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EU agriculture under an import stop for food and feed

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Abstract

Recent disruptions in international trade have had significant impacts on consumers and producers worldwide and stemmed from various reasons. This study aims to identify key vulnerabilities in EU agriculture by examining an import stop on food and feed products. By conducting this stylised simulation using a global PE model (CAPRI), the authors analyse the adjustment mechanisms within the sector, investigate regional differences within the EU and test the model's ability to depict such a comprehensive scenario. The findings suggest that oilseeds are most affected by an import stop due to their high import share. Meat is indirectly impacted as it relies on imported soy for animal feed, whereas other products with high self-sufficiency levels are hardly affected. In response to the import stop, EU production expands, increasing nitrogen surpluses, particularly in regions already facing critical levels. Meat production partially moves out of the EU, increasing global GHG emissions. EU consumers are negatively affected by increased prices, leading to an overall welfare decrease in the EU with exceptions for few member states. Alongside EU imports, exports decrease, affecting prices and welfare outside the EU. In the least developed countries, prices increase especially for products that are already consumed less than recommended.

KEYWORDS
food security, international food trade, PE modelling, trade disruption, trade measures

1 | INTRODUCTION

Trade disruptions occur frequently and for various reasons (Gephart et al., 2016; Maetz et al., 2011), such as international conflicts [e.g. the 2019 US–Chinese 'trade war' (BBC, 2020) or the war in Ukraine], infrastructural issues [e.g. the obstruction of the Suez Canal in 2021 (Russon, 2021)], pandemics [e.g. COVID-19 (FAO, 2020)] and regulatory differences [e.g. potentially for new breeding techniques (Gocht et al., 2021)]. Some governments respond to high food prices with trade stops (Puma et al., 2015), e.g. in 2007–2008, India banned exports of wheat, rice and edible oils (Maetz et al., 2011; Saini & Gulati, 2016), and several countries in Africa, South America and Asia restricted imports (Maetz et al., 2011). Export stops contribute to rising world market prices, whereas import stops do the opposite.

Research on trade disruptions is relevant for science-based policy advice, particularly when governments aim to mitigate the effects of high world market prices or the risks of trade disruptions through self-sufficiency (Cottrell et al., 2019; Maetz et al., 2011; Marchand et al., 2016). Self-sufficiency does not necessarily reduce the risk of market disruptions, as supply chains with multiple sourcing countries as well as domestic production can be less susceptible to singular event disruptions (Cottrell et al., 2019; Godfray et al., 2010; Kummu et al., 2020; Marchand et al., 2016; Puma et al., 2015).

Previous studies focus on likely scenarios such as trade disruptions due to GMO regulation (Gocht et al., 2021), specific trade agreements (e.g. Lu et al., 2020; Seti & Daw, 2022) or scenarios with both the trade disruptions and the shocks that led to them (e.g. Headey, 2011; Rutten et al., 2013). However, there is a research gap regarding the implications of long-term isolationist policies affecting not only single products, but larger parts of the economy. Addressing this gap, we model a severe reduction of imports of agricultural products to the EU using the CAPRI model, which allows for detailed examination of the interactions between the many and diverse value chains of the EU agricultural sector. This stylised scenario allows to draw conclusions regarding both the effects of import stops following decisions by EU policymakers as well as any cease of exports to the EU due to actions of the EU's foreign trading partners.

The stop to imports of soybean and soya cake accounts by far for the largest effects compared to other products, leading to decreasing EU production and exports of meat and highlighting the EU's dependency on soy imports for animal feed. We show that addressing this dependency through attempts of import substitution by increased domestic production of soybean and other conventional protein crops would come at environmental and economic costs and would be of limited success in the medium term. Hence, political action like the EU Protein Strategy (Albaladejo Román, 2023; Wiesner, 2023) should focus instead on the reduction of both consumption and production of meat to decrease the dependency on soy imports while yielding environmental benefits.

2 | METHODS

2.1 | The model

2.1.1 | Selection criteria for the model

To accurately simulate the effects of an EU import stop on agricultural products, the model used in this study must consider the detailed interactions between animal husbandry and crop production, as a significant portion of imports are used as intermediate feed input (EC, 2022). The model should differentiate between internationally tradable and non-tradable feed and depict local markets for intermediate fodder, young animals and manure. Additionally, it should account for endogenous changes in bilateral trade flows, food demand and domestic agricultural production following price changes, as well as operate at an appropriate regional resolution to identify regional impacts. Finally, it should include agricultural legislation, such as mineral fertiliser limitations or grassland conversion bans, as such policies limit market adjustments to a new situation without imports.

Research questions on trade stops have been analysed using partial (PE) and general equilibrium (CGE) models, which depict medium- and long-term scenarios wherein a new market equilibrium is reached after all actors have adjusted to the new circumstances. However, equilibrium models do not capture the adjustment process.

For example, Henseler et al. (2013) simulated a soy import stop, combining the PE model ESIM and the CGE model GTAP-AGR. The combination allowed to analyse effects at EU member state level but not for the regional level. With a biophysical food system model, Karlsson et al. (2021) showed that abolishing EU soybean imports for feed reduces cropland in deforestation prone areas, while maintaining EU diets. Although considering reduced import dependency, they do not account for underlying economic effects. Instead, the economic implications are calculated by balancing nutrient requirements of animal feed using the EU-wide regionalised data basis of the CAPRI (Common Agricultural Policy Regionalised Impact) model. Meanwhile, Gocht et al. (2021) analysed potential trade disruptions from differences in GMO legislation using the CAPRI model. CAPRI can depict substitution between domestically produced and imported products, link animal and crop production in each region and estimate market effects for primary and processed agricultural products and related feed demand. CAPRI has been commissioned by the European Commission in 1999 and is continuously developed by a consortium consisting of numerous research institutions. The model and corresponding databases are freely available and are documented in a public wiki, courses and training material for self-study are offered (CAPRI Consortium, 2022a, 2022b, 2022c, 2022d, 2022e). CAPRI has been utilised in numerous studies addressing various research questions in renowned journals (e.g. Himics et al., 2018; Rieger et al., 2023; Stepanyan et al., 2023).

CAPRI consists of a market equilibrium ('global market') and an optimisation ('European supply') component that can be run individually or combinedly, with the supply module providing production quantities and the market module providing prices (CAPRI Consortium, 2022b).

2.1.2 | The CAPRI global market module

The global market module consists of a spatial, non-stochastic, global model encompassing 56 agricultural products, 71 countries and 10 country blocks (i.e. clusters of small and closely related countries). It is a system of behavioural equations depicting, e.g. supply, human consumption, animal feed and agricultural land use.

It uses the Armington assumption to model trade as multilateral relations among countries or country blocks (Armington, 1969). Consumers are assumed to differentiate products by their origin and treat them as imperfect substitutes. The differentiation occurs in two steps. First, domestic and imported goods; second, imported goods are differentiated by countries of origin, each depicted by a Constant Elasticity of Substitution (CES) utility function. Exports are modelled analogously (CAPRI Consortium, 2022c). Trade policy instruments, such as tariffs or quotas are included in the model as exogenous parameters.

2.1.3 | The CAPRI supply module

The supply module includes 28 crop and 13 animal activities in the NUTS 2[1] administrative regions in the EU. It maximises farm income over the decision variables crop acreages, total land use, herd sizes, fertiliser use and feed mixes, while accounting for restrictions on land availability, nutrient balances, nutrient requirements of animals and political legislation such as quotas and set-aside obligations. CAPRI models the relationship between crop and animal production, considering the respective prices and nutrient requirements of animals and differentiating between internationally traded (e.g. soybean) and regionally produced feed (e.g. grass or maize silage).

2.2 | Scenario implementation

2.2.1 | The baseline scenario

The baseline scenario is the 'business as usual' simulation, which serves as a reference point. The study uses base data from 2012 and projections for population and GDP growth, technological progress and policies from the agricultural outlook projections for markets and income between 2019 and 2030, hence integrating the medium-term market outlook results from the EU Commission (CAPRI Consortium, 2022d; EC, 2019). As adaptations to new policies respectively to simulated shocks take time, all scenarios refer to 2030. Recent events like the COVID-19 pandemic or the war in Ukraine are not accounted for. However, this does not affect the comparison between the scenarios as the underlying relationships and behavioural equations are generally valid.

2.2.2 | The import stop scenario

The import stop scenario builds on the baseline assumptions, but assumes additionally strong reductions of EU imports for 44 out of 55 traded products. The choice to model an import stop rather than a stop of imports and exports was made due to imports being more relevant for domestic food supply. This stylised scenario is not intended to reflect a likely real-world situation, but to understand the adjustment mechanisms to ceasing imports. In reality, trading partners may retaliate by stopping exports from the EU if the EU were to stop imports. However, the

[1]Nomenclature of Territorial Units for Statistics.

countries exporting agricultural products to the EU are not necessarily the same as those importing agricultural products from the EU. Retaliation may also not target the same sector as the initial sanctions [e.g. in 2014 the EU imposed export bans on technology and import bans on Crimean products (Council of the European Union, 2014a, 2014b) and Russia banned food imports from the EU (Walker & Rankin, 2014)].

This stylised scenario serves as a tool for testing the model's ability to deal with extreme scenarios, identifying crucial products and stages in the value chains and examining adjustment mechanisms within EU agriculture. Agriculture's main output food as well as its central production factor land hardly have any substitutes, which makes it both a strategically important and economically interesting sector.

Imports are not restricted for commodities that cannot be produced in the EU (coffee, tea, cocoa) or agricultural non-food products (textiles, tobacco, biodiesel, bioethanol). These products can either not be substituted by domestic products or do not contribute significantly to diets or agricultural value chains. Including them into the scenario would not provide important insights but would make the model unsolvable. Technically, imports are reduced by increasing tariffs so that import quantities of each product are at most 20% of the baseline quantities. For fish, citrus fruit and table grapes, import quantities are fixed to baseline quantities; for sugar they are fixed to 80% of the baseline quantities[2] (see Tables A1 and A2). In CAPRI, government expenses are exogenous. Therefore, the tariff increase does not distort results by changing public spending. The role of tariff income in welfare is discussed in Section 3.2.6. The Armington specification prevents imports from reaching zero if they exceed zero in the baseline scenario. However, the simulated reductions are large enough to draw conclusions on complete import stops.

This scenario can be interpreted as an import stop by the EU, a stop of exports into the EU as decided by the EU's trading partners or a trade disruption for other reasons. In all three versions, prices increase in net-importing countries and decrease in net-exporting countries.

3 | RESULTS

When imports stop, scarcity of the product in the importing country increases, leading to an increase in domestic prices. This incentivises domestic producers to increase production and to sell more domestically instead of exporting. These market mechanisms apply to products that are substitutes (e.g. rapeseed and soybean) or part of the same value chain (e.g. soybean is an input in meat production). Consumers and producers demanding intermediates will substitute products that were much affected by the import stops by the ones less affected, i.e. the ones who became relatively more expensive by the ones with lesser price increases.

3.1 | Categories of product groups

An EU import stop has greater effects on products with a high import share, such as soybean. Substitutes of these products (e.g. rapeseed for soybean) or products in the same value chain

[2]These scenario settings were chosen in consideration of both real-world conditions (e.g. fishing quotas, sugar imports being subject to preferential trade agreements) and model restrictions (e.g. no option for considerable expansion of fish production in the CAPRI model).

(e.g. meat that needs soybean as animal feed) will be indirectly affected even if their import shares are low. Limited potential for production expansion (e.g. due to sub-optimal climatic conditions for soybean) increases prices further.

Product categorisation in Table 1 depends on production characteristics, inputs and consumption, resulting in three groups: (1) directly affected, (2) indirectly affected and (3) relatively unaffected.[3]

3.2 | Economic implications

3.2.1 | General market balance

In the import stop scenario, imports decrease for all products subject to the import stop and lead to changes throughout the market balance. The changes for each product group and balance item as well as of the average producer price are shown in Table 2.

Group 1 shows the highest production increases, mainly in oilseeds (51% increase, including a 264% increase in soybean production, 48% in rapeseed and 3% decrease in sunflower seed production), followed by pulses (+38%) and potatoes (+18%) (in 'other field crops'). Group 2 experiences a decrease in the production of meat and eggs (in 'other animal products'). The absolute production decreases are larger than the import decreases (3.85 vs. 0.68 million tonnes in meat and 590,552 vs. 5505 tonnes in eggs), showing that this is the indirect effect of the import stop to oilseed. In contrast, group 3 shows no substantial production changes. Absolute production increases for oilseeds, 'other field crops' (both group 1), vegetables, fruit and secondary products, i.e. milled rice and sugar (residual group) almost match the import decreases or even overcompensate them.

Export decreases absorb the shock for all product groups, except for oilseeds, as their exports are small in the baseline. The export decrease is especially noteworthy for meat, for which the EU is a major exporter. Instead of being exported, EU meat is redirected towards domestic consumption, compensating for the production decrease and keeping human consumption almost unchanged compared to the baseline. Also, for most other products, human consumption hardly changes. Reduced processing partially absorbs the shock for cereals, pulses, potatoes, vegetables, fruits, eggs and oils. Biofuel processing is reduced and its input composition adapts. Less oils and sugar but more cereals are used. Similarly, use of oilseed cakes in animal feed decreases substantially. Use of cereals decreases slightly, making cereals more dominant in feed composition.

The import stop leads to higher scarcity and thus price increases for all products, with the highest increases in group 1 (oilseeds 74%, oilseed cakes 69%). Soybeans show the highest price increase due to their decreased domestic availability (126% vs. 57% for rapeseed and 46% for sunflower seed). Price increases for oils and cakes are smaller than those for the respective oilseeds as they include unchanged processing costs alongside the increased costs for the raw product. Prices for soybean products increase the most (soya cake 111%, rapeseed cake 36%, sunflower cake 60%; soya oil 61%, rapeseed oil 33%, sunflower oil 34%). Price increases in group 2 are lower than in group 1, as they stem mainly from the import stop for soybean and soya cake, which are only one part of the production costs. Group 3 shows smaller price increases due to their small

[3]Products or product categories that do not fall into one of these groups are fish and other aquatic products, coffee, cocoa, tea, tobacco and textiles.

TABLE 1 Categories of product groups and their relationships to each other.

Group 1: Directly affected (net imported by EU)	
Oilseeds, i.e.	Used for oil production and animal fodder
Soybean	High import shares. Little EU production and production potential
Rapeseed, sunflower seed	Lower import dependency than for soybeans. Substitutes for soybeans in animal fodder and oil/biodiesel production
Oilseed cakes	By-product of processing oilseeds to oil. Used for animal fodder, alongside cereals and distilled dried grains (DDGS)
Other field crops, i.e. pulses and potatoes	Used for human consumption and animal feed at equal shares. Substitutes for cereals and oilseeds
Group 2: Indirectly affected by import stop of group 1 (EU net trade position differs)	
Meat	Meat production depends on oilseeds and oilseed cakes as feed, especially for pig and poultry, which dominate EU meat production. Less for beef, as for cattle grazing and fodder are additional sources of feeding
Other animal products, i.e. raw milk and eggs	Production of eggs and to a lesser extent milk depends on imported animal feed. Raw milk is not traded internationally but is processed to dairy products first
Oils	Used for human consumption and biodiesel production Sunflower and olive oil are produced predominantly by domestically produced sunflower seed respectively olives, whereas rapeseed oil is made both of domestically produced and imported rapeseed. Soya oil is imported or made from imported soybeans
Group 3: Relatively unaffected by import stop (net exported by EU)	
Cereals	Used for feeding animals, human consumption, bioethanol production. DDGS are a by-product of bioethanol production
Dairy products	Cattle relies less than other animals on oilseed as feed as grazing and other locally produced fodder are also important
Other: Heterogeneous product categories with ambiguous reactions	
Vegetables and fruit	Heterogeneous category, therefore individual products are affected differently by the import stop. EU is a net importer for the overall category and specific products (e.g. bananas in sub-category 'other fruits'), but net exporter for other products (i.e. tomatoes, apples, table olives and wine). In the current model specification, there are limited options for substitution both on the demand and the supply side
Secondary products	Heterogeneous category. The EU is a net importer for most products of this category (milled rice, feed concentrates, biodiesel, bioethanol, sugar). Imports are often small compared to domestic production, but domestic production of some products depends on imported inputs (e.g. oilseed for biodiesel production)

TABLE 2 Changes in the market balance and producer prices in the EU (absolute quantity changes in million tonnes and percentage changes).

	Source		Use					
	Imports	Net production	Exports	Human consumption	Feed use	Processing	Biofuel processing	Producer price
Group 1: Directly affected								
Oilseeds	−17.316	14.023	−2.532	−0.143	−0.541	−0.077		
	−90%	51%	−83%	−7%	−27%	0%		74%
Oilseed cakes	−21.071	−0.860	−1.600	0.004	−19.996	−0.338		
	−91%	−3%	−87%	2%	−44%	−75%		69%
Other field crops	−6.397	8.107	−2.247	5.816	0.419	−2.278		
	−98%	19%	−63%	19%	11%	−22%		11%
Group 2: Indirectly affected by import stop of group 1								
Meat	−0.677	−3.850	−4.111	−0.224		−0.193		
	−90%	−9%	−58%	−1%		−41%		26%
Other animal products	−0.006	−1.839	−0.566	0.030	−0.004	−1.304		
	−95%	−1%	−34%	1%	−14%	−1%		14%
Oils	−8.642	0.139	−1.533	−0.278	−0.149	−5.057	−1.921	
	−92%	1%	−63%	−3%	−18%	−75%	−28%	33%
Group 3: Relatively unaffected by import stop								
Cereals	−22.199	2.758	−13.443	1.546	−3.043	−5.019	0.518	
	−94%	1%	−33%	2%	−2%	−28%	5%	7%
Dairy products	−0.217	−0.034	−0.613	0.457	−0.047	−0.047		
	−93%	0%	−12%	1%	−3%	−13%		7%
Other: Heterogeneous product categories with ambiguous reactions								
Vegetables and fruits	−16.217	13.779	−7.189	6.330	−0.484	−0.909	−0.187	
	−53%	11%	−32%	5%	−18%	−24%	−12%	31%
Secondary products	−0.901	1.130	−0.394	0.141	−0.222	−0.080	−0.345	
	−34%	6%	−15%	1%	−69%	−5%	−12%	10%

Note: Imports and exports without intra-trade, human consumption including losses.

import share and relatively unaffected inputs. Behind the medium price increases for vegetable and fruit, there is a span of large increases for some products (e.g. 'other fruits'[4] +94%) and small increases for others (e.g. apples, pears and peaches +3%).

3.2.2 | Market balance for oilseeds

Oilseeds are especially affected and have a major impact on other products. Figure 1 shows how the decrease in imported soy is partly offset by an increase in domestic production of soy and rapeseed, and a decrease in soy used for feed. The figure tracks the flow of oilseed quantities from their sources (production or imports) on the left, to their uses (animal feed, human consumption, other processing, exports) on the right, with a breakdown by type (rapeseed, soy, sunflower) in the middle. Oilseed quantities include those processed to oils and oilseed cakes.

In the baseline, imports exceed domestic production. Soy is the predominant oilseed, followed by rapeseed and sunflower. Eighty-five per cent of domestically available oilseed are processed, primarily into oils and oilseed cakes. A majority is fed to animals. Human consumption, exports and processing into biodiesel make up a smaller share. In the import stop scenario, less oilseed products are used as animal feed and their composition changes, as the share of soy decreases. Sunflower dominates oilseed exports in the baseline, but both it and rapeseed become scarcer as they substitute for soy. This leads to decreasing oilseed exports.

In cattle feeding, non-tradable fodder (mainly grass, which is protein rich) substitutes for the marketable protein feed. Within the fodder rations, more cereals and less protein crops are fed. The composition of feed protein crops is shifted towards more rapeseed cake and less soya cake. This change in composition leads to an increase in kg of feed and fodder per head, whereas there are hardly any changes in the composition or quantities regarding pig and poultry feeding. Here, the missing soy imports are mainly compensated by reducing the number of slaughtered pigs (−9%).

3.2.3 | Regional differences in production changes in the EU

Domestic production increases via more intensive land use and expansion of agricultural area at the expense of mainly shrub or bare land and forest. Figure 2 illustrates the changes in utilised agricultural area and production per NUTS 2 region. Agricultural area expands in almost all EU regions, particularly in Spain, France and South-Eastern Europe.

EU oilseed production increases by 5.8 million tonnes or 50%, with the largest absolute increases in France (0.7 million tonnes), Romania [0.7 million tonnes, especially regions Sud (0.3 million tonnes) and Sud-Est (0.2 million tonnes)], Hungary [0.6 million tonnes, especially region Del-Alfoeld (0.2 million tonnes)], Germany (0.5 million tonnes), Italy [0.4 million tonnes, especially region Veneto (0.13 million tonnes)] and in the Swedish regions Oestra mellansverige (0.14 million tonnes) and Sydsverige (0.13 million tonnes). Scarcer feed leads to a decrease in animal production, particularly for pork and poultry (group 2).

Cereals in group 3 are affected only by small price increases, but price changes of other products lead to new relative prices that are an incentive to either increase cereal production at the

[4]List of products belonging to the categories 'other fruits' and 'other vegetables' in the Appendix: Table A5.

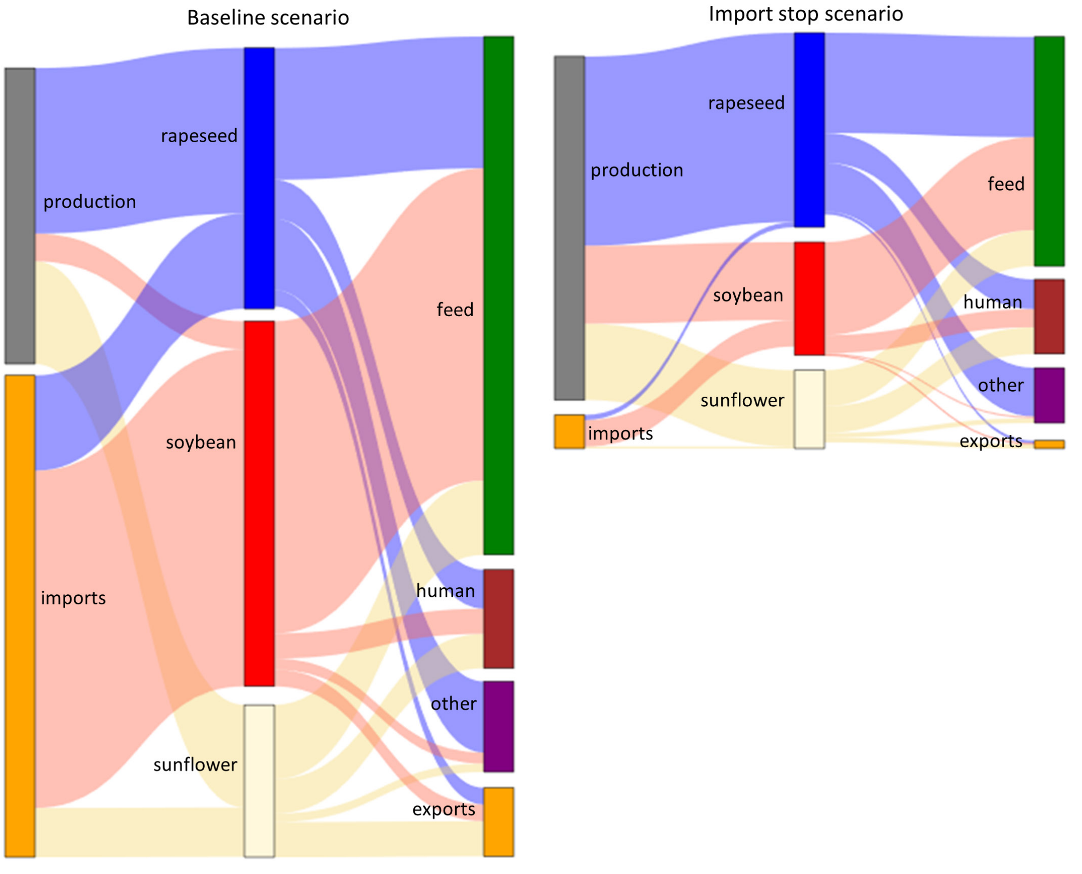

FIGURE 1 Market balance of oilseeds in the EU. Imports and exports without intra-trade, human consumption including losses (see Table A3 for absolute values).

expense of other crops or vice versa. Cereal production is reallocated among EU regions with hardly any net effect.

3.2.4 | Trade between the EU and the rest of the world decreases

An EU import stop affects both the EU and its trading partners. Figure 3 shows that trade between the EU and other world regions usually decreases in both directions.

The import stop scenario leads to some trade diversion, so that trade among non-EU countries increases, but overall global trade declines (not shown). Usually, trade flows into the EU (upper part of Figure 3) decrease more than trade flows from the EU (lower part of Figure 3). The remaining imports into the EU from middle-income countries (MIC) consist of fish which is not subject to the import stop (part of category 'rest') and palm oil. In some cases, net exporters become net importers, e.g. non-EU Europe for oilseed, oilseed cakes (both group 1) and oils (group 2). The opposite occurs for meat (group 2) and dairy (group 3). Net exports of oilseeds and oilseed cakes (both group 1) to the EU decrease strongly, especially from high- and middle-income countries. Net imports of meat and eggs (both group 2) decrease substantially, while cereals and dairy (both group 3) remain largely unaffected.

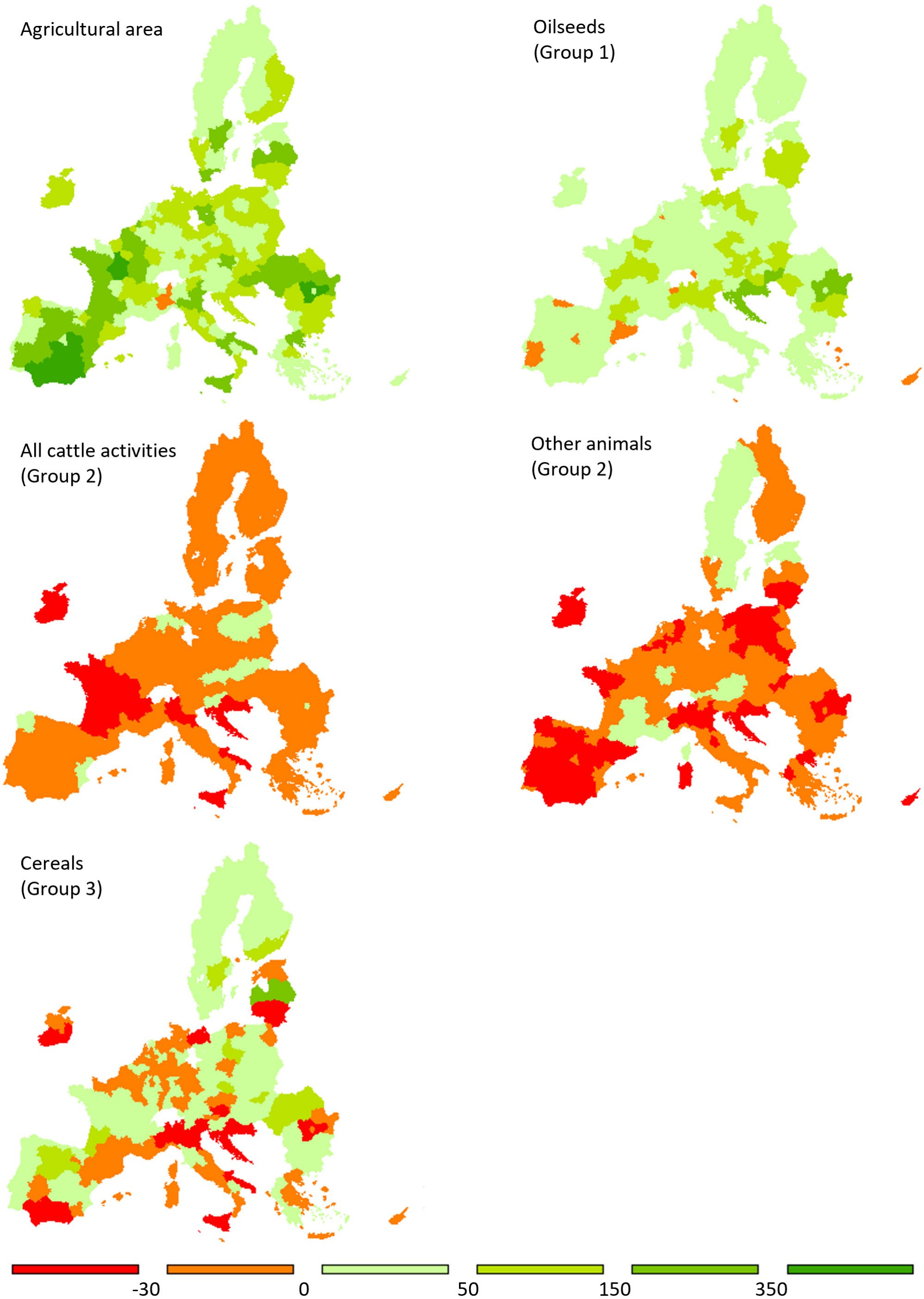

FIGURE 2 Changes in agricultural area and product supply quantity in the EU (absolute changes in 1000 ha respectively 1000 tonnes).

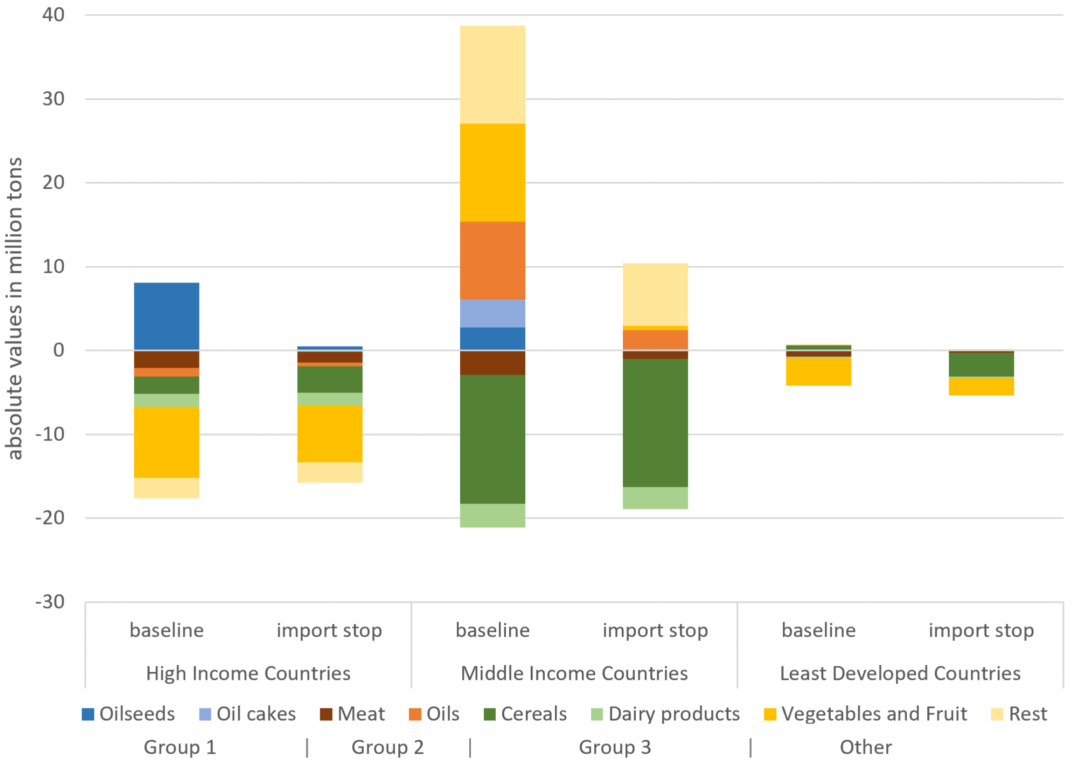

FIGURE 3 Changes in trade with the EU (absolute values).[5]

3.2.5 | Changes in global producer prices

Table 3 shows how the changes in import and export flows affect producer prices for different commodities and country groups. Increases are in green, decreases in red font and shade. EU prices generally increase, whereas other country groups show mixed results.

Regional prices fall if the EU is a net importer, i.e. the decrease in import demand from the EU is dominant over the decrease in exports from the EU. Group 1 (oilseeds and oilseed cakes) shows the most pronounced price changes, with EU price increases generally mirrored by decreases elsewhere. Group 2 (meat and eggs) sees price increases in the EU and other regions. Group 3 (cereals and dairy) shows ambiguous changes, as well as for vegetables, fruit and secondary products with small price reactions outside the EU.

For some countries or country groups, the price changes are considerably higher than the average price changes for the respective income group (HIC, MIC or LDC).[6] For instance, the beef price in the Western Balkan increases by 9%, whereas the average beef price hardly changes when considering all MICs. The pork price in South Africa increases by 7% (average over all MICs is 1%) and in the African LDCs by 6% (average over all LDCs is 3%). For vulnerable households even moderate price increases can cause social hardships and deteriorations in the quality

[5]List of countries in income categories and category thresholds in Table A4. Commodity aggregate "rest" consists of pulses, potatoes, tubers like yams, eggs, milled rice, sugar, fish (imports to EU reduced or fixed), as well as coffee, cocoa, tea, flax and hemp, tobacco, biodiesel and bioethanol, DDGS, feed concentrates (not subject to the import stop).
[6]List of countries belonging to income categories or regional country groups can be found in the Appendix: Table A4.

TABLE 3 Producer price changes for selected product groups and single products (percentage changes).

	European Union (%)	High-income countries (%)	Middle-income countries (%)	Least developed countries (%)	World (%)
Group 1: Directly affected					
Oilseed	74	−6	−3	−4	2
Soybean	126	−4	−6	−5	0
Rapeseed	57	−16	−8	−13	6
Sunflower seed	46	−5	1	−2	5
Oilseed cakes	69	−5	−6	−7	−4
Other field crops, e.g.	11	−1	−1	0	−1
Pulses	37	−1	−1	0	−1
Potatoes	8	−1	−1	0	−1
Group 2: Indirectly affected by import stop of group 1					
Meat, e.g.	26	1	1	1	3
Beef	26	0	0	1	3
Pork meat	23	5	1	3	5
Poultry meat	19	1	1	1	2
Oils	33	0	−2	0	2
Other animal products	14	0	0	2	2
Raw milk	15	1	−1	1	3
Eggs	14	0	1	5	2
Group 3: Relatively unaffected by import stop					
Cereals	7	−1	0	−3	0
Dairy products	7	1	0	0	1
Other: Heterogeneous product categories with ambiguous reactions					
Vegetables and fruit, e.g.	31	0	−1	1	1
Tomatoes	8	0	0	1	0
Other vegetables	30	0	−1	1	0
Apples, pears and peaches	3	0	0	0	0
Other fruits	94	−1	−1	1	3
Secondary products	10	0	−1	0	0

of diets. Springmann et al. (2021) showed that a healthy diet for both individuals and the planet is already too costly for people in LDCs due to high prices of vegetables, fruit and animal protein. In the import stop scenario, the prices of precisely these products increase even further. These findings highlight that trade can help improve food supply and diets (Allouche, 2011; D'Odorico et al., 2014; Fader et al., 2013; Porkka et al., 2017; Suweis et al., 2015).

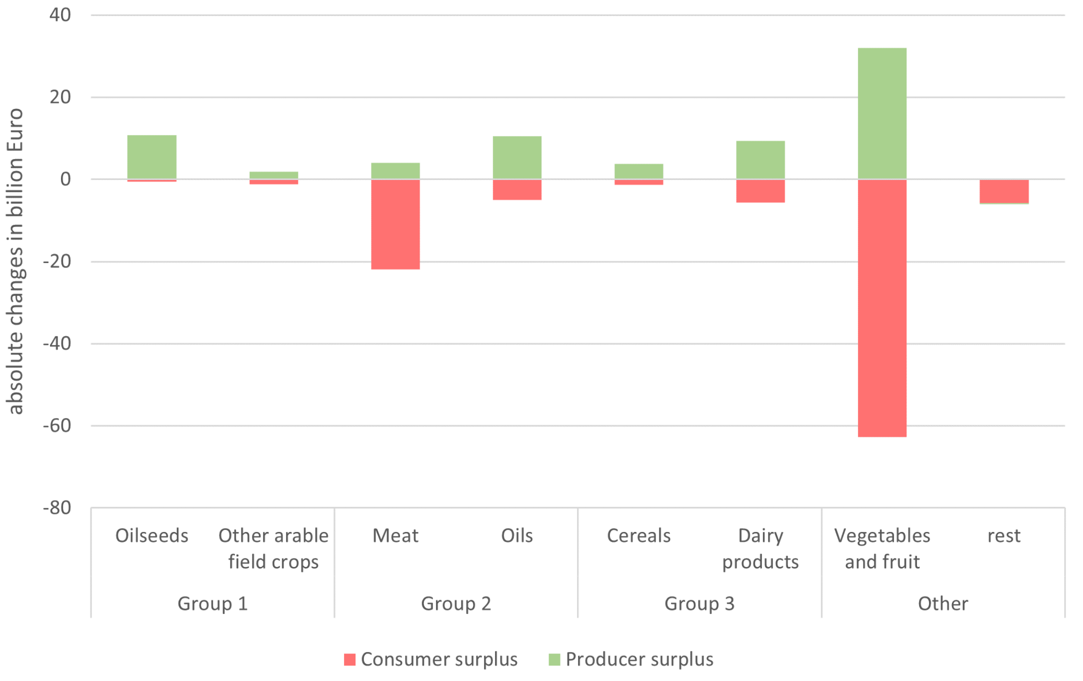

FIGURE 4 Changes in EU agricultural consumer and producer surplus (absolute changes).

3.2.6 | Changes in EU welfare

To analyse the implications on welfare in the agricultural sector, we consider changes in producer surplus and consumer surplus. Changes in producer surplus are calculated as changes in agricultural profits and profits from processing and the dairy industry. Changes in consumer surplus are measured as the change in expenditures needed to achieve the consumer utility level of the import stop scenario assuming baseline prices (CAPRI Consortium, 2022e). As prices are generally higher in the import stop scenario, this change in expenditures is negative and consumer surplus is lower in the import stop scenario than in the baseline. Consumer surplus only accounts for final demand for agricultural products, not for intermediate demand in the processing or animal industry, explaining, e.g. the very small changes in consumer surplus for oilseeds shown in Figure 4. Oilseeds are hardly consumed by final consumers, but rather used for processing or animal feed.

Due to increased prices and production, producer surplus for oilseeds (group 1) increases, mainly due to increased agricultural profits (not shown). Higher prices for rapeseed, soy and sunflower cause a decrease in meat and oil production (both group 2). Consumer surplus in meat decreases due to higher meat prices. The production and price increases lead to increased producer surplus, especially driven by agricultural profits in olive oil (not shown). The higher prices for the net exported cereals and dairy products (both group 3) lead to increases in producer surplus. The largest changes can be observed for vegetables and fruit, driven almost exclusively by the large price increases in 'other fruits' and 'other vegetables' (not shown).

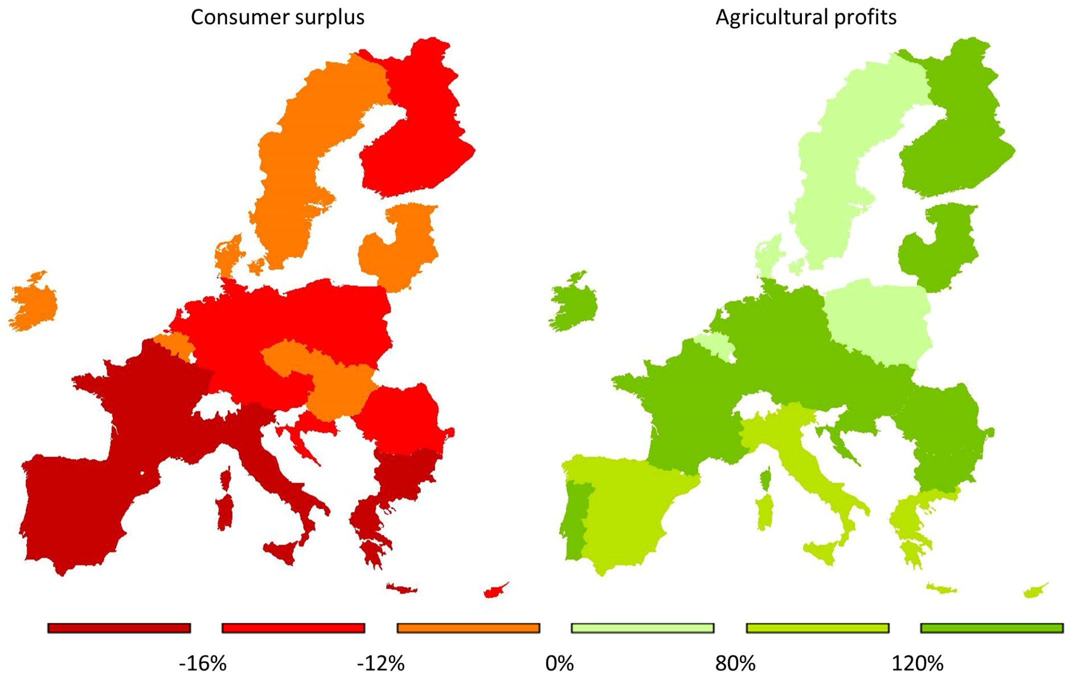

FIGURE 5 Changes in consumer surplus and agricultural profits (percentage changes).

As the changes in consumer surplus and producer surplus solely depend on the change in prices, the respective results are valid for any import stop scenario. The net welfare effects, however, depend on the specific import stop situation.[7]

Figure 5 shows the differing changes of consumer surplus and agricultural profits (dominating the overall changes in producer surplus) per EU member state, with consumers generally losing and producers profiting from higher prices. The decrease in consumer surplus tends to outweigh the increase in agricultural profits.

There are exceptions however. Hungary, Bulgaria and Romania account for a large part of the oilseed production increase. Therefore, increases in agricultural profits outweigh decreases in consumer surplus due to increases in oilseed prices (group 1). For groups 2 and 3 it is difficult to associate them with clear implications for a region. In Ireland, for instance, higher prices of butter (group 3) and beef (group 2) result in additional income for producers, which outweigh consumer losses as Ireland is a net exporter of these products. While in Germany, Denmark, Belgium and Sweden decreases in consumer surplus [mainly due to losses in meat (group 2) from higher feed prices, 'other fruits' and 'other vegetables'] are not compensated by increases in agricultural profits.

For analysing net welfare changes, it is important to differentiate between an import stop and a scenario of import reductions. In the latter case, the implications regarding tariff revenues and therefore, net welfare depend on whether the import reductions stem from the EU's own actions (e.g. higher import tariffs increasing EU tariff revenues) or from its trading partners (e.g. export bans with unclear, but probably negative effects on EU tariff income).

[7]Tariff revenues may increase for very small remaining import quantities, e.g. if the EU causes the import stop by increasing tariff rates, but will decrease if trading partners stop exporting to the EU. Welfare changes (without tariff revenues) for the EU, country aggregates over income and worldwide are shown in the Appendix: Table A6.

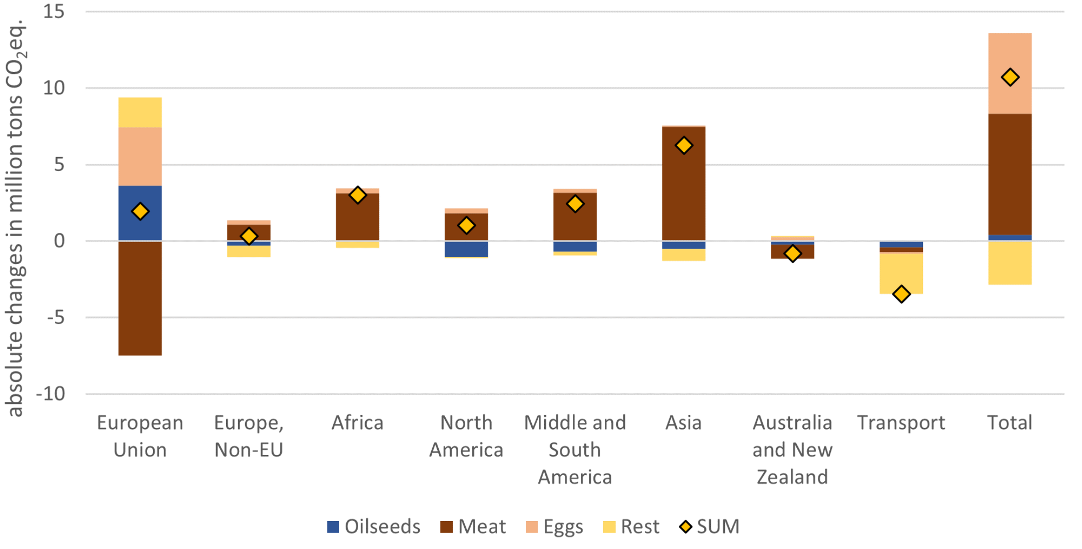

FIGURE 6 Changes in GHG emissions per commodity (absolute changes).[9]

3.3 | Negative environmental implications

Increased production in the import stop scenario leads to higher GHG emissions through more input use and agricultural land expansion. Reduced animal production leads to manure being substituted by mineral fertilisers. Mineral nitrogen fertiliser use increases by 10%, increasing the nitrogen surplus[8] and thus negatively affecting air and water quality and biodiversity.

In the import stop scenario, the EU's average nitrogen surplus increases to 65 kg/ha, up by 2 kg/ha or by a total of 389,000 tonnes. There are large variations between regions, with some areas in the Netherlands showing two-digit increases (e.g. 28 kg/ha in Friesland, 25 in Gelderland, 22 in Overijssel and 19 in Utrecht), increasing the already high levels of nitrogen surplus even further (e.g. to 510 kg/ha for Noord-Brabant, 428 for Gelderland, 426 for Limburg or 367 for Overijssel). Conversely, Southern European regions experience drastic reductions (e.g. −36 kg/ha in Madeira, −24 in Malta, −23 in Lombardia), though their nitrogen surpluses are still above desirable levels (174 kg/ha in Lombardia, 162 in Madeira, 128 in Malta).

With the import stop, production reallocates globally. In the baseline scenario, production occurs where it is cheapest, often corresponding to lowest ecological costs, as optimal climatic conditions and efficient input use usually decrease both economic and ecological costs (Himics et al., 2018). Figure 6 shows that GHG emissions increase in almost all world regions, mainly due to production reallocation of oilseeds (group 1), meat and eggs (both group 2).

CAPRI calculates EU GHG emissions based on nutrient flows and yields. In non-EU countries, emissions on product basis are computed using the AGLINK-COSIMO model and FAO

[8]CAPRI's nitrogen surplus at soil level is calculated as the difference between total input and export, including input from organic and anorganic fertiliser, biological fixation and atmospheric deposition. Exports are harvested material, ammonia losses from organic and mineral fertiliser (Britz & Witzke, 2014).

[9]The commodity aggregate "rest" consists of cereals, pulses, potatoes, tubers, vegetables and fruit, flax and hemp, tobacco, milled rice, sugar, biodiesel and bioethanol, DDGS, feed concentrates (not subject to the import stop).

data for CH_4 and N_2O emissions.[10] GHG emissions in Africa, middle and South America and Asia increase due to CH_4 emissions from higher meat production. The EU sees decreased emissions. N_2O emissions from crop residues and mineral fertiliser application increase due to higher crop production, but CH_4 emissions from enteric fermentation and manure decrease as cattle production decreases. Global emissions from meat increase, albeit decreasing meat production as it has been shifted to ecologically less efficient places. The reduction in emissions from international transport is comparatively small (−3.5 million tonnes CO_2eq. or −11%).[11] Overall, the import stop scenario increases global agricultural GHG emissions by ca. 11 million tonnes CO_2eq. or +0.2%. In comparison, EU's agricultural emissions were 389 million tonnes CO_2eq. in 2019 (EEA, 2022).

4 | DISCUSSION AND LIMITATIONS

To test the robustness of our finding that soybean is the key disruptor in the import stop scenario, we analysed the impact of stopping imports for each product individually.[12] We looked at the production changes for the affected product (red column in Figure 7) and all other products combined (purple column).[13]

Many singular import stops hardly impact domestic production, neither directly of the product for which imports are stopped (red) nor indirectly for other products (purple). In these cases, the import stop is absorbed by the EU agricultural sector without major disruptions. As expected, this is the case for all products from group 2 which are only indirectly affected by the import stop of other products and most products from group 3 which is generally relatively unaffected by any import stops. The import stops for some products (maize, 'other vegetables' and 'other fruits', potatoes, soybean, rapeseed, rapeseed cake) lead to relatively large increases in domestic production of these goods (red column). Only import stops for products from group 1 lead to major production decreases of other goods (and to major impacts on production of other goods in general) (purple column). The decreases are especially large for soybean and soya cake (framed purple columns), confirming that oilseeds and particularly soy are responsible for the large part of the overall shock in the combined import stop scenario. Scenarios in which the imports for all feedstuff,[14] all oilseeds, all oilseeds and cakes, and all soy products are stopped (not shown) further support this result.

Our findings are subject to limitations implied in the method. The human consumption module in CAPRI is a linear expenditure system, calibrated to observed quantities and prices, resulting in high levels of price-independent consumption and rather low reactions to prices changes. Therefore, we probably underestimate demand changes and overestimate changes in

[10]This article reports CH_4 emission from enteric fermentation, manure management (housing and storage) and rice production and N_2O emission from manure management (housing and storage), manure application, grazing, mineral fertiliser application, cultivation of organic soils, crop residues, volatilization (agricultural soils) and indirect emissions of nitrous oxide from leaching and runoff. Emissions are measured in global warming potential (GWP), i.e. 25 for CH_4 and 298 for N_2O (Parry et al., 2007; Pérez Domínguez et al., 2020).

[11]We use emission data for international food transport from Crippa et al. (2021). Emission factors for each trade flow (per product, country of origin and destination) are calculated assuming proportionality between monetary value and emission intensity of each trade flow and are then applied to the changed traded quantities in the import stop scenario.

[12]Note that some 'products' are in fact small product categories, e.g. 'other cereal' or 'apples, peaches and pears'.

[13]Cereals, oilseeds, oilseed cakes, potatoes, pulses, whey powder, DDGS, protein-rich and energy-rich by-products.

[14]Absolute differences to baseline production quantities were added up.

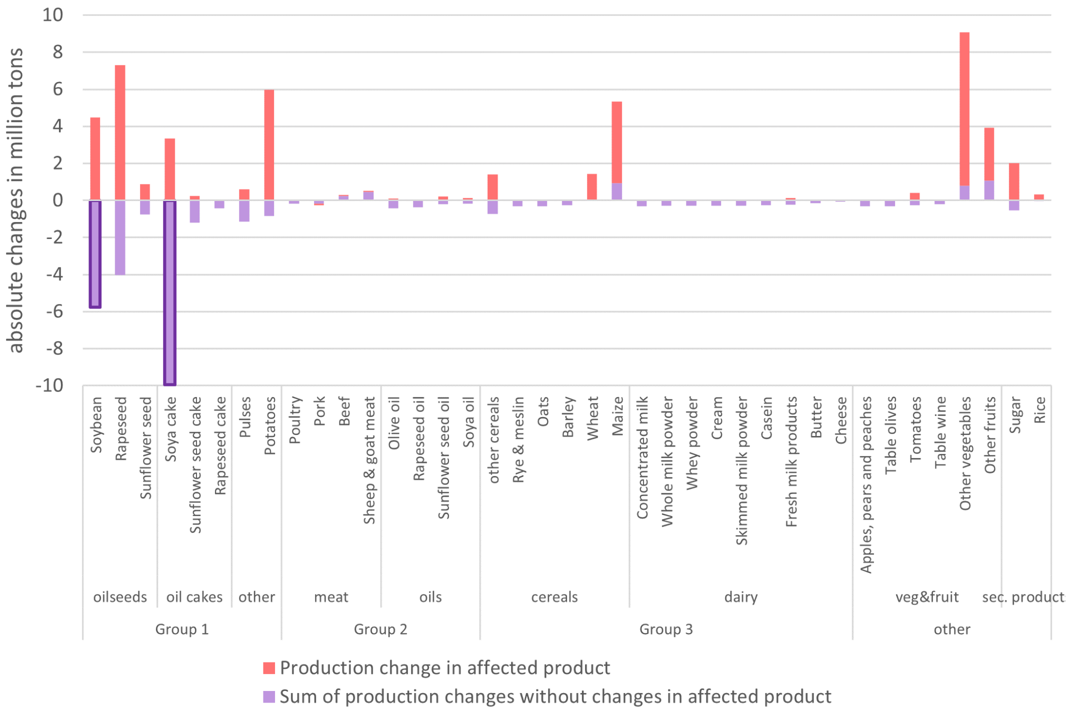

FIGURE 7 EU production changes of singular import stop scenarios compared to baseline (absolute changes).

price, domestic supply and exports. The Armington approach used to model trade may contribute to overestimating price changes as it tends to keep import shares large if large in the baseline and small if initially small (Kuiper & van Tongeren, 2006).

If the import stop also included fertiliser, machinery or fuel, it would likely result in smaller EU production increases because the observed production increases are dependent on increasing these inputs. Finally, CAPRI does not depict the whole food value chain. To assess implications for consumers, price changes in final products should be analysed. The prices of raw products in our analysis only account for part of the final food prices consumers pay.

Our findings align with previous research, including Gocht et al. (2021) and Himics et al. (2018) who also showed that a decrease in agricultural trade results in increased global GHG emissions due to a decrease in emission efficiency. Similarly, Lu et al. (2020) and Wang et al. (2022) found that due to reallocation global production becomes less emission efficient when trade decreases for all sectors and global emissions increase. Land use changes from the reallocation of soybean production were the main drivers for emission increases in Lu et al. (2020), which also supports our finding that soybean is the key product among internationally traded agricultural commodities. Alongside the decrease in emission efficiency, Lin et al. (2019) and Liu et al. (2020) found for trade decreases covering all sectors that they lead to increased prices of the (formerly) traded goods and decreased global consumption, production and emissions. As EU food demand is less elastic than demand for other products and than food demand in poorer world regions, it was within expectations that our study finds only modest negative effects on food consumption. The decrease in emission efficiency from reallocation dominates over production decreases, explaining the net increase of global emissions in our study. In the long run, however, the decrease in emission efficiency may not prevail. Especially in animal husbandry, differences in emission efficiency are not fixed and could be improved in many non-EU countries (Ashitey, 2013; Godfray et al., 2010; Himics et al., 2018). Higher producer prices in the import stop scenarios may make according investments more profitable.

5 | CONCLUSION AND POLICY IMPLICATIONS

We show that soybean and its products are the key commodities linking EU agriculture to the global market. A stop on soy product imports has serious implications for consumers and producers. Gocht et al. (2021) and Henseler et al. (2013) have conducted simulations for import stops on soy products and cereals, respectively, for oilseeds with results in line with ours. The import stops of most other products can be absorbed by EU agriculture without strong price effects, as it is close to self-sufficiency and features favourable soils, climate and advanced technology. Also, the EU is sufficiently large and diverse in terms of agro-ecological zones to produce various products and to cushion local production slumps.

EU food expenditures are a small share of the average consumer's budget, therefore increasing food prices do not affect average EU consumers' welfare as much as in other parts of the world. Nevertheless, some EU regions and household groups would experience hardships, which could be addressed by compensating policies such as direct income transfers. The significance of the welfare decrease in the sector is comparatively low, as agriculture only accounts for a small share of overall welfare and some regions and parts of the sector even benefit. In contrast, consumers in low- and middle-income countries are generally more affected by price increases that can negatively affect food security and dietary quality. The price increases from our simulations would be in addition to those from other trade disruptions (such as the Russian invasion in Ukraine or the COVID-19 pandemic) and from climate change (Huang et al., 2011), making consumers in low- and middle-income countries especially vulnerable.

Reducing meat production and consumption could effectively decrease the EU's dependency on soy imports as is the declared objective of the European Protein Strategy while also reducing global GHG emissions and nitrogen surpluses. Matching decreases in animal production to consumption decreases would prevent leakage and lower global cereal and oilseed demand and prices. Part of the land not used anymore for feed production could be dedicated to ecological purposes, helping to meet climate targets and compulsory EU guidelines on air and water quality.

This article is just one of many articles pointing out the negative effects of isolationist policies. Apart from the welfare losses in a market equilibrium, disruptive trade policies can amplify price shocks and price volatility (Headey, 2011; Martin & Anderson, 2012; Rutten et al., 2013; Tanaka & Hosoe, 2011). Additionally, they can encourage speculation (Tadesse et al., 2014). Suweis et al. (2015) showed that for countries that cannot produce sufficient food, trade helps to secure food availability. Building more secure trade agreements, especially regional and so-called South–South Agreements among low- and middle-income countries can prevent trade disruptions, cushion their impacts and make economies more resilient (Dahi & Demir, 2008; Lewis, 1980).

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the CAPRI consortium (Common Agricultural Policy Regionalised Impact Modelling System). Restrictions to the availability of these data may apply.

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APPENDIX 1

TABLE A1 Import reductions per product in the import stop scenario.

Cereal		Fish and other aquatic products	
Wheat	−96%	Freshwater fish	0%
Rye and meslin	−96%	Saltwater fish	0%
Barley	−96%	Other aquatic products	0%
Oats	−93%	Dairy products	
Maize	−91%	Butter	−99%
Other cereal	−98%	Skimmed milk powder	−91%
Oilseeds		Cheese	−89%
Rapeseed	−93%	Fresh milk products	−90%
Sunflower seed	−91%	Cream	−99%
Soybean	−89%	Concentrated milk	−99%
Other field crops		Whole milk powder	−99%
Pulses	−96%	Casein	−99%
Potatoes	−98%	Whey powder	−99%
Vegetables and permanent crops		Oils	
Tomatoes	−87%	Rapeseed oil	−94%
Other vegetables	−89%	Sunflower oil	−95%
Apples, pears and peaches	−96%	Soya oil	−94%
Table grapes	0%	Olive oil	−95%
Citrus fruit	0%	Palm oil	−92%
Other fruits	−89%	Oilseed cakes	
Table olives	−83%	Rapeseed cake	−98%
Table wine	−93%	Sunflower cake	−96%
Meat		Soya cake	−90%
Beef	−98%	Secondary products	
Pork	−83%	Rice, milled	−77%
Sheep and goat meat	−87%	Sugar	−28%
Poultry	−83%	DDGS	−90%
Other animal products		Protein rich by products	−98%
Eggs	−95%	Energy rich by products	−89%

TABLE A2 Tariff rates as multiplication factors of the import price.

Cereal		Fish and other aquatic products	
Wheat	0.5	Freshwater fish	Trade flow fixed
Rye and meslin	0.5	Saltwater fish	Trade flow fixed
Barley	0.5	Other aquatic products	Trade flow fixed
Oats	0.5	Dairy products	
Maize	0.5	Butter	1.0
Other cereal	1.0	Skimmed milk powder	0.5
Oilseeds		Cheese	1.0
Rapeseed	1.5	Fresh milk products	1.5
Sunflower	1	Cream	1.0
Soybean	2.5	Concentrated milk	1.0
Other field crops		Whole milk powder	1.0
Pulses	1.0	Casein	1.0
Potatoes	1.0	Whey powder	1.0
Vegetables and permanent crops		Oils	
Tomatoes	0.5	Rapeseed oil	1.0
Other vegetables	6.0	Sunflower oil	1.0
Apples, pears and peaches	0.5	Soya oil	1.5
Table grapes	Trade flow fixed	Olive oil	1.0
Citrus fruit	Trade flow fixed	Palm oil	2.5
Other fruits	4.0	Oilseed cakes	
Table olives	0.5	Rapeseed cake	1.5
Table wine	0.5	Sunflower cake	1.5
Meat		Soya cake	2.0
Beef	1.0	Secondary products	
Pork	0.5	Rice, milled	5.0
Sheep and goat meat	1.5	Sugar	Trade flow fixed to 80% of baseline
Poultry	0.5	DDGS	Trade flow fixed to 10% of baseline
Other animal products		Protein rich by products	1.0
Eggs	0.5	Energy rich by products	0.5

TABLE A3 The market balance of oilseeds in the EU (absolute values in million tonnes).

	Baseline scenario							Import stop scenario						
	Imports without intra-trade	Net production	Exports without intra-trade	Human consumption plus losses	Processing	Biofuels processing	Feed use	Imports without intra-trade	Net production	Exports without intra-trade	Human consumption plus losses	Processing	Biofuels processing	Feed use
Rapeseed	8.072	15.506	0.036	0.938	21.824	1.223	0.779	0.598	22.995	0	0.826	22.090	1.392	0.676
Sunflower seed	0.686	9.615	2.898	0.642	6.428	0.052	0.333	0.065	9.283	0.503	0.665	7.942	0.045	0.238
Soybean	10.407	2.598	0.101	0.345	11.630	0.488	0.929	1.186	9.463	0	0.291	9.772	0.372	0.585
Rapeseed oil	0.424	9.450	0.474	2.628	2.135	4.240	0.397	0.024	8.982	0.123	2.704	1.374	4.429	0.377
Sunflower oil	0.825	2.970	0.276	2.561	0.406	0.382	0.169	0.040	3.299	0.056	2.555	0.243	0.339	0.147
Soya oil	1.566	2.283	0.797	1.908	0.243	0.625	0.276	0.092	2.127	0.038	1.801	0	0.212	0.168
Rapeseed cake	0.425	12.157	1.050	0.083	0.282		11.169	0.009	11.547	0.238	0.080	0.113		11.125
Sunflower cake	3.104	3.505	0.120	0.026			6.463	0.139	3.892	0	0.027			4.004
Soya cake	19.625	9.350	0.669	0.098	0.170		28.039	1.936	8.714	0	0.104	0		10.545

Note: Imports and exports without intra-trade, human consumption including losses.

TABLE A4 Countries in income categories (categorisation of 2013) and political and geographical subcategories.

European Union (EU)	High-income countries (HIC) ($13,206 or more)	Middle-income countries (MIC) ($1086–$13,205)	Least developed countries (LDC) ($1085 or less)
Belgium and Luxembourg	European Union	Russia	Bangladesh
Denmark	Norway	Belarus	LDC in Asia and Oceania (Afghanistan, Bhutan, Cambodia, Laos, Maldives, Myanmar, Nepal, Timor Este, Kiribati, Solomones, Samoa, Tuvalu, Vanuatu)
Germany	Switzerland	Kazakhstan	
Greece	USA	Ukraine	
Spain	Canada	Former Soviet Union (Armenia, Azerbaijan, Georgia, Kyrgyzstan, Moldova, Tajikistan, Turkmenistan, Uzbekistan)	
France	Mexico		Ethiopia
Ireland	Japan		LDC in Africa (Angola, Burundi, Central African Republic, Chad, Comoros, Benin, Equatorial Guinea, Djibouti, Gambia, Guinea, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Niger, Guinea-Bissau, Eritrea, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Somalia, Sudan, United Republic of Tanzania, Togo, Uganda, Burkina Faso, Democratic Republic of Congo, Zambia)
Italy	Australia	West Balkan States (Albania, Macedonia, Serbia, Montenegro, Croatia, Bosnia and Herzegovina, Kosovo)	
The Netherlands	New Zealand		
Austria	Taiwan		
Portugal	South Korea	Mediterranean Countries (Tunisia, Algeria, Egypt, Israel)	
Sweden			
Finland		Middle East (Bahrain, Iran, Iraq, Jordan, Kuwait Lebanon, Libya, Qatar, Saudi Arabia, Syria, Oman, UAE, Palestine)	
Cyprus			
Czech Republic		Turkey	
Estonia		India	
Hungary		Pakistan	
Lithuania		China	
Latvia		Other Mercosur (Venezuela, Chile, Bolivia)	
Malta		‘Rest of South and Middle America’ (Bermuda, Aruba, Cayman Islands, Colombia, Costa Rica, Ecuador, El Salvador, Falkland Islands (Malvinas), Guadeloupe, Honduras, Martinique, Montserrat, Nicaragua, Panama, Peru, Puerto Rico, Turks and Caicos Islands, British Virgin Islands, United States Virgin Islands, Anguilla)	
Poland			
Slovenia			
Slovak Republic			
Bulgaria			
Romania			
Norway			
		Vietnam	

TABLE A4 (Continued)

European Union (EU)	High-income countries (HIC) ($13,206 or more)	Middle-income countries (MIC) ($1086–$13,205)	Least developed countries (LDC) ($1085 or less)
		Thailand	
		Malaysia	
		Indonesia	
		'Rest of Asia and Oceania' (American Samoa, Brunei Darussalam, Sri Lanka, Cook Islands, Fiji, French Polynesia, Guam, Democratic People's Republic of Korea, Marshall Islands, Maldives, Mongolia, Micronesia, Nauru, Netherlands Antilles, New Caledonia, Niue, Norfolk Island, Northern Mariana Islands, Pacific Islands Trust Territory, Papua New Guinea, Philippines, Pitcairn Islands, Palau, Tokelau, Tonga, Wallis and Futuna Islands)	
		Nigeria	
		South Africa	
		'Rest of Africa' (Botswana, Cameroon, Cabo Verde, Congo, Gabon, Ghana, Côte d'Ivoire, Kenya, Mauritius, Namibia, Zimbabwe, Réunion, Saint Helena, Seychelles, Western Sahara, Eswatini)	

Note: Countries in sub-categories were not separated for calculations of income categories, but the whole country group was fitted into the category.

TABLE A5 fruits and vegetables in the residual categories 'other fruits' and 'other vegetables'.

Other fruits:
Bananas, dates, figs, pineapple, avocados, guavas, mango, melons, papayas, apricots, cherries, plums, sloes, strawberries and other berries (HS6 codes: 80300, 80410, 80420, 80430, 80440, 80450, 80710, 80711, 80719, 80720, 80910, 80920, 80940, 81010, 81020, 81030, 81040, 81050, 81060, 81090, 81110, 81120, 81190, 81210, 81220, 81290)
Other vegetables:
Onions, garlic, leeks, cauliflower, broccoli, brussel sprouts, cabbage, lettuce, chicory, carrots, turnips, beetroot, celery, radishes, cucumbers and gherkins, artichokes, asparagus, aubergines, celery, mushrooms, truffles, capsicum, spinach, sweetcorn, vegetable mixtures, capers, processed potatoes, processed starchy roots and tubers (HS6 codes: 70310, 70320, 70390, 70410, 70420, 70490, 70511, 70519, 70521, 70529, 70610, 70690, 70700, 70910, 70920, 70930, 70940, 70951, 70952, 70959, 70960, 70970, 70990, 71030, 71040, 71080, 71090, 71110, 71130, 71140, 71151, 71159, 71190, 71210, 71410, 71420, 71490)

TABLE A6 Changes in welfare from primary agricultural activity, excluding changes in tariff revenues (absolute changes in billion Euro).

	European Union	High-income countries	Middle-income countries	Least developed countries	World
Group 1: Directly affected (net imported by EU)					
Oilseeds	9.425	−2.156	−2.488	−0.018	0.832
Oilseed cakes	−0.024	1.164	4.106	0.068	7.345
Other field crops	0.524	0.039	0.698	0.061	1.397
Group 2: Indirectly affected by import stop of group 1 (EU net trade position differs)					
Meat	−17.892	−1.874	−0.805	−0.373	−21.352
Oils	5.535	−0.238	1.409	0.144	6.720
Other animal products	−2.204	0.504	−0.351	−0.045	−2.167
Group 3: Relatively unaffected by import stop (net exported by EU)					
Cereals	3.269	0.063	−0.313	0.559	3.762
Dairy products	3.700	−0.738	0.369	−0.123	3.239
Others					
Vegetables and fruit	−30.816	−0.658	4.459	−1.618	−28.848
Secondary products	−0.521	−0.029	−1.302	0.023	−1.818
Coffee, teas and cocoa	−0.045	−0.052	−0.035	−0.009	−0.164
All other crops	−0.012	−0.001	0.019	0	0.006
Fish and other aquatic products	−3.198	−0.078	−0.254	−0.053	−3.637
Sum	−32.259	−4.054	5.512	−1.384	−34.685

Note: The shading indicates positive (green) and negative (red) changes exceeding 100 million Euro.