral trade and gravity data: 1827–2014. CEPII Working Paper, CEPII. http://www.cepii.fr/PDF_PUB/wp/2016/wp2016-14.pdf

Freeman, R. (2010). Stratgic management—A stakeholder approach. *Cambridge University Press*. https://doi.org/10.1017/CBO9781139192675

Friedman, M. (1970). The social responsibility of business is to increase its profits. *New York Times Magazine* (pp. 122–126).

Friedman, T. (2022). Is globalization dead? Author and columnist Thomas Friedman in conversation at Davos 2022. https://www.weforum.org/agenda/2022/06/thomas-friedman-is-globalization-dead-davos-2022-agenda-dialogues/

Gaulier, G., Jean, S., & Ünal-Kesenci, D. (2004). Regionalism and the Regionalisation of International Trade. Paris: Centre d'Etudes Prospectives

et d'Informations Internationales (CEPII). http://www.cepii.fr/PDF_PUB/wp/2004/wp2004-16.pdf

Gera, I. (2022, May 27). Do Thomas Malthus's words still hold water? Business Standard. https://www.business-standard.com/podcast/economy-policy/do-thomas-malthus-s-words-still-hold-water-122052700061_1.html

Gielens, K., Dekimpe, M. G., Mukherjee, A., & Tuli, K. (2023). The future of private-label markets: A global convergence approach. *International Journal of Research in Marketing, 40*(1), 248–267. https://doi.org/10.1016/j.ijresmar.2022.07.006

Girod, S. J. (2016). *The end of globalization?* https://www.imd.org/research-knowledge/articles/part-1-the-end-of-globalization/

Gleditsch, N. (2021). This time is different! Or is it? NeoMalthusians and environmental optimists in the age of climate change. *Journal of Peace Research, 58*(1). https://doi.org/10.1177/0022343320969785

Grievink, J.-W. (2003, February 6). The changing face of the global food supply chain. Presentation OECD Conference The Hague.

Grievink, J.-W., Josten, L., & Valk, C. (2003). Power resides where the information is unique: Interview with Wout Dekker, Nutreco. In J.-W. Grievink, L. Josten, & C. Valk (Eds.), *State of the Art in Food: The changing face of the worldwide food industry* (pp. 308–314). Cap Gemini Ernst & Young and Reed Elsevier.

Grigg, D. (1992). Agriculture in the world economy: An historical geography of decline. *Geography, 77*(3), 210–222. http://www.jstor.org/stable/40572192

Grimes, G., & Plain, R. (2009). U.S. Hog Marketing Contract Study: January 2009. University of Missouri. http://agebb.missouri.edu/mkt/vertstud09.pdf

Grubbs, T. J. (n.d.). *History of agriculture timeline for 1800–1900*. https://www.timetoast.com/timelines/history-of-agriculture-timeline-1800-1900

Gustavsson, J., Cederberg, C., Sonesson, U., van Otterdijk, R., & Meybeck, A. (2011). Global food losses and food waste: Extent, causes and prevention. Food and Agriculture Organization of the United Nations (FAO). https://www.fao.org/3/i2697e/i2697e.pdf

Hahn, W. (2004). Beef and pork values and price spreads explained. USDA Economic Research Service. https://www.ers.usda.gov/webdocs/outlooks/37369/49585_ldpm11801.pdf?v=6246.2

Hambur, J., & La Cava, G. (2018). Business concentration and mark-ups in the retail trade sector. Reserve Bank of Australia. https://www.rba.gov.au/publications/bulletin/2018/dec/business-concentration-and-mark-ups-in-the-retail-trade-sector.html

Hands off the Land Alliance. (2014). The global water grab: A primer. Transnational Institute. https://www.tni.org/en/publication/the-global-water-grab-a-primer

Hansen, H. O. (2005). *Vækst i Fødevareindustrien: Vækst, fusioner, strukturudvikling, globalisering og koncentration i det agroindustrielle kompleks i Danmark og globalt*. Handelshøjskolens Forlag.

Hansen, H. O. (2013). *Food economics: Industry and markets*. Routledge.

Hansen, H. O. (2016). Landbrugets trædemølle—gælder den stadig? [The agricultural treadmill—does it still apply?]. *Tidsskrift for Landøkonomi, 202*(3), 241–251.

Hansen, H. O. (2019). The agricultural treadmill—a way out through differentiation? An empirical analysis of organic farming and the agricultural treadmill. *Journal of Tourism, Heritage & Services Marketing, 5*(2), 20–26. https://doi.org/10.5281/zenodo.3601667

Hansen, H. O. (2020). Danish farmer cooperatives: Development, importance and lessons. *Cooperativismo & Desarrollo, 29*(119), 1–34. https://doi.org/10.16925/2382-4220.2021.01.03

Hansen, Henning Otte. (2018). *Strategic challenges and solutions in agro and food companies*. Samfundslitteratur.

Hansen, S. (1983). *Økonomisk vækst i Danmark. Bind II: 1914–1983* (3rd Edition). Københavns Universitets Økonomiske Institut.

Harris, J., Kaufman, P. R., Martinez, S. W., & Price, C. (2002). The U.S. Food Marketing System, 2002 Competition, Coordination, and Technological Innovations into the 21st Century. USDA (Agricultural Economic Report No. 811). https://doi.org/10.22004/ag.econ.34001

Heineken. (n.d.). *Our Strategy—Welcome to EverGreen*. https://www.theheinekencompany.com/our-company/our-strategy

Henriksen, O. B., & Ølgaard, A. (1969). *Danmarks Udenrigshandel 1874–1958*. Københavns Universitets Økonomiske Institut.

Herre, B., Rodés-Guirao, L., Roser, M., Hasell, J., & Macdonald, B. (n.d.). *War and Peace*. https://ourworldindata.org/war-and-peace

Herrmann, R., Möser, A., & Weber, S. A. (2009). Grocery retailing in Germany: Situation, development and pricing strategies. Zentrum für internationale Entwicklungs- und Umweltforschung der Justus-Liebig-Universität Gießen (Discussion Paper, No. 41). https://www.econstor.eu/bitstream/10419/39806/1/593466845.pdf

Hestermann, O. B., & Horan, D. (2017). *The demand for 'local' food is growing—Here's why investors should pay attention*. https://www.businessinsider.com/the-demand-for-local-food-is-growing-2017-4?r=US&IR=T

Hodgson, A. (2019). Megatrend: Middle class retreat. Euromonitor International. https://www.euromonitor.com/video/megatrends-middle-class-retreat

Humbird, D. (2020). Scale-up economics for cultured meat. Techno-economic analysis and due diligence. DWH Process Consulting LLC, San Francisco.

ICA. (n.d.). *Facts and figures. International Cooperative Alliance*. Retrieved February 2, 2024, from, https://www.ica.coop/en/cooperatives/facts-and-figures

Ichikawa, T. (1994). Functional foods in Japan. In I. Goldberg (Ed.), *Functional foods: Designer foods, pharmafoods, nutraceuticals* (pp. 453–467). Springer.

IPBES. (2018). The assessment report on land degradation and restoration. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). https://zenodo.org/record/3237393#.Y9HGPnZBw2x

IPCC. (2022). Climate change 2022. Mitigation of climate change. Intergovernmental Panel on Climate Change. https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_FullReport.pdf

ISAAA. (2017). Global Status of Commercialized Biotech/GM Crops in 2017: Biotech crop adoption surges as economic benefits accumulate in 22 years. ISAAA. International Service for the Acquisition of Agri-biotech Applications (ISAAA). https://www.isaaa.org/resources/publications/briefs/53/download/isaaa-brief-53-2017.pdf

ISAAA. (2019). Brief 55: Global Status of Commercialized Biotech/GM Crops: 2019. International Service for the Acquisition of Agri-biotech Applications. https://www.isaaa.org/resources/publications/briefs/55/default.asp

Jacks, D. S. (2019). From boom to bust: A typology of real commodity prices in the long run. *Cliometrica, 13*, 201–220. https://doi.org/10.1007/s11698-018-0173-5

Johanson, J., & Vahlne, J.-E. (1977). The internationalization process of the firm: A model of knowledge development and increasing market commitments. *Journal of International Business Studies, 8*, 23–32. https://doi.org/10.1057/palgrave.jibs.8490676

Johnson, G. L. (1958). Supply function—Some facts and notions. In E. O. Heady, H. G. Diesslin, H. R. Jensen, & G. L. Johnson (Eds.), *Agricultural adjustment problems in a growing economy* (pp. 74–93). Iowa State College Press.

Keller, C., & Marold, R. (2023). Deglobalisation: What you need to know. World Economic Forum. https://www.weforum.org/agenda/2023/01/deglobalisation-what-you-need-to-know-wef23/

Kim, D. H. (2009). The Case of Korea. In K. W. Stiegert, & D. H. Kim (Eds.), *Structural changes in food retailing: Six country case studies* (pp. 77–103). Food System Research Group. https://ageconsearch.umn.edu/record/60676/files/_food_retailingchapter5.pdf

Kim, N.-n. (2018). *Korean long-term statistics* 1. Seoul National University Press Cultural Center.

Kim, W. C., & Mauborgne, R. (2005). *Blue ocean strategy*. Harvard Business School Press.

Kirkova, D. (2013). *Time-poor Britons spend just 38 minutes cooking dinner... but Sunday roast is STILL the nation's favourite dish*. https://www.dailymail.co.uk/femail/article-2372431/Time-poor-Britons-spend-just-38-minutes-cooking-dinner-today-compared-hour-half-1960s.html

Landbrugsraadet. (several issues). Landbrugseksporten (The agricultural export). Copenhagen: Landbrugsraadet (Danish Agricultural Council).

Lay, J., Ward, A., Eckert, S., Flachsbarth, I., Kubitza, C., Nolte, K., & Giger, M. (2021). *Taking stock of the global land rush: Few development benefits, many human and environmental risks*. Bern Open Publishing. https://doi.org/10.48350/156861

Lebergott, S. (1966). Labor force and employment, 1800–1960. In D. S. Brady (Ed.), *Output, employment, and productivity in the United States after 1800* (pp. 117–204). National Bureau of Economic Research. https://www.nber.org/system/files/chapters/c1567/c1567.pdf

Legge, S., & Lukaszuk, P. (2021). Regionalization vs globalization: What is the future direction of trade? World Economic Forum. https://www.weforum.org/agenda/2021/07/regionalization-globalization-future-direction-trade/

Lincicome, S. (2022, March 30). It's the end of globalization as we know it (and that's probably fine). *The Dispatch*. https://www.cato.org/commentary/its-end-globalization-we-know-it-thats-probably-fine-part-1

Liu, X., Liu, W., Tang, Q., Liu, B., Wada, Y., & Yang, H. (2022). Global agricultural water scarcity assessment incorporating blue and green water availability under future climate change. *Earth's Future, 10*, e2021EF002567. https://doi.org/10.1029/2021EF002567

Low, S. A., Adalja, A., Beaulieu, E., Key, N., Martinez, S., Melton, A., Perez, A., Ralston, K., Stewart, H., Suttles, S., & Jablonski, B. B. (2015). Trends in U.S. local and regional food systems. USDA, Economic Research Service. https://www.ers.usda.gov/publications/ap-administrative-publication/ap-068

Lowder, S. K., Skoet, J., & Singh, S. (2014). What do we really know about the number and distribution of farms and family farms worldwide? Background paper for The State of Food and Agriculture. Food and Agriculture Organization of the United Nations (FAO). https://www.fao.org/3/i3729e/i3729e.pdf

MacDonald, J. M. (2020). Tracking the consolidation of U.S. *Agriculture, 42*(3), 361–379. https://doi.org/10.1002/aepp.13056

Mariano, K. P., Bressan, R. N., & Luciano, B. T. (2021). Liquid Regionalism: A typology for regionalism in the Americas. *Revista Brasileira De Política Internacional, 64*(2), e004. https://doi.org/10.1590/0034-7329202100204

Marquis, C. (2019). The business roundtable CEOs have spoken. Here's how they can act. https://socapglobal.com/2019/09/the-business-roundtable-ceos-have-spoken-heres-how-they-can-act/

Martec. (n.d.). *What is driving the growth of private label brands? Martecgroup*. Retrieved February 5, 2024, from, https://martecgroup.com/private-label-growth/

Martinez, S. (2021). Local food sales continue to grow through a variety of marketing channels. USDA, Economic Research Service. https://www.ers.usda.gov/amber-waves/2021/october/local-food-sales-continue-to-grow-through-a-variety-of-marketing-channels/

Martinez, S. W. (1999). Vertical coordination in the pork and broiler industries. Implications for pork and chicken products. USDA, Economic Research Service (Report No. 777).

Martinez, S. W. (2007). The U.S. food marketing system: Recent developments, 1997–2006. United States Deptartment of Agriculture, Economic Research Service. https://www.ers.usda.gov/publications/pub-details/?pubid=45821

Martinez, S. W. (2007). The U.S. food marketing system: Recent developments, 1997–2006. United States Department of Agriculture, Economic Research Service. https://doi.org/10.22004/ag.econ.55962

Mascaraque, M. (2021). E-commerce moves front for food industry business strategies. Euromonitor International. https://www.euromonitor.com/article/e-commerce-moves-front-for-food-industry-business-strategies

McBride, W. D., & Key, N. (2013). U.S. hog production from 1992 to 2009: Technology, restructuring, and productivity growth. USDA, Economic Research Service. http://www.ers.usda.gov/publications/err-economic-research-report/err158

McKinsey. (2022). *The next horizon for grocery e-commerce: Beyond the pandemic bump*. https://www.mckinsey.com/industries/retail/our-insights/the-next-horizon-for-grocery-ecommerce-beyond-the-pandemic-bump/

McRae, L. (2019). *Vegan, vegetarian, pescatarian, flexitarian and macrobiotic diets—What's the difference?* https://www.northshore.org/healthy-you/vegan-flexitarian-vegetarian-pescatarian-and-macrobiotic-diets--whats-the-difference/

Micheletti, M., & Boström, M. (2014). Political consumerism: Consumer choice, information, and labeling. In P. B. Thompson, & D. M. Kaplan (Eds.), *Encyclopedia of food and agricultural ethics* (pp. 1508–1515). Springer. https://doi.org/10.1007/978-94-007-0929-4_244

Ministry of Food and Drug Safety of South Korea. (2021). *Functional food production status*.

Mondeléz. (n.d.). *Growth & strategy*. https://www.mondelezinternational.com/About-Us/Who-We-Are/Growth-Strategy

Montano, B., & García-López, M. (2020). Malthusianism of the 21st century. *Environmental and Sustainability Indicators, 6*, 100032. https://doi.org/10.1016/j.indic.2020.100032

Mukunda, G. (2014). The price of wall street's power. *Harward Business Review, 92*(6), 70–78.

Müller, M. F., Penny, G., Niles, M. T., Ricciardi, V., Chiardelli, D., Davis, K. F., Dell'Angelo, J., D'Odorico, P., Rosa, L., Rulli, M. C., & Mueller, N. D. (2021). Impact of transnational land acquisitions on local foodsecurity and dietary diversity. *PNAS, 118*(4), e2020535118. https://doi.org/10.1073/pnas.2020535118

Naisbitt, J. (1982). *Megatrends: Ten new directions transforming our lives*. Warner Books.

Nestlé. (n.d.). *Our business strategy*. https://www.nestle.com/about/strategy

NFU. (2010). NFU briefing: Food price inflation update and impact on retail prices. https://www.commercialfarmers.co.uk/wp-content/uploads/2016/09/Food-inflation-analysis-November-2010.pdf

Nguyen, N., Mobsby, D., & Goesch, T. (2016). Farm-to-retail price spread and farm share in food supply chains: Background paper. ABARES. https://doi.org/10.13140/RG.2.2.18569.60001

Njie, D. (2022). Food loss and waste—A global challenge. *Sustainable food systems: Resource efficiency, food loss and food waste*.

Noormann, P., & Tillmanns, S. (2017). Drivers of private-label purchase behavior across quality tiers and product categories. *Journal of Business Economics, 87*, 359–395. https://doi.org/10.1007/s11573-016-0837-1

Nutrition Business Journal. (several issues). *Global Supplement Business Report*. https://store.newhope.com/

OECD. (1999). *Review of agricultural policies in Korea*. Organisation for Economic Co-operation and Development (OECD). https://www.oecd.org/korea/40417830.pdf

OECD. (2000). *Review of agricultural policies*. Bulgaria 2000. OECD.

OECD. (2010). The economic impact of export restrictions on raw materials. *OECD Publishing*. https://doi.org/10.1787/9789264096448-en

OECD. (2011). *Society at a glance 2011*. OECD Publishing. https://doi.org/10.1787/soc_glance-2011-en

OECD. (2016). Megatrends affecting science, technology and innovation. In *OECD, OECD Science, Technology and Innovation Outlook 2016* (pp. 21–76). OECD Publishing. https://doi.org/10.1787/sti_in_outlook-2016-en

OECD. (2017). *Water risk hotspots for agriculture*. OECD. https://doi.org/10.1787/9789264279551-en

OECD. (2019). *The evolution of the treatment of agriculture in preferential and regional trade*. OECD. https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=TAD/TC/CA/WP(2018)5/FINAL&docLanguage=En

OECD. (2020a). Global value chains in agriculture and food: A synthesis of OECD analysis. *OECD Publishing*. https://doi.org/10.1787/6e3993fa-en

OECD. (2020b). *COVID-19 and international trade: Issues and actions*. https://www.oecd.org/coronavirus/policy-responses/covid-19-and-international-trade-issues-and-actions-494da2fa/

OECD. (2021a). *Agricultural policy monitoring and evaluation 2021: Addressing the challenges facing food systems*. OECD Publishing. https://doi.org/10.1787/2d810e01-en

OECD. (2021b). *Sustainable management of water resources in agriculture*. OECD. https://doi.org/10.1787/9789264083578-en

OECD. (2022). *Agricultural policy monitoring and evaluation 2022: Reforming agricultural policies for climate change mitigation*. OECD Publishing. https://doi.org/10.1787/7f4542bf-en

OECD and FAO. (2022). *OECD-FAO agricultural outlook 2022–2031*. OECD Publishing. https://doi.org/10.1787/f1b0b29c-en

OECD. (n.d.a). *Global value chains*. Retrieved February 9, 2024, from, https://www.oecd.org/industry/global-value-chains/

OECD. (n.d.b). *Managing water sustainably is key to the future of food and agriculture*. https://www.oecd.org/agriculture/topics/water-and-agriculture/

Ortiz-Ospina, E., & Tzvetkova, S. (2017). *Working women: Key facts and trends in female labor force participation*. https://ourworldindata.org/female-labor-force-participation-key-facts

Park, W. (2023). How far can vertical farming go? BBC Future Planet. https://www.bbc.com/future/article/20230106-what-if-all-our-food-was-grown-in-indoor-vertical-farms

Peterson, R. N., & Brooks, N. L. (1993). The changing concentration of U.S. Agricultural production during the 20th century. U.S. Department of Agriculture, Economic Research Service. https://doi.org/10.22004/ag.econ.309686

Pilkauskas, N. (2018). What's behind the dramatic rise in 3-generation households? *The Conversation*. https://theconversation.com/whats-behind-the-dramatic-rise-in-3-generation-households-104523

PLMA. (2022). PLMA's 2022 International Private Label Yearbook. PLMA International Council. Industry News. https://www.retaildetail.eu/news/food/switzerland-is-private-label-champion-belgium-in-second-place/

Politi, J. (2020, May 10). Multinationals fear rise in protectionism because of pandemic. *Financial Times*.

Punthakey, J. J. (2020). *Foreign direct investment and trade in agro-food global value chains*. OECD Publishing. https://doi.org/10.1787/993f0fdc-en

PwC. (2016). Five megatrends and their implications for global defense & security. PricewaterhouseCoopers LLP. https://www.pwc.com/gx/en/government-public-services/assets/five-megatrends-implications.pdf

Rabobank. (2012). *Producing both brands and private label*. Rabobank.

ReferenceForBusiness. (n.d.). *Burger King Corporation—Company profile, information, business description, history, background information on Burger King Corporation*. Retrieved February 13, 2024, from, https://www.referenceforbusiness.com/history2/18/Burger-King-Corporation.html

Reshoring Initiative®. (n.d.a). *Presentations*. https://www.reshorenow.org/presentations/

Reshoring Initiative®. (n.d.b). *Reshoring Initiative® 2022 Data Report*. Reshoring Initiative®. https://reshorenow.org/content/pdf/2022_Data_Report.pdf

Reshoring Initiative®. (n.d.c). *Reshoring Initiative® 2020 Data Report*. https://reshorenow.org/content/pdf/RI_2020_Data_Report.pdf

Retail Institute Scandinavia. (several issues). *Dansk Dagligvarehandel*. Retail Institute Scandinavia.

Rogers, K. (2023). *Eating meat without slaughtering animals may be in our future*. https://edition.cnn.com/2022/06/06/health/lab-grown-meat-pros-cons-life-itself-wellness-scn/index.html

Rogers, R. T. (2001). Structural change in U.S. food manufacturing, 1958–1997. *Agribusiness, 17*(1), 3–32. https://doi.org/10.1002/1520-6297(200124)17:1<3::AID-AGR1001>3.0.CO;2-1

Rudd, J. (2019). Checking out productivity in grocery stores. *Beyond the Numbers, 8*(15). https://www.bls.gov/opub/btn/volume-8/checking-out-productivity-in-grocery-stores.htm

Rulli, M. C., Saviori, A., & D'Odorico, P. (2013). Global land and water grabbing. *Proceedings of the National Academy of Sciences, 110*(3), 892–897. https://doi.org/10.1073/pnas.1213163110

Schuman, M. (2011, July 15). Was Malthus right? *Time Business*. https://business.time.com/2011/07/15/was-malthus-right/

Seale, J. L., Jr., & Regmi, A. (2006). Modeling international consumption patterns. *Review of Income and Wealth, 52*(4), 603–624. https://doi.org/10.1111/j.1475-4991.2006.00204.x

Senmatic. (n.d.). *Vertical farming*. https://www.senmatic.com/horticulture/solutions/vertical-farming

Sindal, H. (2019). *Lokale varer: Nærheden er lige til at spise*. https://samvirke.dk/artikler/lokale-varer-naerheden-er-lige-til-at-spise

Sisodiya, A. S. (2004). *Mergers and demergers: Concepts and cases*. ICFAI University Press.

Statistics Sweden. (several issues). *Jordbruksstatistisk årsbok* (*Yearbook of agricultural statistics*). Örebro: Statistiska Centralbyrån (Statistics Sweden).

Tangermann, S. (2011). Policy solutions to agricultural market volatility: A synthesis. International Centre for Trade and Sustainable Development (ICTSD). https://www.files.ethz.ch/isn/138403/tangermann-price-volatility-and-policy-options.pdf

ter Beek, V. (2017). *Spain hasn't seen the end of its growth yet*. https://www.pigprogress.net/World-of-Pigs1/Articles/2017/7/Spain-hasnt-seen-the-end-of-its-growth-yet-163772E/

The Brewers of Europe. (n.d.). *Beer trends/Key figures*. Retrieved February 13, 2024, from, https://brewersofeurope.org/eu-beer-trends/european-union/

Toulemonde, M. (2021). Inside the great African land rush. The Africa Report. https://www.theafricareport.com/77291/inside-the-great-african-land-rush/

Tremblay, V. J., Iwasaki, N., & Tremblay, C. H. (2005). The dynamics of industry concentration for U.S. micro and macro brewers. *Review of Industrial Organization, 26*, 307–324. https://doi.org/10.1007/s11151-004-8114-9

Trewavas, A. (2002). Malthus foiled again and again. *Nature, 418*, 668–670. https://www.nature.com/articles/nature01013.pdf

Tropea, F. (2016). Price volatility in agricultural markets: Risk management and other tools. European Parliamentary Research Service. https://www.europarl.europa.eu/RegData/etudes/BRIE/2016/586609/EPRS_BRI(2016)586609_EN.pdf

Tudoran, A. A., Fischer, A. R., van Trijp, H. C., Grunert, K., Krystallis, A., & Esbjerg, L. (2012). Overview of Consumer Trends in Food Industry. RECAPT—Retailer and Consumer Acceptance of Promising Novel Technologies and Collaborative Innovation Management. https://pure.au.dk/ws/files/70401792/Overview_of_Consumer_Trends_in_Food_Industry.pdf

Turchin, P. (2016). *Ages of discord: A structural-demographic analysis of American history*. Beresta Books.

Tyson Foods. (2021). *Tyson foods: Outpacing a growing, global protein market*. https://www.tysonfoods.com/news/news-releases/2021/12/tyson-foods-outpacing-growing-global-protein-market

UBS. (2018). *Is the kitchen dead?* https://www.youtube.com/watch?v=1jixPRfafkc

UN. (1987). *Our common future: The world commission on environment and development*. Oxford University Press.

UN. (n.d.). *Household size and composition—Database on household size and composition 2022*. United Nations Population Division. https://www.un.org/development/desa/pd/data/household-size-and-composition

UNCCD. (2022). *The global land outlook—Land restoration for recovery and resilience* (2nd Edition). United Nations Convention to Comat Desertification (UNCCD). https://www.unccd.int/sites/default/files/2022-04/UNCCD_GLO2_low-res_2.pdf

UNCTAD. (2021). Trade and development report 2021. From recovery to resilience: The development dimension. UNCTAD. United Nations Publications. https://unctad.org/system/files/official-document/tdr2021_en.pdf

UNCTAD. (2022). International tax reforms and sustainable investment. United Nations Publications. https://unctad.org/system/files/official-document/wir2022_en.pdf

UNCTAD. (2023). *World Investment Report: Annex Tables*. https://worldinvestmentreport.unctad.org/annex-tables/

UNCTAD. (several issues). World Investment Report. United Nations Conference on Trade and Development (UNCTAD).

UNDP. (n.d.). The SDGs in action. What are the Sustainable Development Goals? The United Nations Development Programme (UNDP). https://www.undp.org/sustainable-development-goals

UNEP. (2021). Food Waste Index Report 2021. United Nations Environment Programme, Nairobi. https://www.unep.org/resources/report/unep-food-waste-index-report-2021

UNESCO. (2020). *The United Nations world water development report 2020: Water and climate change*. https://unesdoc.unesco.org/ark:/48223/pf0000372985

UNIDO. (2015). Global value chains and development: UNIDO's Support towards Inclusive and Sustainable Industrial Development. United Nations Industrial Development Organization (UNIDO). https://www.unido.org/sites/default/files/2016-03/GVC_REPORT_FINAL_0.PDF

University of Copenhagen. (n.d.). Vertical farming. Urban Farming Science. https://urbanfarming.ku.dk/english/research/alternative-cultivation-practices/

UN-Water. (2021). Summary Progress Update 2021: SDG 6—Water and sanitation for all. UN-Water. https://www.unwater.org/sites/default/files/app/uploads/2021/12/SDG-6-Summary-Progress-Update-2021_Version-July-2021a.pdf

USDA. (2005a). The 20th century transformation of U.S. Agriculture and Farm Policy. United States Department of Agriculture, Economic Research Service. Retrieved November 11, 2023, from, https://www.ers.usda.gov/webdocs/publications/44197/13566_eib3_1_.pdf

USDA. (2005b). Cooperatives in the Dairy Industry. United States Department of Agriculture. https://www.rd.usda.gov/files/cir1-16.pdf

USDA. (2015a). Farmer, rancher, and fishery cooperative historical statistics, 1913–1950. United States Department of Agriculture, Rural Development Cooperative Programs. https://www.rd.usda.gov/sites/default/files/cir1-26-part-i-stats-1913-1950_0.pdf

USDA. (2015b). Farmer, rancher, and fishery cooperative historical statistics, 1951–1999. United States Department of Agriculture, Rural Development Cooperative Programs. https://www.rd.usda.gov/sites/default/files/cir1-26-part-ii-stats-1951-1999_0.pdf

USDA. (2015c). Farmer, rancher, and fishery cooperative historical statistics, 2000–2012. United States Department of Agriculture, Rural Development Cooperative Programs. https://www.rd.usda.gov/sites/default/files/cir1-26-part-iii-stats-2000-2012.pdf

USDA. (2022). Crop production. Historical track records: April 2022. USDA, National Agricultural Statistics Service. https://www.nass.usda.gov/Publications/Todays_Reports/reports/croptr22.pdf

USDA. (several issues a). Agricultural statistics. United States Department of Agriculture, National Agricultural Statistics Service. https://usda.library.cornell.edu/concern/publications/j3860694x?locale=en&page=9#release-items

USDA. (several issues b). Census of agriculture. United States Department of Agriculture (USDA). https://www.nass.usda.gov/AgCensus/index.php

USDA. (several issues c). Census of agriculture. USDA. https://agcensus.library.cornell.edu/

Vestring, T., & Felenbok, J.-P. (2017, January 18). How Conglomerates in Southeast Asia can live long and prosper. Bain & Company. https://www.bain.com/insights/how-conglomerates-in-southeast-asia-can-live-long-prosper/

villysgaard. (2015). *Was Malthus completely wrong?* https://mereconomics.com/2015/12/07/was-malthus-completely-wrong/

von Braun, J., & Lohlein, D. (2003). Policy options to overcome subsistence agriculture in the CEECs. In S. Abele, & K. Frohberg (Eds.), *Subsistence agriculture in Central and Eastern Europe: How to break the vicious circle?* (pp. 46–70). Institute of Agricultural Development in Central and Eastern Europe (IAMO). https://ageconsearch.umn.edu/record/93082/files/sr_vol22.pdf

von Braun, J., & Meinzen-Dick, R. (2009). "Land grabbing" by foreign investors in developing countries: Risks and opportunities. International Food Policy Research Institute (IFPRI Policy Brief 13). https://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/14853/filename/14854.pdf

Vranken, L., Tabeau, E., Roebeling, P., & Ciaian, P. (2021). Agricultural land market regulations in the EU Member States. *Publications Office of the European Union*. https://doi.org/10.2760/86127

Wadsworth, J. J. (2019). Marketing operations of dairy cooperatives: 2017. United States Department of Agriculture. https://www.rd.usda.gov/files/publications/RR234MarketingOperationsofDairyCooperatives2017.pdf

Walsh, B. (2018). Chinese overseas agricultural investment and Beijing's dream of a new economic world order. Future Directions International. https://apo.org.au/sites/default/files/resource-files/2018-05/apo-nid172036.pdf

Wendt, H., & Peter, G. (2014). Gestiegene Erzeugerpreise für tierische Erzeugnisse treiben den Erzeugeranteil nach oben. Braunschweig: Thünen-Institut für Marktanalyse. https://literatur.thuenen.de/digbib_extern/dn054226.pdf

Wi, P. Y. (2018). The dynamic change analysis and implications of Korea's top 500 companies (1998–2017). ERRI (Economic Reform Research Institute).

Wiebe, K. (2003). Will land degradation prove Malthus right after all? USDA, Economic Research Service. https://www.ers.usda.gov/amber-waves/2003/june/will-land-degradation-prove-malthus-right/

World Bank. (1986). World Development Report 1986. Oxford University Press. https://openknowledge.worldbank.org/handle/10986/5969

World Bank. (2018). ESS5: Land acquisition, restrictions on land use and involuntary resettlement. Guidance Note for Borrowers. https://documents1.worldbank.org/curated/en/294331530217033360/ESF-Guidance-Note-5-Land-Acquisition-Restrictions-on-Land-Use-and-Involuntary-Resettlement-English.pdf

World Bank. (2020). World Development Report 2020: Trading for Development in the Age of Global Value Chains. *World Bank*. https://doi.org/10.1596/978-1-4648-1457-0

World Bank. (2022). *Water in agriculture*. https://www.worldbank.org/en/topic/water-in-agriculture

World Economic Forum. (2019). The Global Risks Report 2019: 14th Edition. Geneva: World Economic Forum. https://www3.weforum.org/docs/WEF_Global_Risks_Report_2019.pdf

World Obesity Federation. (2023). World Obesity Atlas 2023. World Obesity Federation. https://data.worldobesity.org/publications/WOF-Obesity-Atlas-V5.pdf

WTO. (2011). The WTO and preferential trade agreements: From co-existence to coherence. World Trade Organization. https://www.wto.org/english/res_e/booksp_e/anrep_e/world_trade_report11_e.pdf

WTO. (2019). World Trade Report 2019. The future of services and trade. World Trade Organization. https://www.wto.org/english/res_e/booksp_e/00_wtr19_e.pdf

WTO. (2020). *WTO report finds growing number of export restrictions in response to COVID-19 crisis*. https://www.wto.org/english/news_e/news20_e/rese_23apr20_e.htm

WTO. (2021a). Annual overview: Implementation of SPS Transparancy Provisions and Specific Trade Concerns. World Trade Organization. https://docs.wto.org/dol2fe/Pages/SS/directdoc.aspx?filename=q:/G/SPS/GEN804R13.pdf&Open=True

WTO. (2021b). Sanitary and Phytosanitary Information Management System. Notifications submitted per year. WTO. http://spsims.wto.org/en/PredefinedReports/NotificationsSubmittedPerYearPage

WTO. (2021c). Sanitary and Phytosanitary Measures Agreement. 10 Key Results From 2020. World Trade Organization. https://www.wto.org/english/res_e/booksp_e/sps10key2020_e.pdf

WTO. (2022). World Trade Statistical Review 2022. World Trade Organization. https://www.wto.org/english/res_e/booksp_e/wtsr_2022_e.pdf

WTO. (n.d.a). Information note on trade in intermediate goods: second quarter 2022. World Trade Organization, Economic Research and Statistics Division. https://www.wto.org/english/res_e/statis_e/miwi_e/info_note_2022q2_e.pdf

WTO. (n.d.b). *WTO in brief*. Retrieved February 11, 2024, from, https://www.wto.org/english/thewto_e/whatis_e/inbrief_e/inbr_e.htm

Xing, Y., Gentile, E., & Dollar, D. (2021). Global Value Chain Development Report 2021. Beyond production. Asian Development Bank et al. https://doi.org/10.22617/TCS210400-2

Yi, J., Meemken, E.-M., Mazariegos-Anastassiou, V., Liu, J., Kim, E., Gómez, M. I., Canning, P., & Barrett, C. B. (2021). Post-farmgate food value chains make up most of consumer food expenditures globally. *Nature Food, 417–425*. https://doi.org/10.1038/s43016-021-00279-9

Zagema, B. (2011). Land and power: The growing scandal surrounding the new wave of investments in land. Oxfam International. https://oxfamilibrary.openrepository.com/bitstream/handle/10546/142858/bp151-land-power-rights-acquisitions-220911-en.pdf;jsessionid=53F913DB7045CB36466252D01856C7EA?sequence=32

Zammit, K., & Howden, M. (2020). Farmers' terms of trade. Update to farm costs and prices paid. Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES). https://doi.org/10.25814/5e339b991ce73

Zeihan, P. (2022). *The World is just the beginning. Mapping the collapse of globalization*. Harper Business.

Zhang, W., Plastina, A., & Sawadgo, W. (2018). *Iowa farmland ownership and tenure survey, 1982–2017: A thirty-fiveyear perspective*. Iowa State University. https://store.extension.iastate.edu/product/6492

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https://doi.org/10.1007/978-3-031-58152-6

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