



## **Food security in Denmark**

### **A data-driven assessment**

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# IFRO Commissioned Work



Food security in Denmark:  
A data-driven assessment

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*Lærke Jensbye*

**IFRO Commissioned Work 2024/06**

**(IFRO Udredning 2024/06)**

Food security in Denmark: A data-driven assessment

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## Preface

This report is commissioned by the Danish Veterinary and Food Administration (DVFA) through an agreement between the Ministry of Food, Agriculture and Fisheries and the Department of Food and Resource Economics (IFRO) at the University of Copenhagen. The aim of this commissioned work is to study the food security situation in Denmark, including the availability, access, and stability of major food groups, and to describe the main policy instruments that support food security in Denmark.

In-person meetings were held between DVFA (participation by Susanne Berendt and Nikolas Kühn Hove) and IFRO (participation by Wusheng Yu and Lærke Jensbye) to define the scope of the study and to keep DVFA updated on the progress of the work. In connection with the DVFA's participation in the European Food Security Crisis Preparedness and Response Mechanism (EFSCM), Wusheng Yu presented the interim findings of the study at a meeting of the EFSCM in January 2024.

Professor Jørgen Dejgård Jensen from IFRO has commented on this work.

The authors have conducted the study independently and are solely responsible for its contents.

## Summary

Recent disruptions to the global food supply chain and food price inflation have raised food security concerns in many countries. This report provides an assessment of the food security situation in Denmark during the past decade, using a set of publicly available data such as food security indicators, production structure, net trade positions and trade dependencies sourced from official statistics.

Using commonly adopted food security indicators, we find that Denmark has consistently maintained a high level of food security. However, slight increases in the prevalence of food insecurity have also been observed in recent years, mainly due to weakened accessibility rather than availability. As a country with a strong export-oriented agricultural sector, Denmark's domestic agricultural outputs provide more than enough food supply measured in macronutrients (i.e. calories, proteins and fats). However, as the Danish agricultural sector is mainly focused on producing cereal grains and livestock, there is a mismatch between the domestic production pattern and the dietary pattern consisting of a wider range of products. This explains the Danish dependency on imported products such as vegetables and fruits. Furthermore, the large export-oriented animal food sector in Denmark requires sizable feed imports. While most of Danish agricultural and food imports are sourced within the EU common market, there are instances where imports from other regions are also needed, such as soybeans, maize, vegetable oil and fertilisers. The stability of some of these imports has been impacted by recent geopolitical events and biophysical shocks linked to extreme weather events and climate change impacts. Based on the results of the analysis, the report concludes with a set of considerations to be included in further vulnerability and risk analyses focusing on enhancing food security in Denmark.

# Contents

Preface.....	1
Summary.....	2
Contents .....	3
1. Introduction.....	4
2. Food security in Denmark at a glance .....	6
3. Production levels and structure of Danish agriculture.....	9
3.1 Production levels in the livestock sector and other animal-based food sectors.....	10
3.2 Production levels in the crop sectors .....	11
4. A structural mismatch between food production and consumption.....	13
5. International trade .....	14
6. Potential vulnerabilities.....	18
6.1 Food price shocks .....	18
6.2 Feed dependency .....	19
6.3 Fertilisers .....	20
6.4 Land use.....	22
7. Policy framework for ensuring food security in the EU and Denmark.....	22
8. Conclusion and discussion .....	25
References.....	26
Appendix 1. Danish production trends and net trade levels of processed food products .....	28
Appendix 2: EU production of and trade dependence on key commodities .....	30

# 1. Introduction

The World Food Summit in 1996 put forward a definition of food security:

*Food security exists when all 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 (World Food Summit, 1996).*

In Denmark, the physical quantity of food produced has consistently surpassed domestic dietary needs measured in macronutrients (carbohydrates, fats, and proteins), providing a good basis for ensuring food supply. At the same time, the legislation and controls related to food standards are relatively stringent, leading to a high level of food safety. However, economic access to food remains a concern for a very small segment of the Danish population, despite the country's high income level and rather equal income distribution. This concern has slightly escalated recently due to the rise in food price inflation resulting from market disruptions such as the Ukrainian war and the COVID-19 outbreak. The lack of economic access is even more apparent when considering consumers' food preferences, the final element of food security, as limited economic accessibility can restrict the options to fulfil dietary needs and preferences.

The Danish agricultural sector primarily focuses on animal-based foods, utilising most of the available land area for feed production. This specialisation results in the need to import other food groups (for example vegetables and fruits). Dietary diversity for consumers is therefore reliant on trade, mainly with other EU member states. The dependency on imports from Southern EU member states could present future challenges, as they are expected to face climate change impacts which will negatively impact their production possibilities (Andersen et al., 2023). The Danish agriculture imports that are primarily sourced from outside of the EU consist mainly of feed, vegetable oils and fertilisers and are thus not primarily for direct human consumption. However, recent experience has revealed vulnerabilities in terms of the reliance on only a limited number of import sources for these products. For example, the need to reduce the dependence on imported fertilisers sourced from Russia has made it necessary to increase domestic production and imports from elsewhere. However, rising energy prices have made domestically produced fertilisers in the EU more costly. This highlights the need for diversified import sources for particular commodities and agricultural inputs.

In this report, we first assess the current state of food security in Denmark, with other Nordic countries as a point of reference. This comparison considers indicators such as the prevalence of food insecurity, the adequacy of available calories, and the rate of obesity. Moving beyond this broad overview, the analysis looks more in depth at the trends in the Danish agricultural production of primary products, juxtaposing these trends with the net trade status of these commodities in order to better understand the potential food security implications of the revealed trends. The assessment also includes an examination of the macronutrient composition of the Danish food supply, emphasizing the product groups contributing to the intake of calories and proteins. These levels are then compared with the levels of these same product groups produced within Denmark in order to reveal a structural mismatch between Denmark's food production and its food consumption. This mismatch points to the need for net imports of a number of food products into Denmark, despite its status as a net food-exporting country.

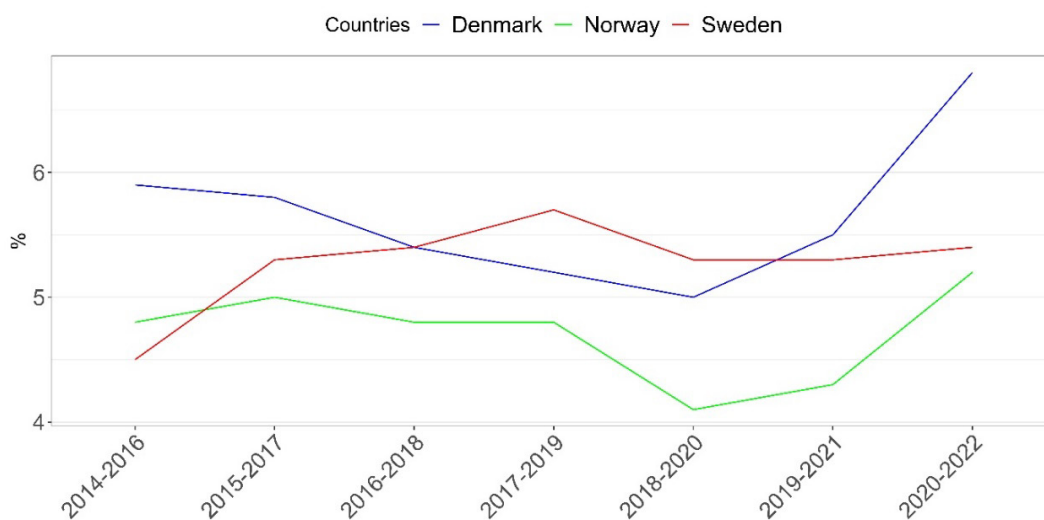
Recent disruptions to global food supply chains in connection with the COVID-19 pandemic and Russia's invasion of Ukraine as well as the food price inflation experienced recently in many countries point to risks

and vulnerabilities in the food system, some of which are at times framed as connected to either general import dependencies or dependencies on particular sourcing countries. In this connection, we also assess the potential vulnerabilities of food supply in Denmark. We do so by analysing the diversity of sourcing countries for various product groups, with a specific focus on the proportion of products sourced from outside the EU. This is because the trade relationships with the member states within the EU common market are considered more stable than the trade relationships with countries outside the EU. In this regard, the analysis highlights sensitive aspects of Danish food security, such as fluctuations in the food price index, trade diversification concerning feeds and fertilisers, and diversification in land use. Within these more sensitive traded commodities, we further assess the trade dependency of the EU as a whole. The findings across these different elements are summarised to underscore the food system's stability and vulnerability. Based on this analysis, we further discuss options available for mitigating the potential vulnerability of Danish food supply. This discussion is positioned within the context of the existing food security policy framework of the EU and Denmark.



## 2. Food security in Denmark at a glance

Over the past decade, food insecurity levels in Denmark have closely mirrored those of other Nordic countries (Figure 1). Compared to the average food security situation in other high-income countries, as measured by the indicator *Prevalence of moderate and severe food insecurity* (measured as the percentage of people in the population living in households classified as moderately or severely food insecure, see note below Figure 1), Denmark experiences rather low food insecurity (FAO, 2023a). However, in the most recent period, there has been a small but noticeable uptick not just in Denmark but also across its neighbouring countries. This rise can be attributed to a growth in the food price index and generally high inflation levels in recent years, which have led to reductions in real household income. Importantly, the recent growth in food insecurity is connected to the financial situation of consumers rather than a reduction in food availability on the Danish market.

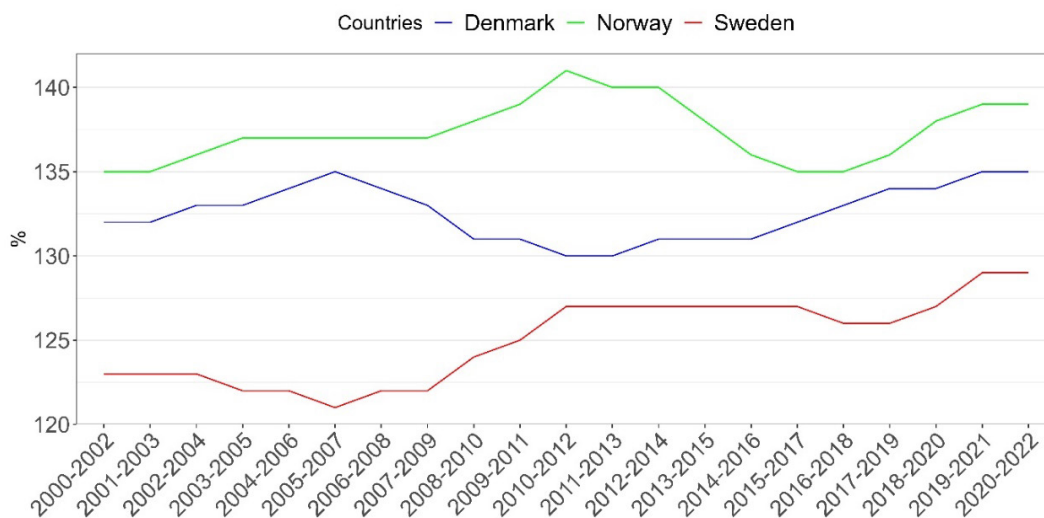


**Figure 1.** Prevalence of moderate and severe food insecurity

Note: The prevalence of moderate or severe food insecurity is defined as the percentage of people in the population living in households classified as moderately or severely food insecure. The threshold to classify for "moderate or severe" food insecurity corresponds to the severity associated with the item *Having to eat less* on the global Food Insecurity Experience Scale.

Source: FAO (2023a).

Indeed, judging by the average dietary energy supply available within Denmark, it appears that on average Danish consumers have had a stable level of dietary energy supply 30-35 percent higher than the energy requirement over the past two decades (Figure 2). This excess of available calories is common across Scandinavia and other high-income regions, indicating that the distributional and accessibility elements of food insecurity are the main drivers of the observed current increase in food insecurity. As a result of this ample supply, the rate of undernourishment in Denmark is less than 2.5 percent of the population, below the threshold at which FAO statistics provide an exact measurement (FAO, 2023a).

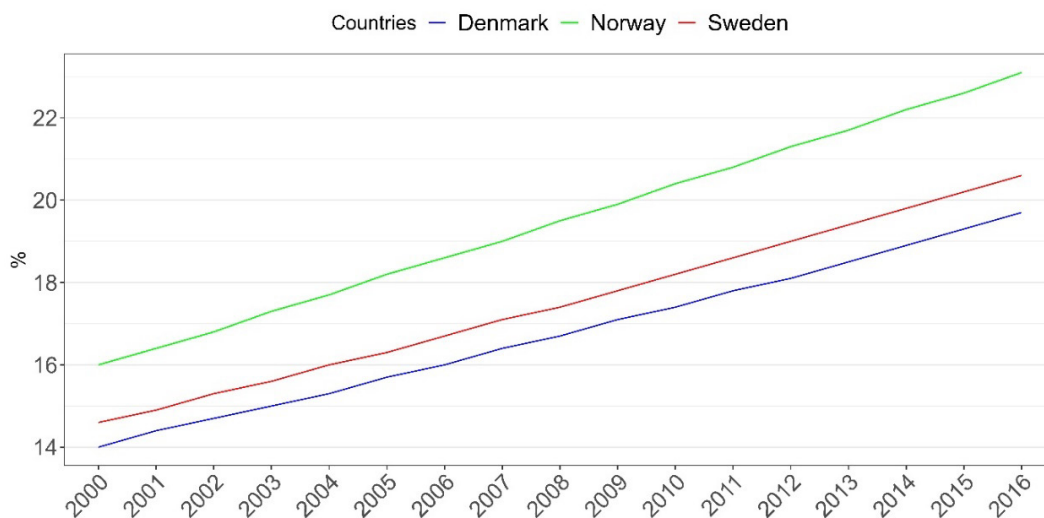


**Figure 2. Average dietary energy supply adequacy**

Note: This indicator expresses the Dietary Energy Supply (DES) as a percentage of the Average Dietary Energy Requirement (ADER).

Source: FAO (2023a).

The surplus of available calories has contributed to a continuous rise in obesity levels in Denmark (Figure 3). This trend is not limited to Denmark. While Danish obesity levels are comparatively lower than those in the rest of the Nordic countries, all countries in the region are experiencing a rise in obesity rates. This indicates that the issue is not one of food insecurity due to a lack of food as required in the definition of food security but rather a growing problem of overconsumption or diets not befitting an active and healthy life.



**Figure 3. Prevalence of obesity within the adult population**

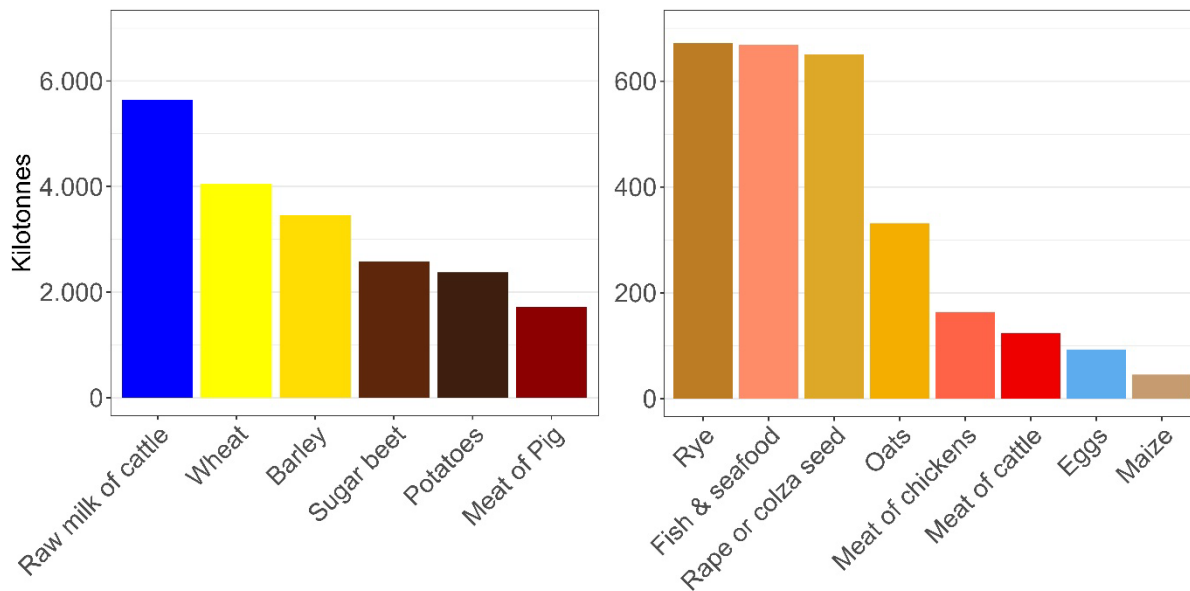
Note: The prevalence of obesity in the adult population is the percentage of adults ages 18 and over whose Body Mass Index (BMI) is more than 30 kilograms per m<sup>2</sup>. Body Mass Index (BMI) is a simple index of weight-for-height or a person's weight in kilograms divided by the square of their height in meters.

Source: FAO (2023a).

### 3. Production levels and structure of Danish agriculture

Turning to the production side, the stability of Denmark's food supply hinges on the country's level of domestic production and net trade positions. To evaluate this stability, we first analyse changes in the production pattern of primary commodities within Denmark, which are predominantly milk, wheat, barley, sugar beet, potatoes, and pig meat (as depicted in the left panel of Figure 4). Additionally, our assessment extends to other key products such as rye, fish and seafood products, rapeseed, oats, chicken, beef, eggs, and maize produced at a much smaller scale (right panel, Figure 4). These product groups collectively illustrate the structure of Danish agriculture, highlighting the predominant focus on animal-based foods. Notably, a considerable portion of the cereals produced is channelled into the animal-based agricultural sectors as feeds, a fact that will be further discussed later.

The different production levels of these products and their differential uses in human consumption and as animal feed result in different net trade positions. In this section, we focus on primary agricultural products and present their production levels and net trade positions (in section 5, we present Denmark's net trade positions for several processed product groups). As will be shown in Table 1, Denmark's net imports are primarily vegetables and fruits. These product groups are not present on the list of products with high production levels shown in Figure 4, due to climatic conditions in Denmark that constrain a large-scale production of these products. As dietary guidelines stress the importance of vegetables, fruits, and legumes, the lower domestic production level of such products in Denmark points to a potential vulnerability in the availability of these products in terms of satisfying food preferences and fitting with an active and healthy life.



**Figure 4.** Food products with high Danish production levels in 2021

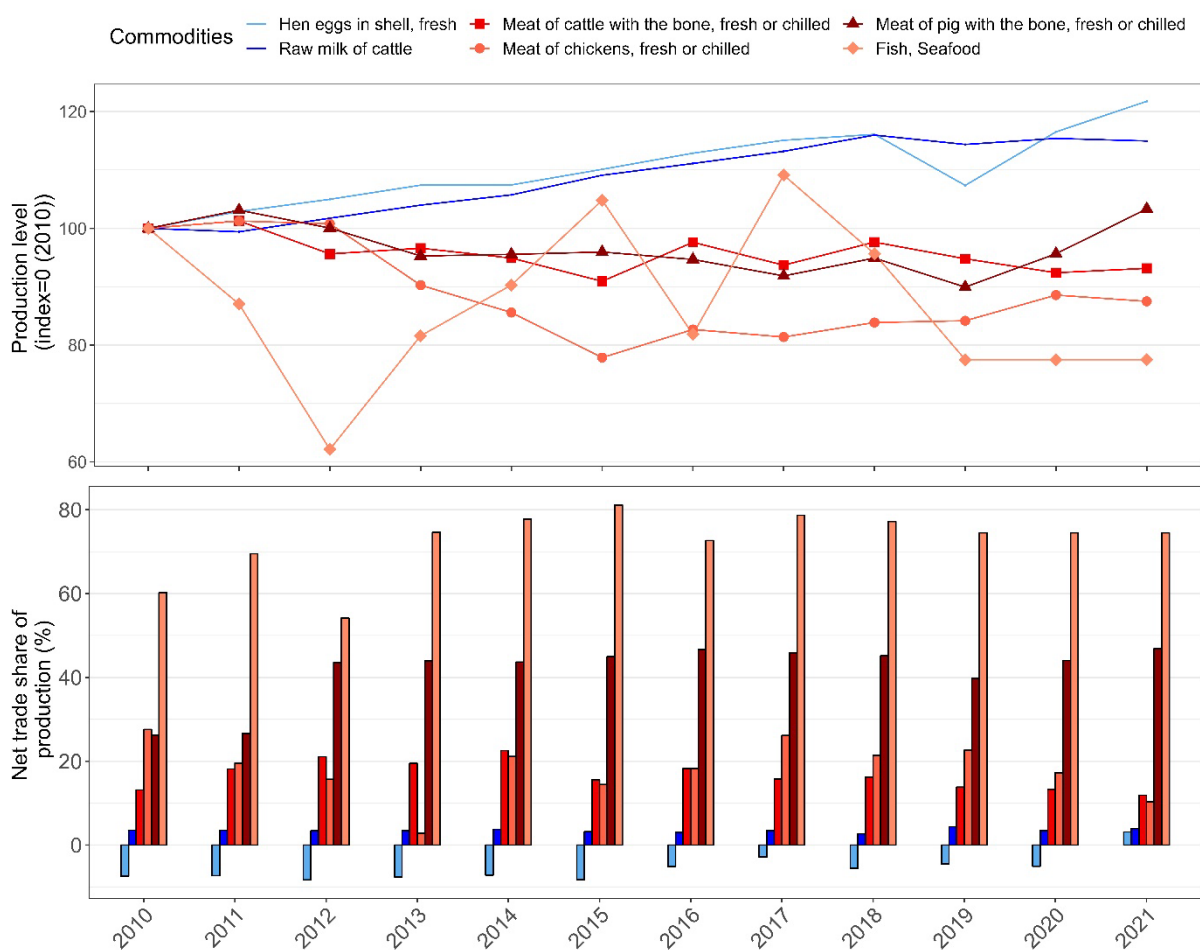
Source: FAO (2023b, 2023c).

### 3.1 Production levels in the livestock sector and other animal-based food sectors

When assessing the development of livestock and animal-based food production in Denmark during the past decade, several trends emerge (upper panel, Figure 5 on the next page). Firstly, there has been a consistent increase in the production of eggs and raw milk, although milk production appears to have stabilised within the last four years. Secondly, meat production levels initially decreased during this period before stabilizing. Pig meat is the only meat product to have surpassed its 2010 production levels within the most recent year of this period (i.e. 2021). Thirdly, as cattle meat production in Denmark mainly stems from dairy cows, the decrease in cattle meat production can be attributed to the dairy sector's focus on yield growth and optimisation, resulting in fewer animals needed for the same level of production (Danmarks Statistik, 2023a). Fourthly, the most unstable production level is observed for the fish and seafood category, as it is mostly dependent on factors not controlled by the individual producers such as fishing quotas and stocks.

With the exception of the egg sector (which was a net import sector until 2020), all primary animal-based agricultural sectors in Denmark are export-oriented (lower panel, Figure 5). Among them, the fish and seafood sector, which contains both primary and processed products, is the most export-oriented sector with a net export share of around 80 percent of the sector's total output. The pig sector is the most export-oriented primary sector, with consistently high shares of net exports relative to the production level for the whole period, as a significant share of Danish pigs are slaughtered and processed outside of Denmark. Similarly, stable but small export shares are observed for the raw milk sector. The smaller export share can be explained by the fact that the Danish dairy sector's exports are mainly more processed dairy products. Indeed, most of the Danish milk processing occurs within the country, leading to a much higher level of export of processed dairy goods rather than that of raw milk. The net trade shares of the processed pig meat and dairy sectors are provided in appendix 1, both with net export shares relative to a production of around or above 50 percent in most years. As the levels of production have decreased within the chicken and cattle meat sectors, so have their net export levels, indicating that domestic consumption levels have not been as impacted. In summary, the supply of primary animal-based food products in Denmark and the associated export shares have remained high in the past decade.

Future risks to maintaining a high level of animal-based food production in Denmark are associated with multiple factors, such as a higher prevalence of heat stress and insect-borne diseases (Andersen et al., 2023). Both factors could have negative implications on the future production levels of animal-based foods. Furthermore, the effect of climate change on crop production may trigger more intensified fluctuations in feed availability. For instance, the recent droughts in 2018 (Ritzau, 2018) and 2023 (Danmarks Statistik, 2023b; Ministeriet for Fødevarer, Landbrug og Fiskeri, 2023) have had major negative consequences on the domestic feed production in Denmark.



**Figure 5.** Production level (line plot) and net trade share of production (bar plot) for certain animal-based food commodities in Denmark

Source: FAO (2023b, 2023c).

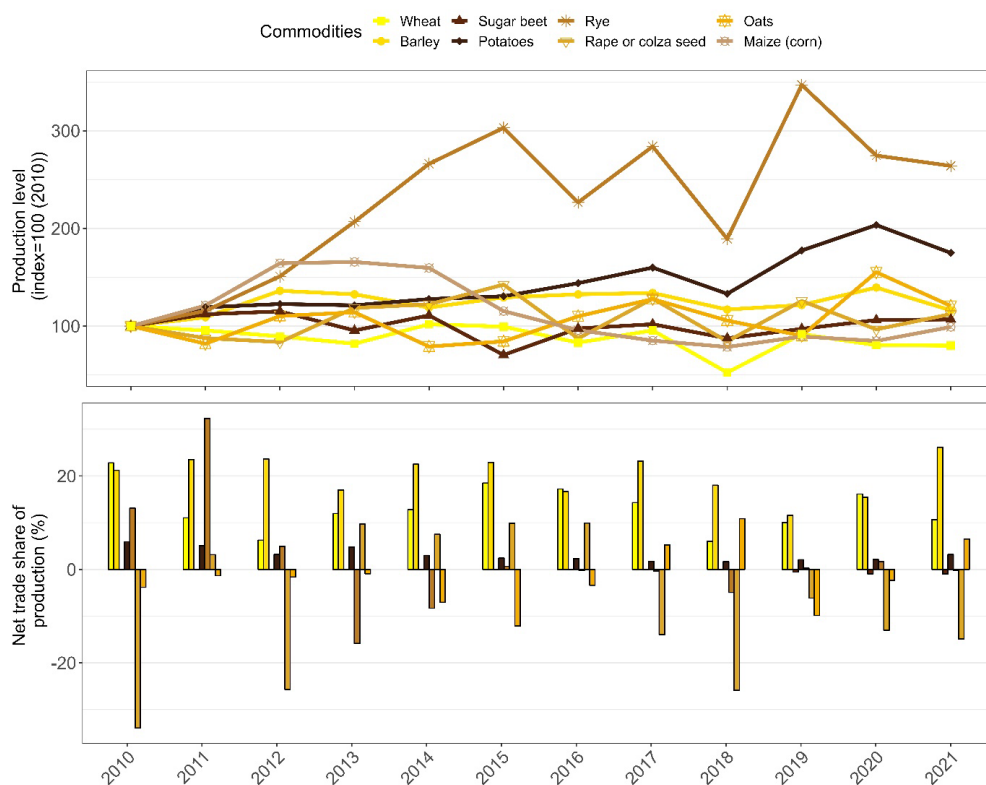
### 3.2 Production levels in the crop sectors

When examining crop production levels (Figure 6 below), most crops show stable or growing trends. However, wheat, the crop with the highest production level, has had lower production levels in recent years compared to historical levels. Conversely, rye production has seen consistent growth over the past decade, with a 2021 production level 2.5 times higher than the level in 2010. Similarly, potato production has also experienced growth, albeit at a slower pace. Other crops display cyclical patterns with fluctuating production levels. These changes in production levels can be partially explained by the shift in land-use patterns (as displayed in Figure 14). However, studies have also found that the temperature increases linked to climate change have had negative implications for the Danish wheat yields (Andersen et al., 2023). Despite the decrease in wheat production, wheat remains a net export sector along with barley and potatoes. On the other hand, rapeseed has been imported most years in the past decade. The net trade positions of other crops vary based on production fluctuations.

Note that key feed crops such as maize and soybeans are not included in the lower panel of Figure 6. Soybeans are entirely imported in Denmark, as there is no domestic production of this crop. Thus, it is not

possible to include soybeans in Figure 6. There has also been a heavy import of maize in the past decade, with net imports of this crop constituting approximately 2.7 times the size of domestic production in 2021. This, however, signifies a reduced reliance on the import of maize compared to the levels in 2018 and 2019, where the reliance on the net imports of maize was notably higher (with net imports of maize seven to nine times higher than domestic production). The above indicates a reliance on imported products in commodity groups commonly used for feed, an aspect that will be further analysed in subsequent sections.

The observed effect of climate change has so far resulted in increased yields for most crops (Andersen et al., 2023). This is expected to continue in Northern Europe until 2050. However, Andersen et al. (2023) find that high summer temperatures have a negative effect on wheat and potato production, whereas they create advantageous conditions for the production of crops such as maize that are currently imported (Andersen et al., 2023). To ensure continued high shares of domestic feed production, shifts within the production patterns of crops are therefore needed in the long term. Furthermore, increased levels of disease and pests are expected, raising the vulnerability of production and resulting in larger annual yield fluctuations.



**Figure 6.** Production levels (line plot) and net trade shares of production (bar plot) of crops in Denmark

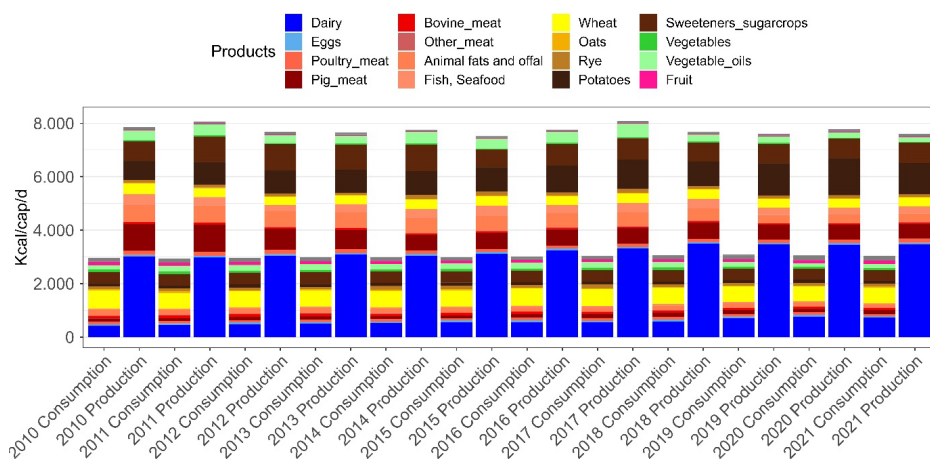
Note: The net trade share of maize is not included in the figure, as net maize imports in Denmark were about three times the size of domestic production in 2021, resulting in a net trade share of -300 percent. However, this actually represents a significant reduction in import dependency. In 2018, the Danish net imports of maize were 11 times the size of domestic production.

Source: FAO (2023b).

## 4. A structural mismatch between food production and consumption

One way to measure the adequacy of the domestic food supply is to aggregate the macronutrients (such as calories, proteins and fats) that all food products contain. In this section, we highlight the stark contrast between the macronutrients available from domestic production and those available for consumption. As shown in Figures 7 and 8, the per capita calories and proteins available from the aggregated domestic food production in Denmark exceed the per capita calorie and protein consumption by a wide margin.<sup>1</sup> In fact, the calories available from domestic production in Denmark are more than twice the size of those available to Danish consumers, while the proteins available from domestic production is about three times of the actual amount of protein consumed. This is consistent with the status of Denmark as a net food-exporting country.

The largest source of calories in Danish food consumption are vegetal products, such as wheat-based products and sugar crop commodities. In contrast, the calories embodied in Danish agricultural production mainly stem from dairy products, meats, and potatoes. This difference highlights that the Danish food system is highly concentrated on animal food production and does not match the dietary structures to satisfy domestic food requirements but rather produces commodities aimed at export markets.



**Figure 7. Calories per capita per day in domestic food consumption and production in Denmark**

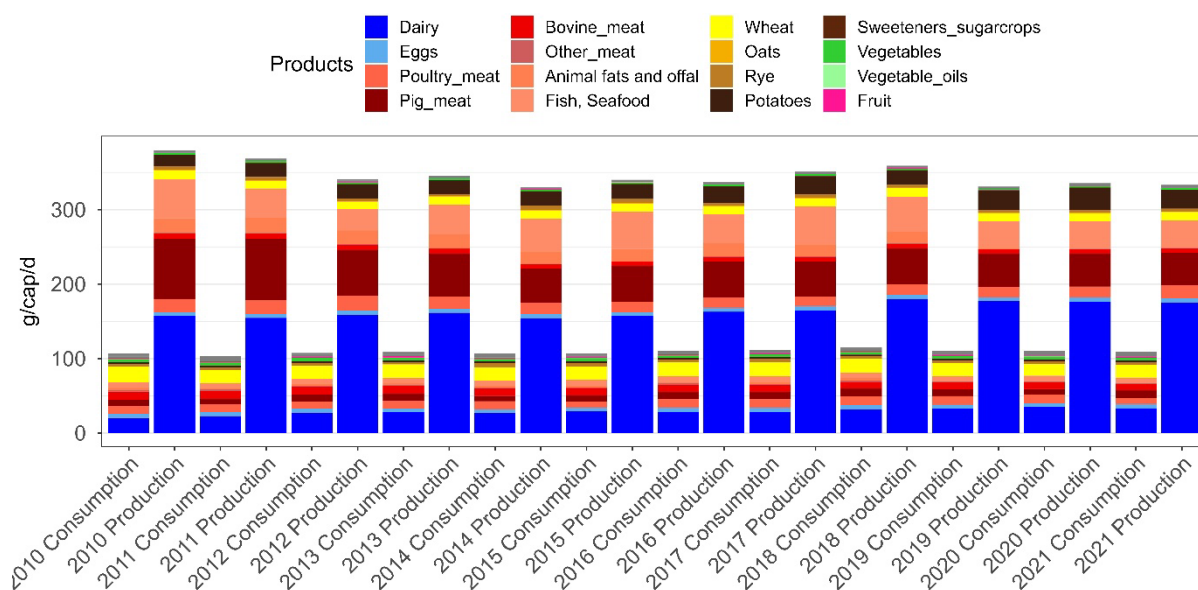
Note: Food supply is defined as domestic production adjusted for net trade, other product uses, and waste. For each product, we assume that the level of calories is the same in production and consumption. Only products currently a part of the Danish food supply are considered. Alcoholic beverages and stimulants are not considered.

Source: FAO (2023b, 2023c).

<sup>1</sup> In our calculation, no adjustments have been made for feed used in livestock production. Therefore, the total macronutrients from agricultural and livestock production may be overstated.



The mismatch between domestic production and domestic consumption is even more visible when assessing the level of available proteins, as animal-based foods have a higher protein content. The domestic production of proteins in Denmark is roughly three times the size of the amount of proteins consumed by Danish consumers (Figure 8). The gap is primarily driven by dairy and pork production. Similar observations can be made regarding the production of fat. Overall, the Danish food production measured in macronutrients is more than sufficient to meet domestic food demand. However, food production in Denmark consists of a large-scale production of relatively few agricultural commodities such as meat and dairy products, indicating that a dietary pattern reliant on domestic production would not be very diversified, with particularly insufficient levels of vegetable and fruit production.



**Figure 8.** Grams of protein per capita per day in domestic food consumption and production in Denmark

Note: Food supply is defined as domestic production adjusted for net trade, other product uses and waste. It is assumed that the protein content is the same for the produced products as the estimate for the protein in the food supply. Alcoholic beverages and stimulants are not considered.

Source: FAO (2023b, 2023c).

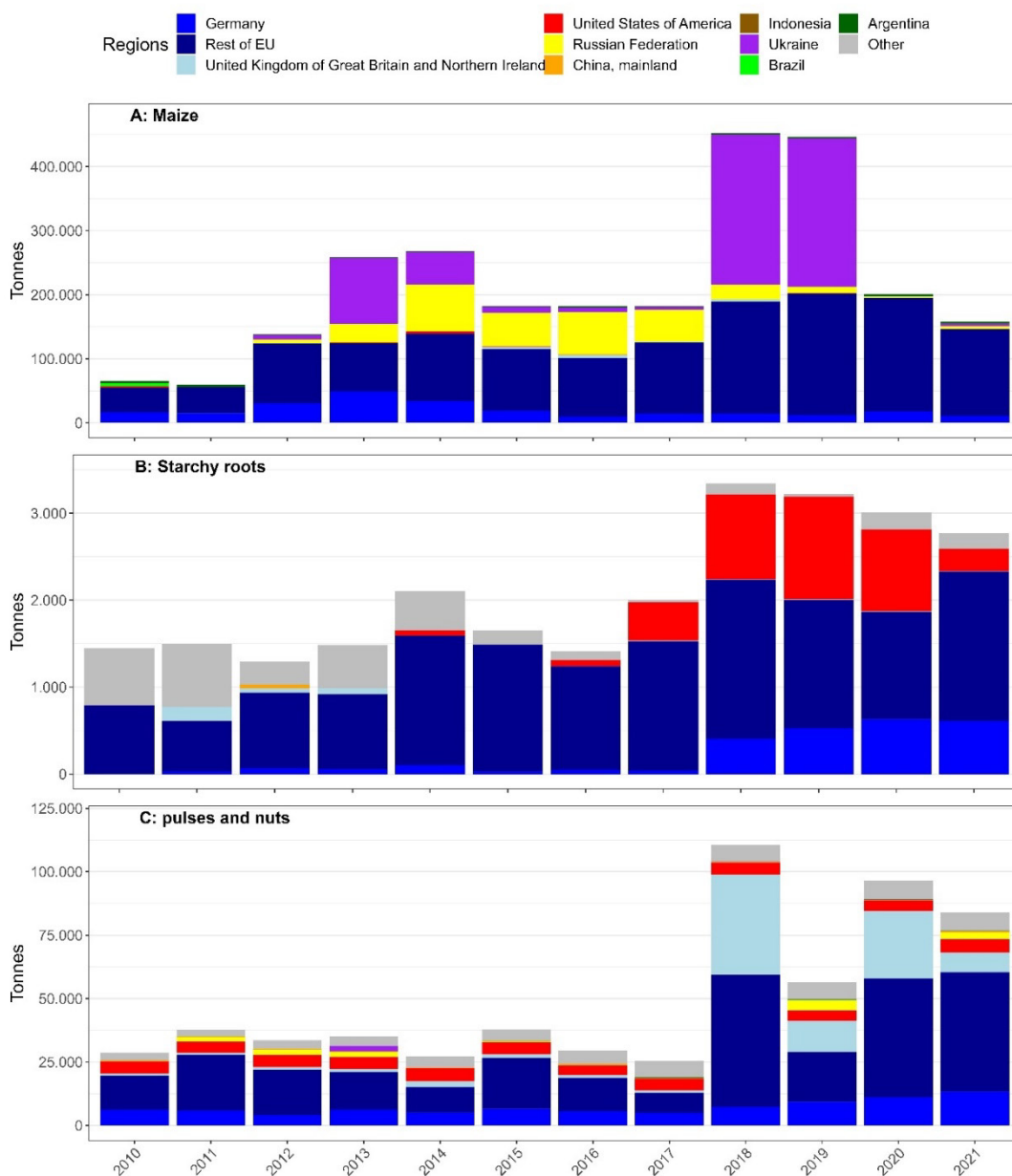
## 5. International trade

As discussed in earlier sections, Denmark is a large net exporter of animal food products, particularly meat, and dairy products as well as fish and seafood products. At the same time, Denmark also imports significant amounts of feed for the livestock sector, including soybeans (no domestic production), maize, and rapeseed. A number of other agricultural products such as vegetables and fruits are also imported for human consumption. At the product group level (Table 1), other EU member states are the dominant suppliers of the majority of the imported food products (particularly Germany, given its geographical proximity to Denmark). For example, imported fruits and vegetables are a key part of the Danish consumption pattern and are among the most import-dependent food products. As shown in Table 1, imported vegetables and fruits are mainly sourced from other EU member states, indicating stable trade relationships. It should be noted, however, that climate change can have negative impacts on the EU regions producing larger shares

of fruit and vegetables (Andersen et al., 2023). Countries from outside the EU play important roles in exporting several other product groups such as vegetable oil, pulses and nuts, and rice to Denmark. In particular, nearly half of Denmark's imports of vegetable oil in 2021 was sourced from non-EU countries, primarily due to a high level of imports of palm oil from Asia.

Although the import patterns depicted in Table 1 are based on data from 2021, this pattern has been the same for the past decade for the majority of the product groups, with the exception of maize, starchy roots, pulses and nuts, which are separately reported in Figure 9 on the next page. In 2018, the import levels of these products increased in connection with the drought in Denmark. For maize, Russian and Ukraine have emerged as major suppliers to the Danish market for various years in the past decade. For example, Ukraine was the most important supplier of maize to Denmark in both 2018 and 2019. However, both countries nearly ceased their exports to Denmark in both 2020 and 2021 due to their exports being redirected to other markets (Figure 9a). For starchy roots (Figure 9b) and pulses and nuts (Figure 9c), imports from both EU and non-EU sources have increased significantly in recent years.

At the detailed product level (lower panel, Table 1 below), Denmark is dependent on a number of products imported from outside the EU, many of which are related to animal feed. More than 50 percent of the imported animal feed to Denmark stems from non-EU member states. In the case of soybean cakes, about 1 million tons of imported soybean cakes – about two-thirds of Denmark's total soybean cake import – were sourced from non-EU countries in 2021. Other products such as beet pulp, molasses, sunflower cakes, soybean oil, palm oil, and residues of fatty substances are similarly dependent on non-EU supplies, although in much smaller import quantities. Within the EU, it should be noted that the dependency on imported animal feed such as soybeans and maize is not unique for Denmark, as a number of other EU member states also have a relatively large animal-based food production reliant on imported feed (see details of the EU's feed import dependence in appendix 2).



**Figure 9.** Danish imports by sourcing countries of a) maize, b) starchy roots and c) pulses and nuts

Source: FAO (2023b).

**Table 1. Danish imports of selected food groups and food products: shares sourced from the EU and net trade levels in 2021**

	Import share from EU (%)	Net trade level (tonnes) (- indicates net imports)
<b>Product groups</b>		
Fruit	87.1	(-) 391,115
Vegetable oil	53.9	(-) 339,275
Vegetables	95.5	(-) 325,764
Sweetener and sugar crops	96.2	24,516
Potatoes	96.2	47,243
Rye	99.9	(-) 1,873
Oats	99.8	13,394
Wheat	94.8	281,748
Animal fats and offal	99.0	233,326
Other meat	91.4	(-) 5,683
Bovine meat	98.0	(-) 15,971
Pig meat	98.1	1,200,586
Poultry meat	98.4	48,506
Fish and Seafood	-	498,430
Eggs	89.0	(-) 1,115
Dairy	94.9	471,258
Oil crops	84.3	(-) 73,225
Pulses and nuts	72.0	(-) 23,126
Other starchy roots	84.0	(-) 1,697
Rice	77.7	(-) 40,600
Maize	92.5	(-) 130,637
Other cereals	96.3	91,544
<b>Sub-products</b>		
Pulp, waste of fruit for feed	6.5	(-) 26,305
Beet pulp	9.6	(-) 107,806
Unmanufactured tobacco	9.7	(-) 5,193
Coffee, green	19.1	(-) 14,349
Molasses	26.6	(-) 105,278
Cake of sunflower seeds	28.2	(-) 192,854
Raisins	30.2	(-) 5,536
Cake of soybeans	34.1	(-) 1,533,243
Soybean oil	35.9	(-) 86,662
Palm oil	39.2	(-) 78,284
Residues of fatty substances	39.6	(-) 81,955
Almonds, shelled	39.8	(-) 8,821
Groundnuts, shelled	40.1	(-) 7,003
Vegetable products for feed n.e.c.	41.8	(-) 98,335

Note: The bilateral trade data used do not include fish and seafood.

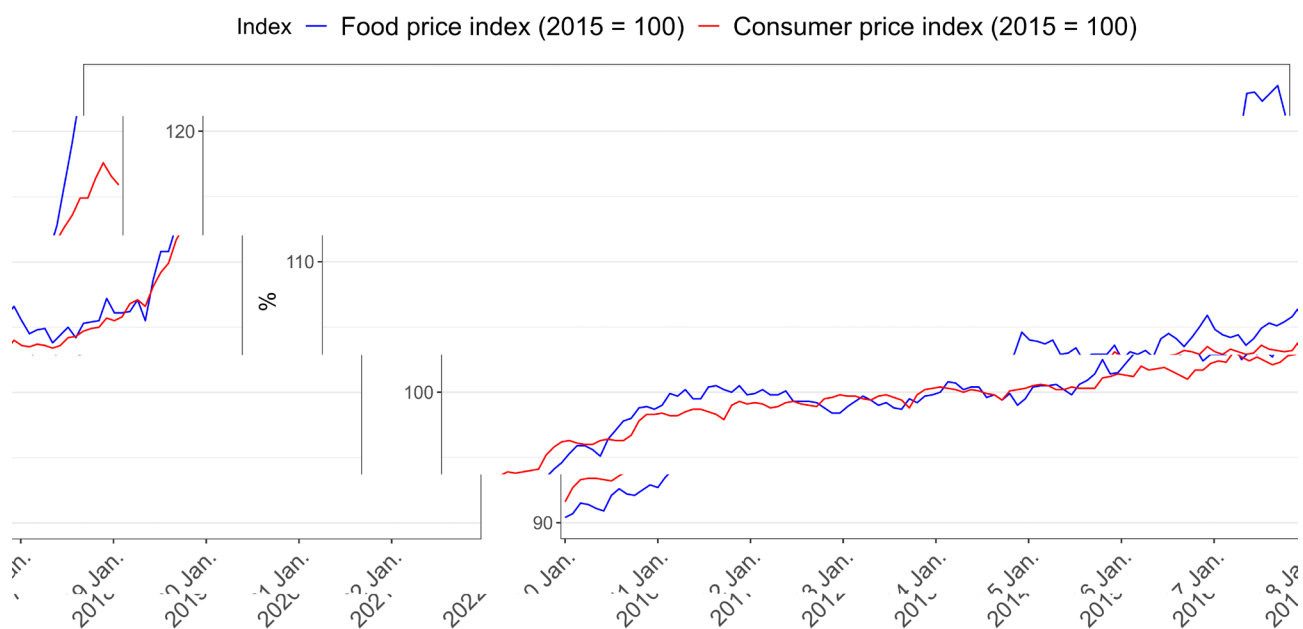
Source: FAO (2023b, 2023c).

## 6. Potential vulnerabilities

### 6.1 Food price shocks

As noted earlier in this report, despite an overall high level of food security in Denmark, there are still vulnerable consumers who are susceptible to food price shocks, for example those related to the war in Ukraine that have disrupted exports of key Ukrainian commodities such as grains. The war also impacted the fertiliser and energy markets, which in turn raised the costs of agricultural production. Thus, such events can increase the level of food insecurity in Denmark and other EU member states from both the demand and supply sides, indicating a need for effective responses in the event of future market shocks. It also calls for an increased preparedness, particularly considering the surge of imports of several products from Ukraine and Russia in the recent past.

Looking further back within the last decade, the food price index steadily increased month by month, following a trend similar to the general price index, even prior to the Ukraine war, but with some deviations during the COVID-19 period. With adjustments taken place in world commodity markets and alternative arrangements for Ukraine to re-establish its grain and seed oil exports, the food price shocks are expected to abate. Indeed, the most recent observations in Figure 10 point to a reduction in the food price index. Depending on the future developments of the war, this may indicate a future normalisation of the food price level. In any case, the impact of price fluctuations on the level of food insecurity indicates a need for short-term policy measures to counteract the negative impacts of price shocks. In addition to geopolitical events, the expected rise in the frequency and prevalence of climate change events could trigger further supply shocks and food price fluctuations (Bertolozzi-Caredio et al., 2023), thus requiring enhanced preparedness.



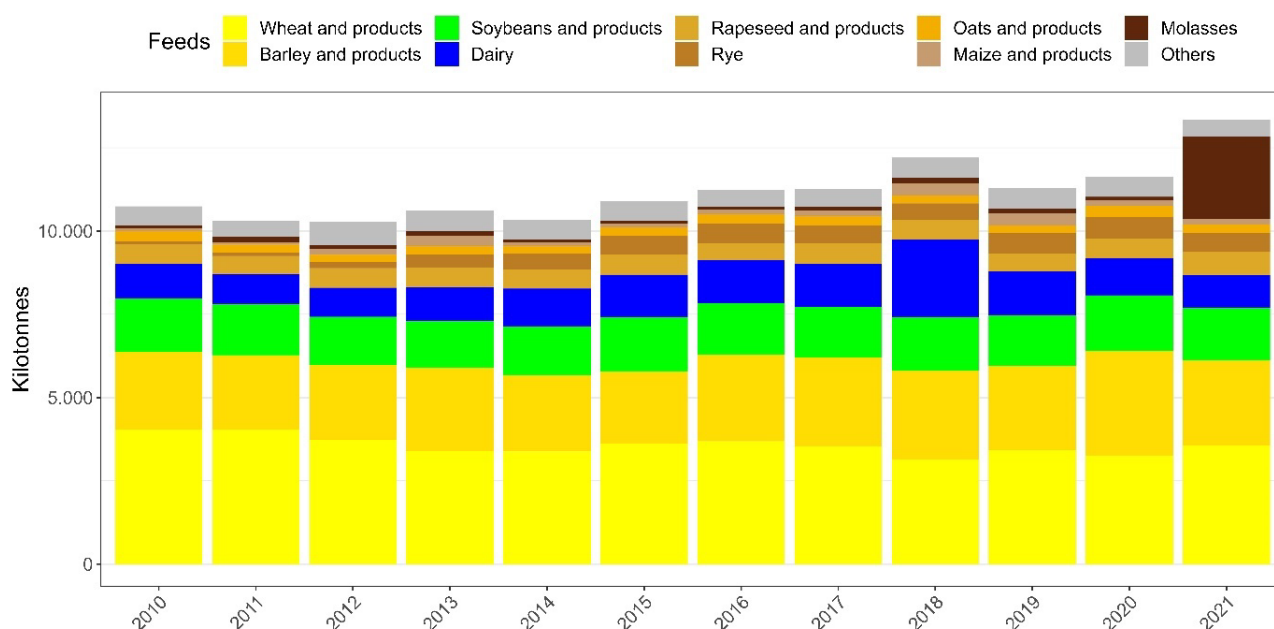
**Figure 10.** General and food price indices in Denmark

Source: FAO (2023a).

## 6.2 Feed dependency

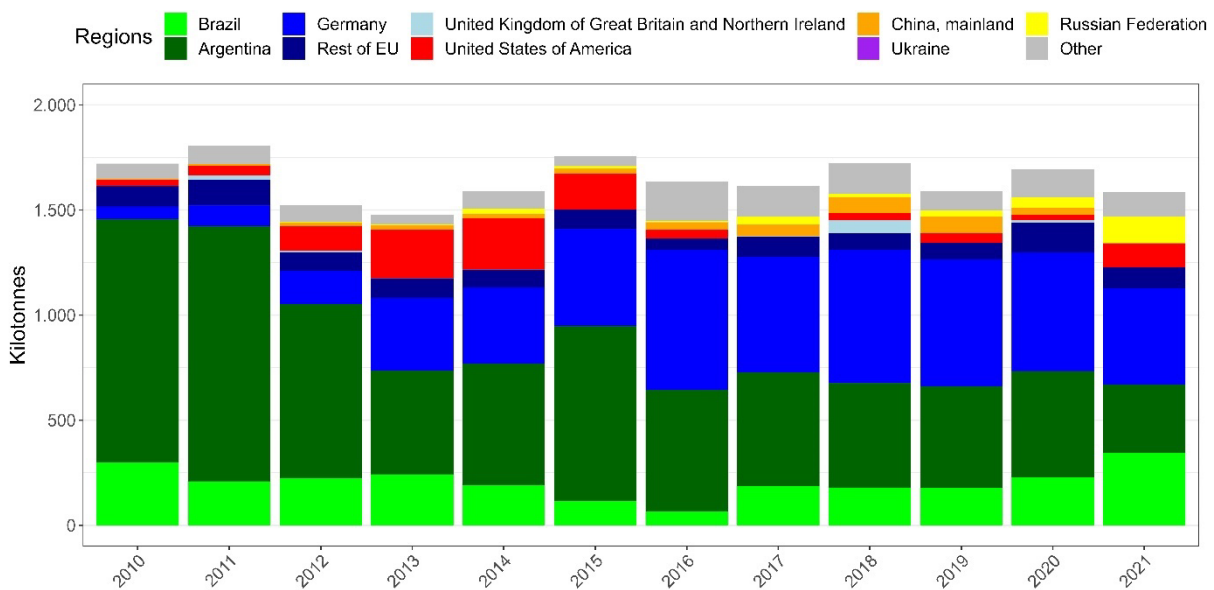
The majority of animal feed used in Denmark is sourced from wheat and barley (Figure 11). This is the main reason for the high domestic production levels of these cereal grains and the net export position consistently enjoyed by Denmark in the past decade. This is a common pattern across the EU, as both wheat and barley are net export sectors from the region (Figure A3). However, the reliance on soybean products as the third largest source of feed indicates potential vulnerabilities in the animal production system, as soybeans are not at all produced in Denmark. In 2010, the imported soybeans and soybean products were primarily sourced from South America (mainly Argentina and Brazil, see Figure 12). Since then, the share imported from within the EU has steadily increased over the past decade. However, while Denmark sources more soybean products from other EU countries, the EU's net imports of soybeans remain at four to five times the level of its domestic outputs (Figure A4 in appendix 2). In fact, Denmark's increasing reliance on soybean products imported from Germany is mainly due to the latter's role as a processor of imported soybeans, as Germany has a limited domestic production of soybeans. Overall, even with this increase in the diversification of import sources, only three countries supply 70 percent of the imports of soybeans and soybean products to Denmark, indicating potential sourcing risks. Appendix 2 further illustrates the EU feed production and net trade development.

The domestic feed supply in Denmark has faced challenges in recent years, for example the droughts in 2018 and 2023 that limited domestic feed availability (Danmarks Statistik, 2023b), making the sourcing of feed an issue for the animal-based food sectors. However, as discussed earlier in this report, the Danish output of animal-based food products far outweighs domestic consumption needs. Therefore, challenges associated with feed sourcing do not indicate an immediate risk to domestic consumption. However, instability in feed supply and rising costs can influence the price of animal foods and impact their affordability.



**Figure 11.** Feed use in Denmark by feed products

Source: FAO (2023b).

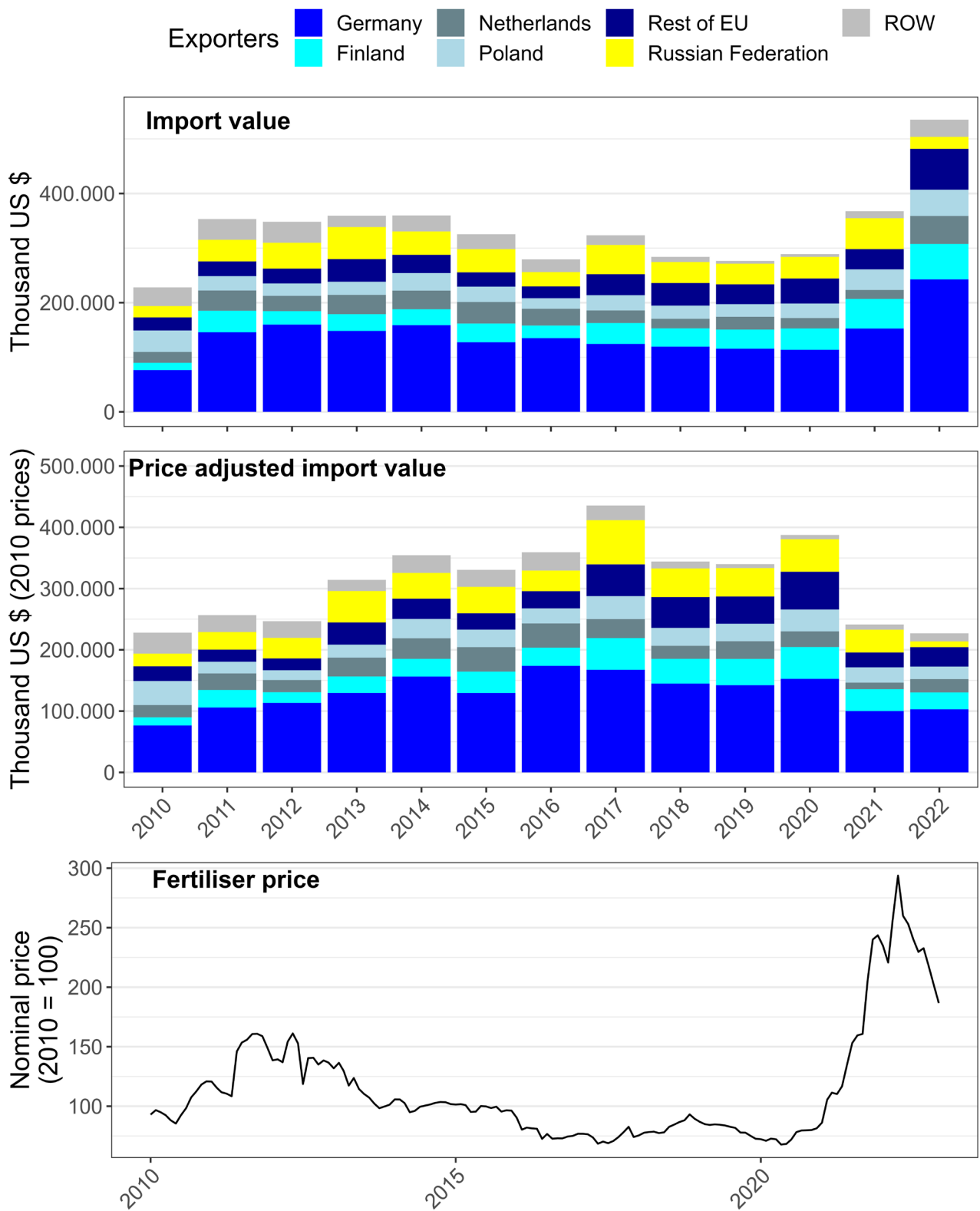


**Figure 12.** Danish imports of soybeans and soybean cakes

Source: FAO (2023b).

### 6.3 Fertilisers

Most of the fertilisers imported to Denmark are sourced from Germany, followed by Finland, the Netherlands, and Poland. Together, these four EU members supplied 75 percent of Danish imports of fertilisers measured in value terms in 2021 (Figure 13 on the next page). Russia, another major supplier of fertilisers, saw its export share to Denmark drop from 15 percent in 2021 to only 4 percent in 2022 as a consequence of the Ukrainian war. Given the high global share of fertiliser production in Russia and Belarus, the conflict has resulted in a significant increase in the price of fertilisers, with the price more than doubling in 2022 compared to previous years (Figure 13). This change in price has resulted in the observed significant increase in the value of Danish imports of fertiliser in 2022 (Figure 13). Despite the fact that the main sourcing countries that supply Denmark were not part of the conflict, rising energy prices in the EU have raised the costs of fertiliser production in Europe (European Commission, 2023). The major roles played by Russia and Belarus in the fertiliser market combined with higher fertiliser prices within the EU connected to higher energy costs affect the EU member states concurrently, placing significant risks on the supply of fertilisers.



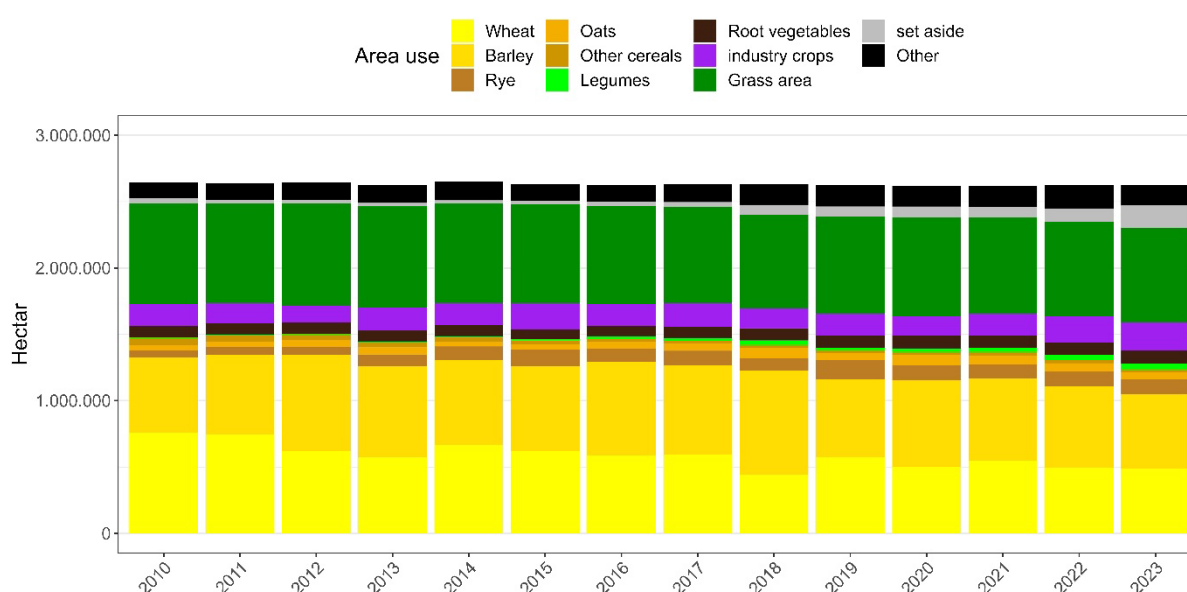
**Figure 13.** Danish imports of fertilisers and the global price development of fertiliser

Sources: International Trade Center (2023) and World Bank (2023).



## 6.4 Land use

Around 60 percent of the Danish land area is cultivated. Half of this area is used to produce cereal crops, and a quarter of the area is used to grow grass. These shares have remained roughly the same over the past ten years, with minor changes due to an increase in the level of set-aside land. Around 70 percent of the Danish cereal production is typically used as feed (Danmarks Statistik, 2023b). With the expected impact of climate change on Denmark in the form of increases in the frequency of more extreme weather such as seasonal droughts and increased period of precipitation, the specialisation of Danish production in primarily wheat, barley and grass may have adverse implications for food security, as some of the main Danish crops can be negatively impacted by droughts that decrease yields, as observed in 2018 and more recently in 2023 (Danmarks Statistik, 2023b). More diversity in the types of crops produced and an increased focus on drought resistant crops may therefore be needed to ensure adequate long-term production levels.



**Figure 14.** Utilization of the Danish land area

Source: Danmarks Statistik (2023c).

## 7. Policy framework for ensuring food security in the EU and Denmark

Agricultural production in EU member states, including Denmark, has been subject to the EU's Common Agricultural Policy (CAP) for over six decades. In what is known as the Treaty of Rome, ensuring food availability at reasonable prices is included as a main goal of the CAP, together with increasing productivity, stabilizing markets, and providing fair living standards for farmers.<sup>2</sup> Despite the multiple rounds of major reforms to the CAP, maintaining food supply at reasonable prices continues to be one of its main goals. Today,

<sup>2</sup> See European Council, n.d. Feeding Europe: 60 years of common agricultural policy. <https://www.consilium.europa.eu/en/60-years-of-common-agricultural-policy/> (Accessed: 1 March 2024).

the main instrument of the CAP is the direct support provided to farmers within the EU, mainly in the form of “decoupled” direct payments not linked to production decisions (e.g. what products to grow and at what scale). According to OECD (2023), during the triennial period of 2020-2022, about half of the CAP payment was based on so-called “historical entitlement”, less than a third was tied to current planting areas or animal numbers, and the remaining part was linked to the use of inputs. With the CAP increasingly focusing on the environmental impacts of the agricultural sectors, more and more CAP payments are now referencing mandatory environmental regulations. On average, using the OECD’s producer support estimates (PSE), about 16 percent of gross farm receipts in the EU were made up of agricultural support in the 2020-2022 period (OECD, 2023). In addition to producer support, the EU also maintains a set of trade barriers for certain sectors that provides further support to domestic producers. However, the redesigns of the CAP over the years have greatly reduced the importance of these trade barriers and other forms of market price support.

The current CAP, for the 2023-2027 period, entered into effect in January 2023.<sup>3</sup> It is built around ten specific objectives, reflecting both long-standing food security, farm income, rural development goals, and environmental and climate actions. EU member states have submitted their national CAP Strategic Plans to address the CAP objectives and their specific needs. In the case of Denmark, its Strategic Plan aims to achieve “sustainable development of farming, food and rural areas while ensuring food security through a competitive agri-food sector”.<sup>4</sup> The plan envisions a new mechanism for harmonising agricultural support through hectare-based direct payments, with some redistributions from large farms to smaller farms. At the same time, “coupled” support based on current planting areas or animal numbers will be given to specific sectors facing a risk of declining production (for example livestock, dairy, and starch potato). The plan also includes instruments to address Denmark’s Greenhouse Gas (GHG) emission reduction targets by 2030 as well as issues related to generational renewal in the farm sector.

Aside from the instruments in the CAP and the complementary trade policy instruments regulating imports and export flows, the EU generally does not apply other market support measures used in other countries for food security purposes. For example, India relies on not only subsidies on production but also extensive subsidies attached to a public distribution system to ensure access to basic grains by poor consumers (Yu et al., 2015). In China, aside from sizable producer support, the government also maintains a large public stocking system covering grains and other food products (Yu, 2017). In various other developing countries, cash transfers are also offered to poor consumers to improve food access. In the case of the US, assistance to low-income consumers, commonly known as food stamps, is now offered under the Supplemental Nutrition Assistant Program. During periods of severe food price shocks and other market disruptions, many national governments also used contingency measures to combat price shocks and to increase domestic supply. However, some of these emergency measures proved to be counter-productive. For example, both export restrictions and the removal of import barriers tend to reduce world market supply and increase world market demand, thus worsening the demand-supply imbalance. Other measures, such as assistance to

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<sup>3</sup> See European Commission, n.d. CAP Strategic Plans. [https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans\\_en#background](https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans_en#background) (Accessed: 1 March 2024).

<sup>4</sup> See European Commission, n.d. CAP Strategic Plans. [https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans\\_en#background](https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans_en#background) (Accessed: 1 March 2024).

vulnerable consumers and release of products from public storage, can help improve the access of poor consumers and increase market supply.

Similarly in the EU, emergency measures not normally in use and built-in flexibilities in the CAP that do not usually apply have been used to tackle food security concerns arising from recent shocks. In responding to the COVID-19 pandemic, the European Commission provided member states with the possibility to provide time-bounded assistance to sectors experiencing economic difficulties, with a few members implementing measures targeting various agricultural sectors (OECD, 2023). As noted in this analysis, Russia's invasion of Ukraine has brought several more concrete disruptions to the food supply and agricultural production in the EU, including to the supply of feed grains, vegetable oils and fertilisers. As summarised in OECD (2023), the EU has activated/initiated a number of measures to mitigate the negative consequences of these shocks, utilising the built-in flexibilities in the CAP (for example allowing crop production on fallow land and advances of CAP payments), establishing exceptional market measures (for example aid granted to private storage), dispensing direct aids to farmers, and initiating new actions to strengthen resilience. At the member state level, countries have also responded with national measures, some of which were aided by EU funding through the crisis reserve of the CAP or through the new Temporary Crisis Framework that allows member states to provide state assistance to combat rising input costs. Some member states also conducted interventions on the consumption side.

To enhance cooperation between the public and private sectors and evaluate risks during crises, the European Commission established the European Food Security Crisis preparedness and response Mechanism (EFSCM), as communicated in November 2021.<sup>5</sup> The EFSCM monitors market imbalance and initiates interventions as necessary, ensures functioning supply chains and trade flows and movements of workers in the food sector, and conducts early, regular, and transparent communication. In practice, the EFSCM convenes periodic expert group meetings to improve preparedness and to coordinate crisis responses. In December 2022, the European Commission launched a food supply and security dashboard featuring data for monitoring and assessing food supply and security in the EU. Under the EFSCM, bi-annual surveys are conducted and analysed to supplement the food supply and security dashboard. In summary, at the EU level, coordinated interventions have been taken to ensure food security during recent disruptions and new mechanisms such as the EFSCM have been established for these purposes. At member state level, as summarised in OECD (2023), different member states have utilised the various EU provisions and national flexibilities to different extents to address their respective national needs. In this regard, according to the summary by OECD (2023), Denmark has conducted relatively few direct interventions, possibly reflecting the relatively high level of food security and strength of its existing social security net.

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<sup>5</sup> See European Commission, n.d. Ensuring global food supply and food security. [https://agriculture.ec.europa.eu/common-agricultural-policy/agri-food-supply-chain/ensuring-global-food-supply-and-food-security\\_en](https://agriculture.ec.europa.eu/common-agricultural-policy/agri-food-supply-chain/ensuring-global-food-supply-and-food-security_en) (Accessed: 1 March 2024).

## 8. Conclusion and discussion

According to the commonly used food security indicators, there has not been any significant food security concern in Denmark in the last decade, despite multiple shocks and disruptions to the food supply chain. These shocks, particularly the recent food price inflation and rising consumer price index, have resulted in a slightly increased prevalence of modest or severe food insecurity. However, this is not due to reduced food availability but likely a reflection of a reduced purchase power of more vulnerable groups in Danish society. As a net food exporting country with a large export-oriented animal food sector, the available food in Denmark surpasses what is needed at the macronutrient level. The extent of current food insecurity in Denmark is therefore not linked to availability but to accessibility due to higher food prices.

While there is currently a stable and sufficient food supply in Denmark, the mismatch between the structure of domestic production and that of domestic consumption suggests issues related to the utilisation of domestic food production and the need for imported food products such as vegetables, fruit, vegetable oils, and a few other products. Furthermore, the large-scale livestock production in Denmark requires sizable feed imports, particularly of soybeans, maize, and sunflower cakes. In addition, key agricultural inputs such as fertilisers are also imported. While most imports are primarily sourced from within the EU, the concentrations of high-level imports of key inputs such as feed and fertilisers from several sourcing countries outside the EU point to potential vulnerabilities. This should however be understood in the context that the animal food production within Denmark is export-oriented. Thus, a reduction in the imports of feed caused by disruptions to the trade environment would not necessarily cause shortages in the domestic supply of animal-based products. However, it may influence the competitiveness of Danish exports on the world market.

The focus on animal-based food production in Denmark also implies a reliance on sourcing vegetables and fruit from other countries, mostly from other EU member states. The highly specialised agricultural production pattern in Denmark cannot support a diversified diet compliant with the country's dietary guidelines. In particular, a higher consumption of fruits, vegetables and legumes will need to be met with imports mainly from other EU member states. This could potentially create vulnerabilities when the challenges faced by the EU agricultural production system in the form of higher energy prices and fertiliser costs are transferred onto Danish consumers. Furthermore, the climatic changes expected in the southern European countries could potentially disturb the Danish access to products such as vegetables and fruits.

In comparison to many other countries adversely impacted by the COVID-19 pandemic and the supply disruptions linked to Russia's invasion in Ukraine, Denmark's food security has benefitted from its own agricultural production capacity and access to the EU internal market as well as the high per capita income level and strong social safety net. In terms of the policy environment, the EU's common agricultural policy, including its general provisions through direct payments and the embedded flexibilities in allocating resources to crisis responses and in establishing temporary market measures, is important for safeguarding food availability and access within the common market. New initiatives such as the recently established EFSCM reflect a heightened attention to food security within the EU through more coordinated risk and vulnerability monitoring and analysis, and enhanced preparedness.

Moving forward, further discussions are needed to appropriately identify the risks and vulnerabilities within the EU and Danish food supply chain. In this regard, it is important to recognise that food security in Denmark and EU is not only enhanced through adequate supply at the EU level but also through open and stable

market linkages, including those connecting the EU with its external trading partners. With global trade being impacted by geopolitical events and tensions, more research is needed to analyse potential food security outcomes within alternative trading environments. Last but not least, recent extreme weather events in Denmark and elsewhere in the EU also point to biophysical risks associated with climate change impacts. Future research should investigate the role of international trade in mitigating climate change impacts and enhancing food security, both from a global and an EU/Danish perspective.

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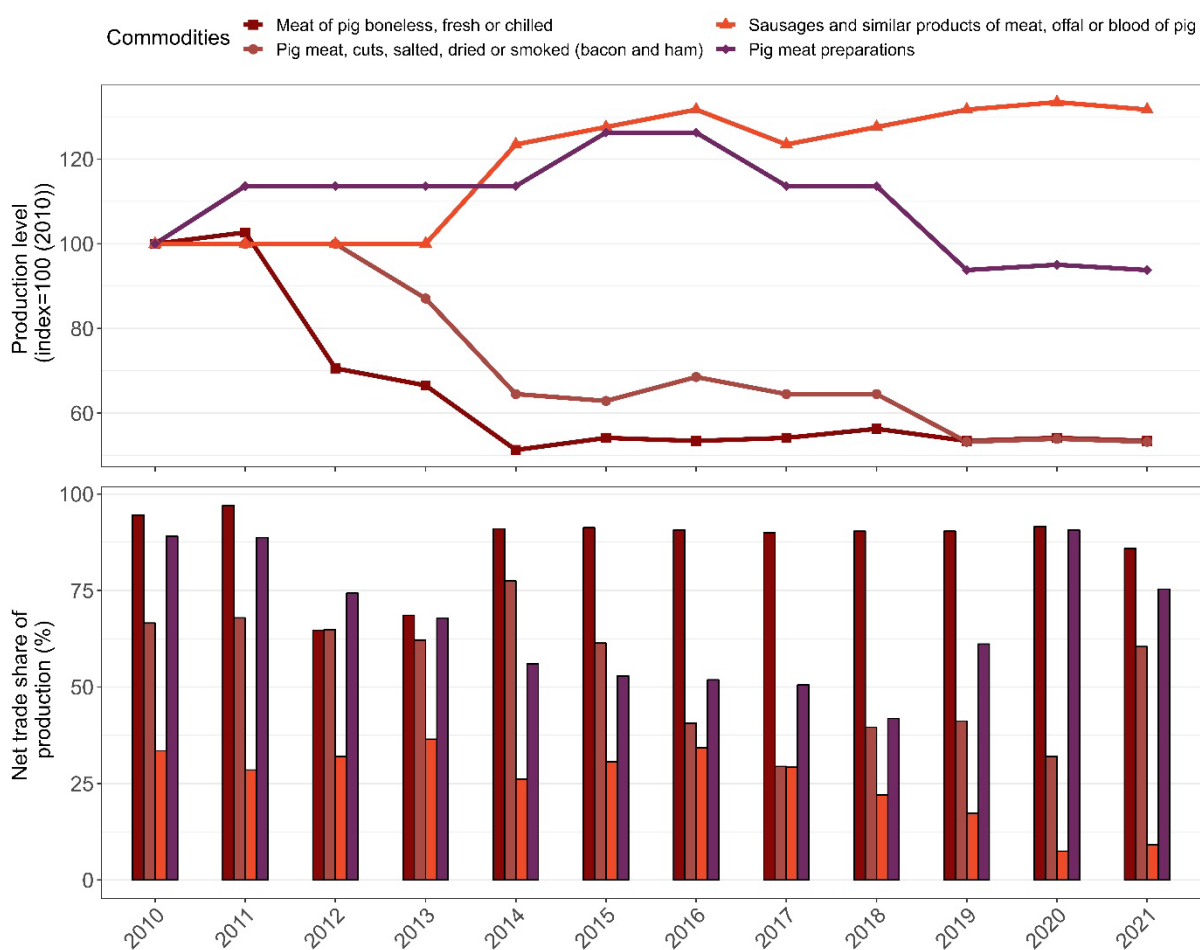
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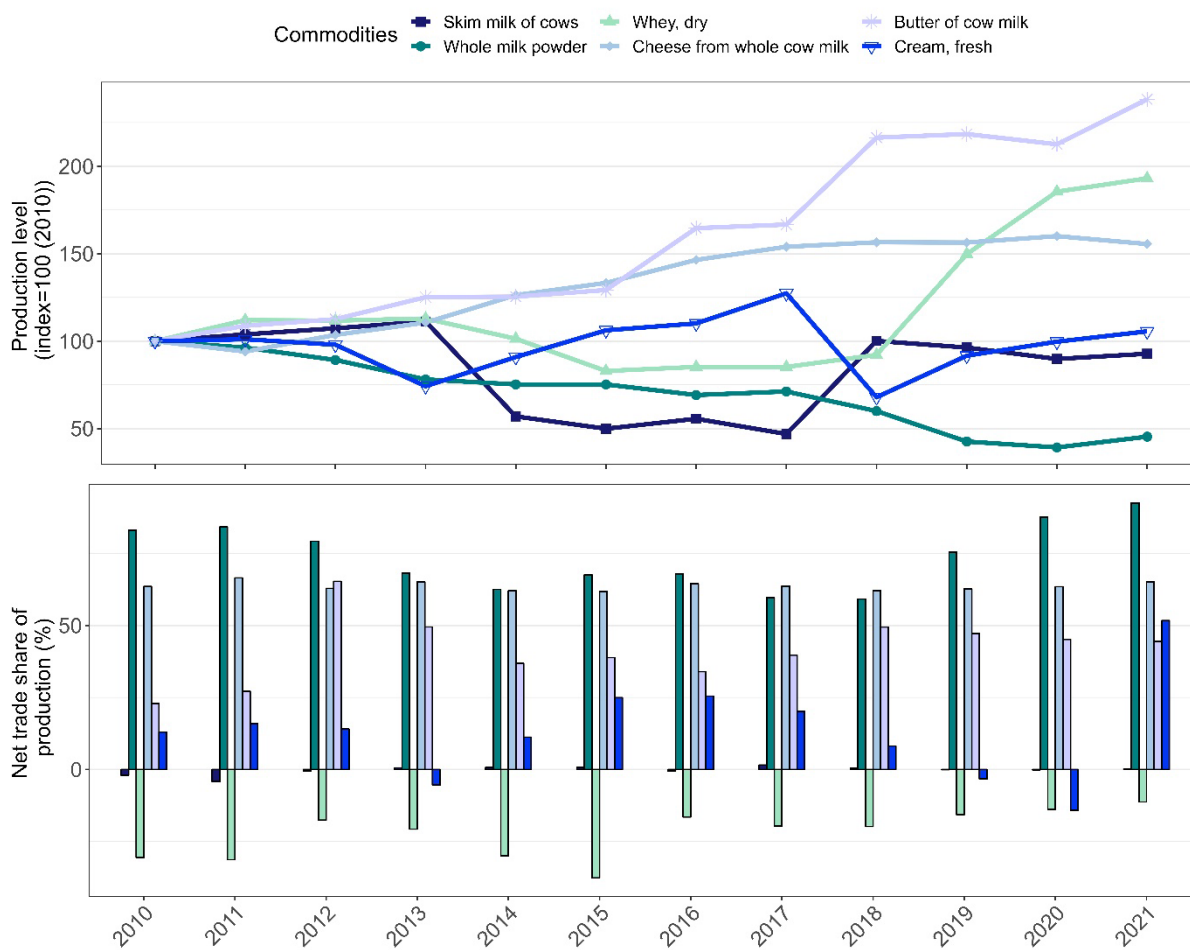
## Appendix 1. Danish production trends and net trade levels of processed food products

This appendix illustrates the net production shifts and net trade status of the main animal-based food sector within Denmark. The dairy and pig meat sector are both extremely export-oriented. For the pig meat sector, part of the processing activities takes place in other countries, which is reflected in the high net export level of the primary pig products. However, even higher shares of processed pig meat are exported (Figure A1). Processing activities in the dairy sector remain mainly within Denmark, resulting in a lower primary net trade share. However, the majority of milk powder, cheese and cream produced are exported, with export shares above 50 percent (Figure A2 below).



**Figure A1.** Processed pig meat products, indexed Danish production level (line plot) and net trade share of Danish production (bar plot)

Source: FAO (2023b).



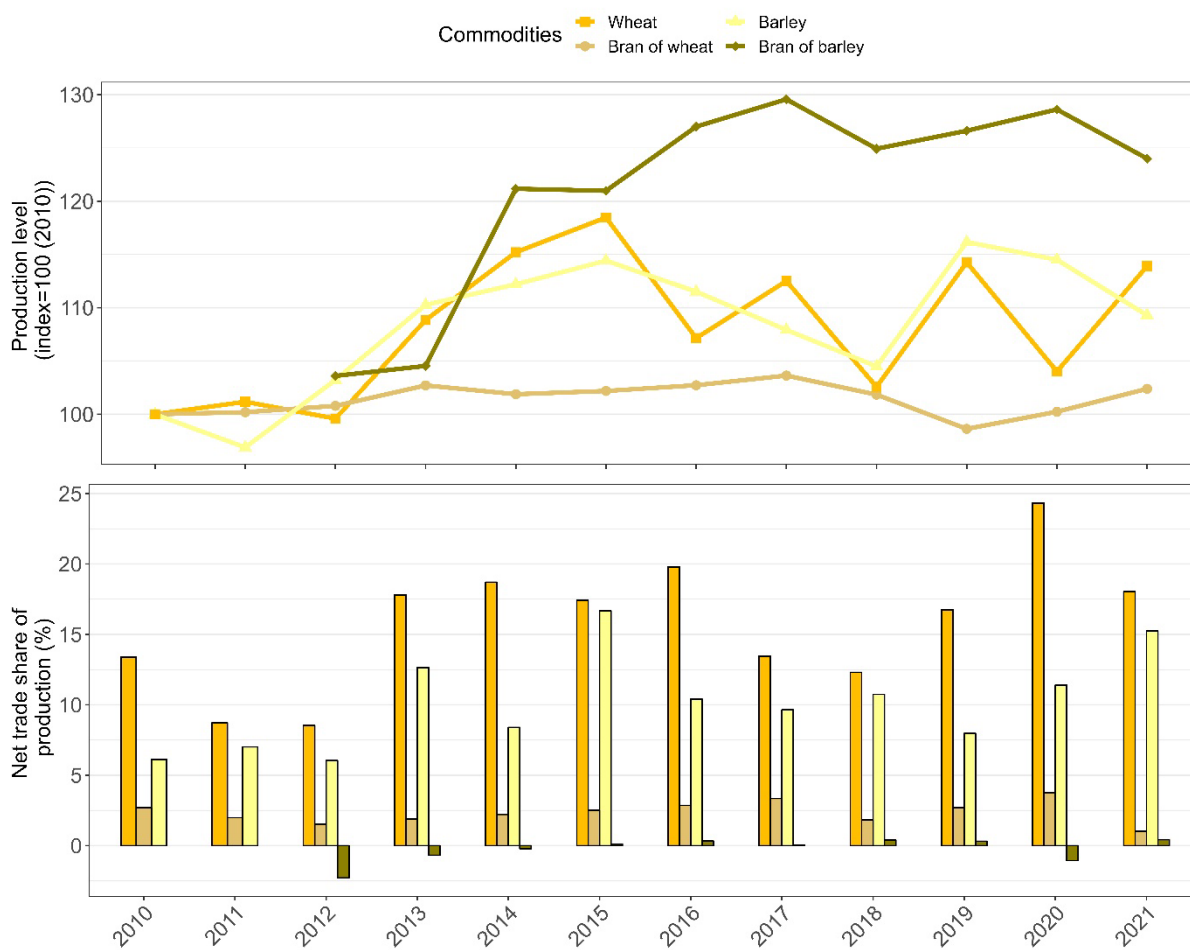
**Figure A2:** Processed dairy products, indexed Danish production level (lines plot) and net trade share of Danish production (bar plot)

Source: FAO (2023b).



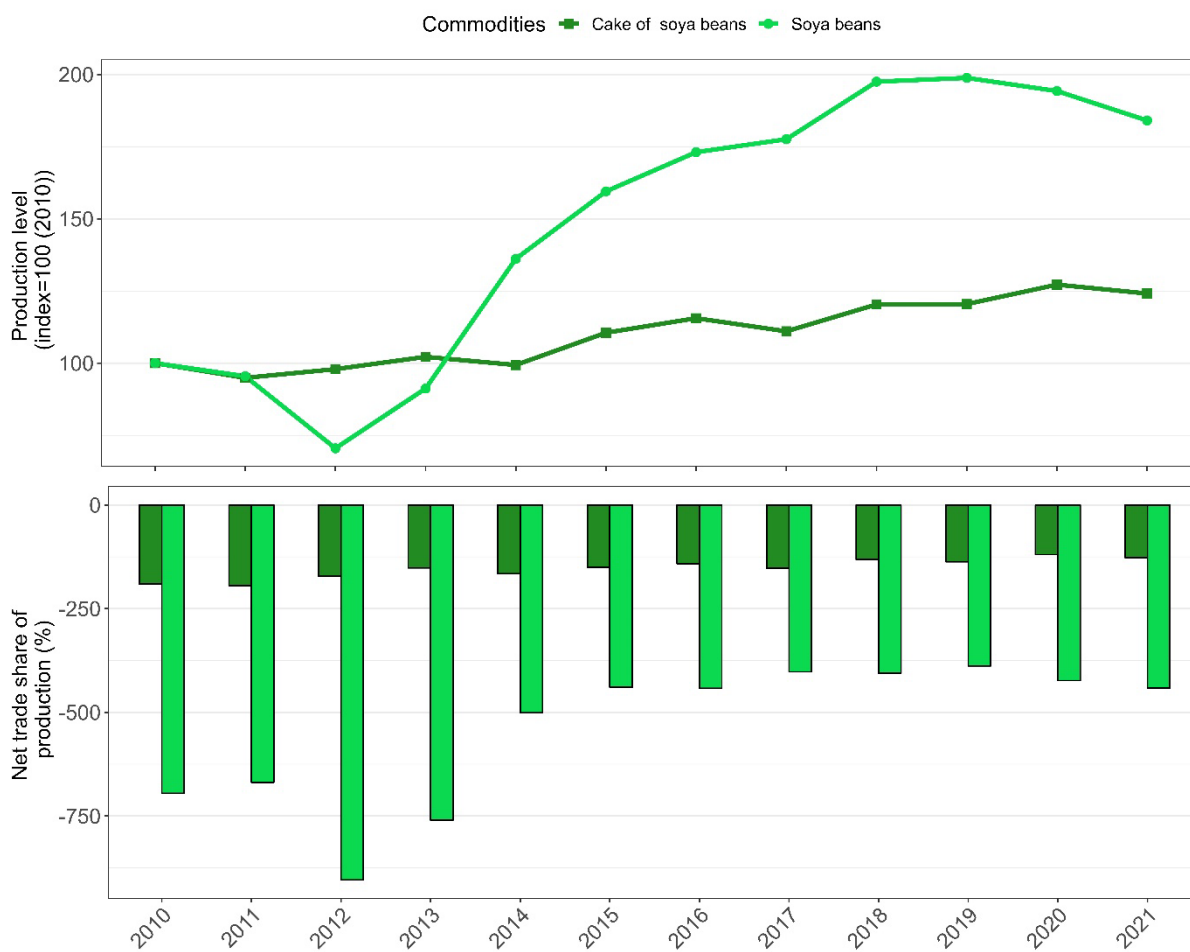
## **Appendix 2: EU production of and trade dependence on key commodities**

The stability of feed and fertiliser supply is not only a Danish concern but a concern for the entire EU. We therefore assess the EU-wide trade dependence on these key commodities. Across the EU, we observe an ample supply of both wheat and barley (Figure A3 on the next page). These are also the main cereals produced in Denmark. However, the EU's net imports of soybeans far outweigh the domestic production of soybeans, with net imports four to five times the size of the domestic production (Figure A4 below). Similarly, net imports of maize and rapeseed are needed to meet the feed demand in the EU (Figure A5 below). However, the EU's net import share relative to the production level of maize is much smaller than that of Denmark, indicating a more stable supply for the EU region than for Denmark as a single country. With regards to the import of fertilisers, at the EU level, a large share of the import of fertiliser stems from Russia, leading to a potential issue due to an unstable trade relationship (Figure A6 below).



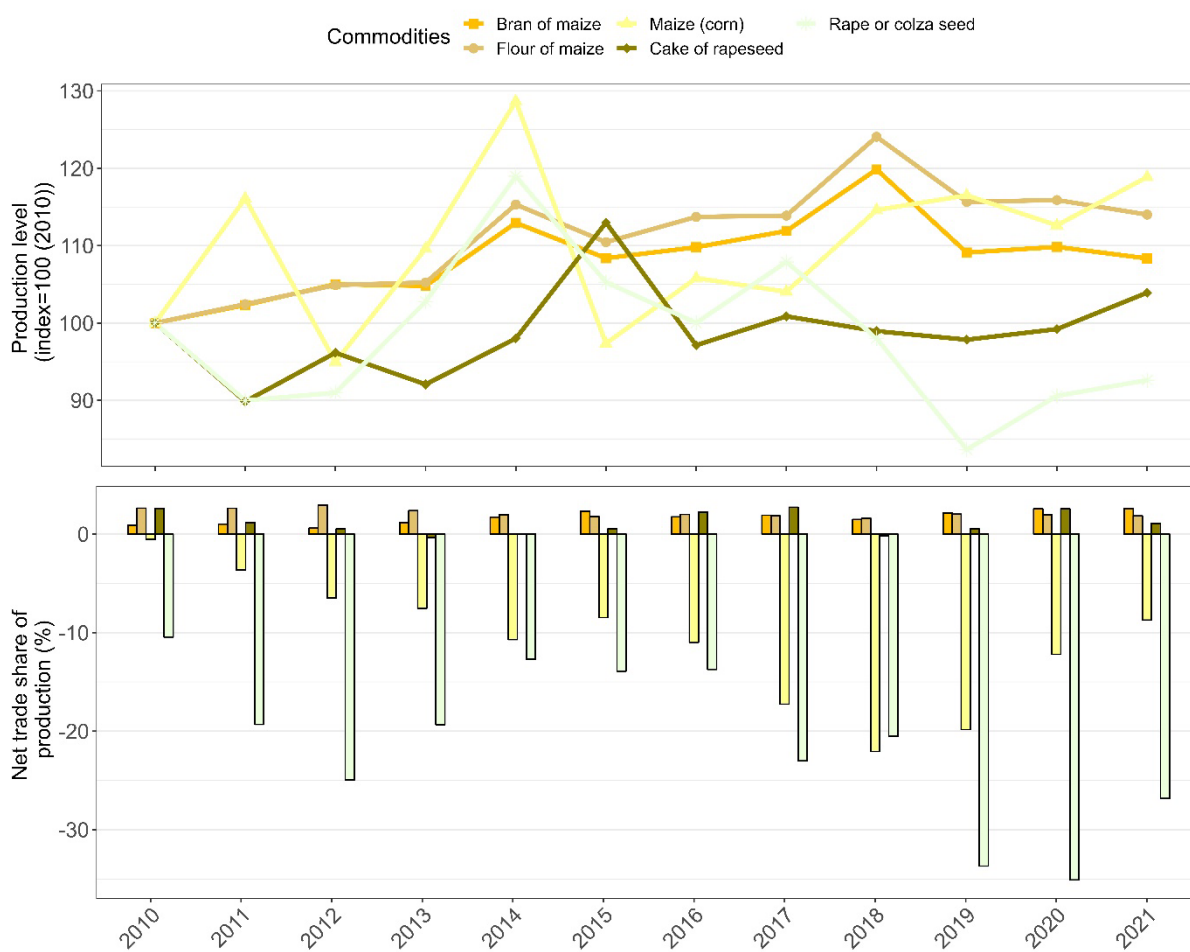
**Figure A3.** Wheat and barley, indexed EU production level (line plot) and net trade share of EU production (bar plot)

Source: FAO (2023b).



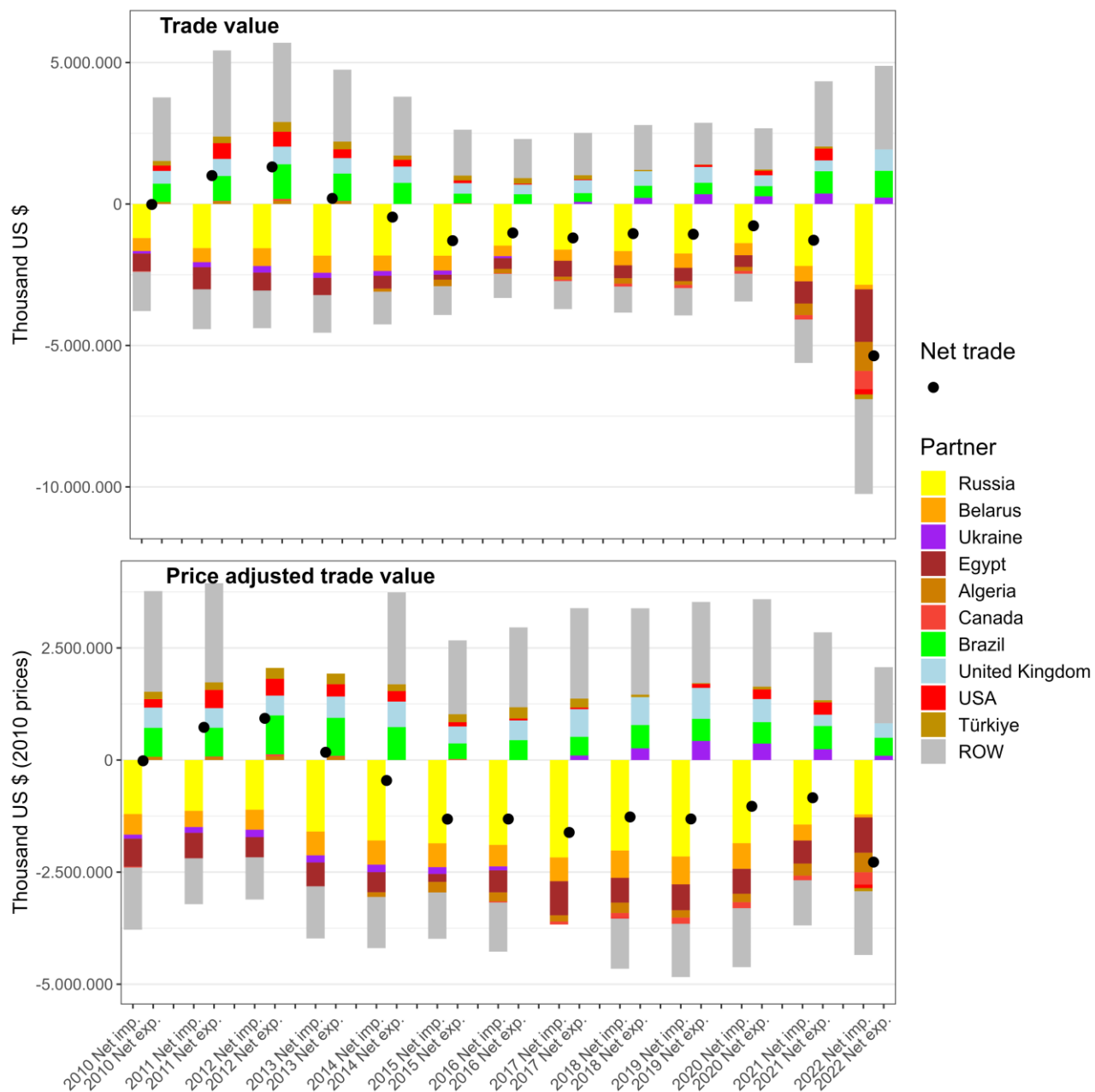
**Figure A4.** Soybean and soybean cakes, indexed EU production level (line plot) and net trade share of EU production (bar plot)

Source: FAO (2023b).



**Figure A5.** Maize and rapeseed, indexed EU production level (line plot) and net trade share of EU production (bar plot)

Source: FAO (2023b).



**Figure A6.** The EU's trade of fertiliser

Sources: International Trade Center (2023) and World Bank (2023).