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Covid-19 and Food Protectionism

The Impact of the Pandemic and Export Restrictions on World Food Markets

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Abstract

This paper analyzes the impact of Covid-19 and uncooperative trade policies on world food markets. It quantifies the initial shock due to the pandemic under the assumption that products that are more labor intensive in production are more affected through workers' morbidity and containment policies. It then estimates how escalating export restrictions to shield domestic food markets could magnify the initial shock. The analysis shows that, in the quarter following the outbreak of the pandemic, the global export supply of food could decrease between 6 and 20 percent and global prices increase between 2 and 6 percent on average. Escalating export restrictions would multiply the initial shock by a factor of 3, with world food prices rising by up to 18 percent on average. Import food dependent countries, which are in large majority developing and least developed countries, would be most affected.

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The Impact of the Pandemic and Export Restrictions on World Food Markets

Alvaro Espitia, Nadia Rocha, Michele Ruta[2]

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1. **Introduction**

Could Covid-19 (coronavirus) lead to a global food crisis? As the virus spreads around the world, there are concerns that global food security could come under pressure (Laborde, Martin and Vos, 2020; Torero, 2020; Voegele, 20020). Food production is currently high, but it could be negatively impacted by increased workers' morbidity, disruption in supply chains, and containment measures. Governments' attempts to restrict food exports to meet domestic needs could make things worse. This paper analyzes how world trade in food could be affected by Covid-19. It shows that, similarly to the global food crises in the late 2000s, uncooperative trade policy actions could magnify the disruptions in global food markets caused by Covid-19, leading to spikes in world food prices.

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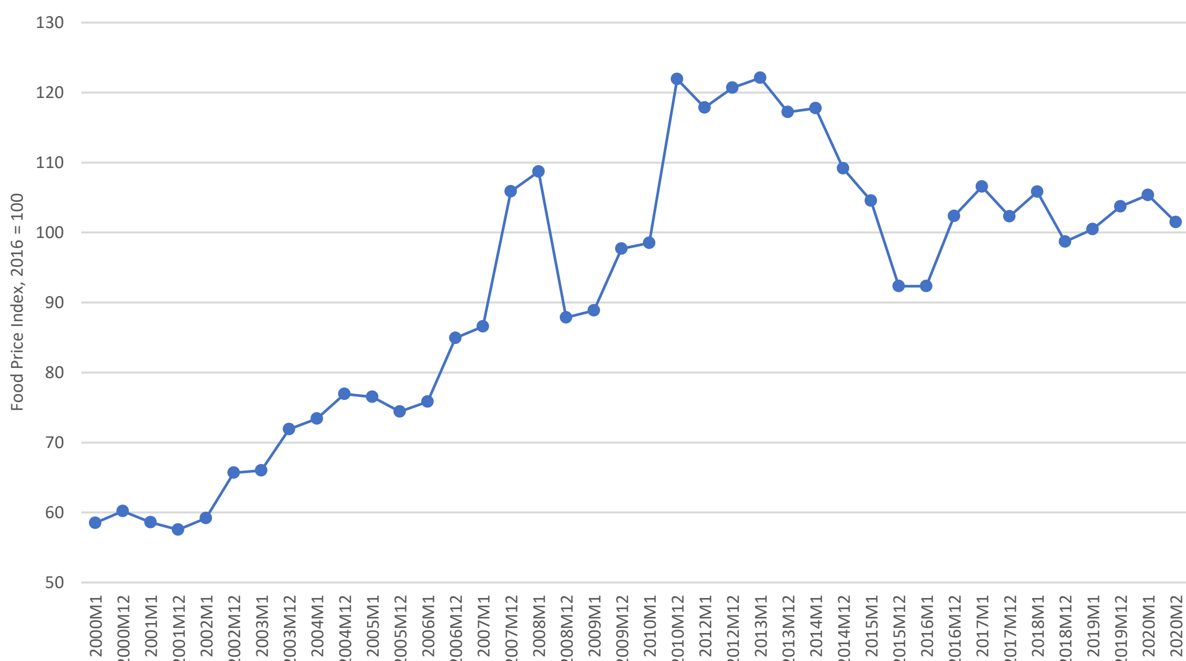
The experience of the late 2000s is instructive. In 2006-2007 and again in 2008-2011, a series of shocks created a gap between global demand and supply of food, leading to sharp increases in food prices (Figure 1). Many governments intervened, implementing export restrictions that aimed at isolating domestic food markets from global market developments. These measures contributed to reduce global supply, leading to even higher food prices. Giordani, Rocha and Ruta (2016) found that uncooperative trade policies alone were responsible for an increase in global food prices by 13 percent, on average. This effect was even higher for specific food markets. Martin and Anderson (2012) found that trade policy changes accounted for 45 percent of the increase in the world price of rice and 30 percent of the world price of wheat.

The situation today is in part different due to more favorable initial conditions. Back in the mid- to late 2000s, global food stocks were low, oil prices were high and weather-related shocks affected production in major exporting countries (FAO, 2009). Today, production levels of all major staples (wheat, rice, maize) are above the average of the past five years, oil prices are low and stock levels relative to consumption for major grains are 70-100 percent higher than in the late 2000s (Voegele, 2020). Indeed, as shown in Figure 1, global food prices have been relatively stable in recent years and they have remained low in the first months of 2020.

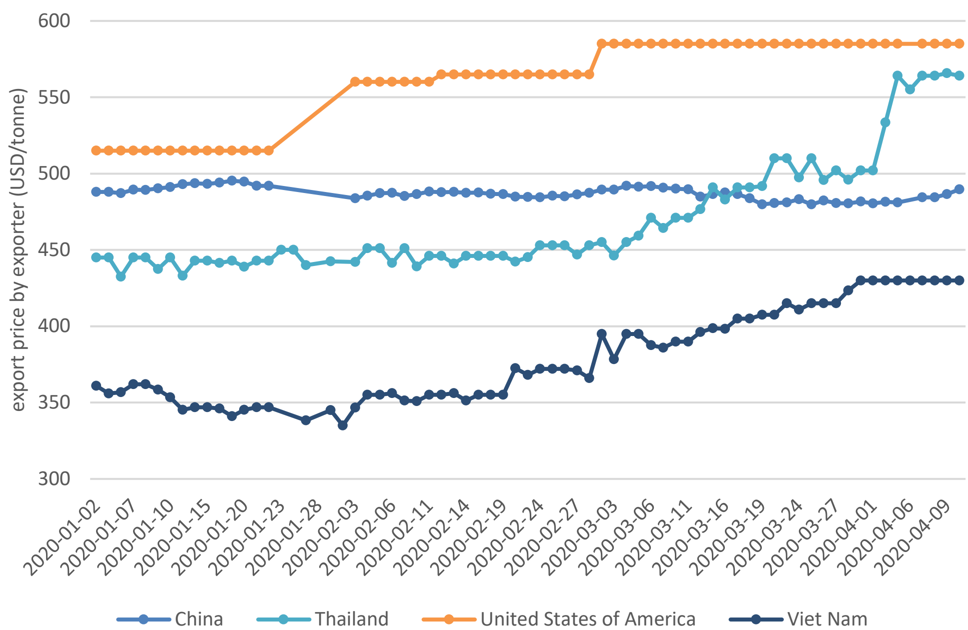
Figure 1. Food Price Index (January 2000 – February 2020)



Source: International Monetary Fund Primary Commodity Prices (January 2000-February 2020).
Note: Food Price Index, 2016 = 100, includes Cereal, Vegetable Oils, Meat, Seafood, Sugar, and Other Food (Apple (non-citrus fruit), Bananas, Chana (legumes), Fishmeal, Groundnuts, Milk (dairy), Tomato (vegetables)).

Despite favorable initial conditions, the virulent and rapid global diffusion of Covid-19 could lead to the emergence of problems in global food markets in the coming months. Declines in food supplies could result from a number of factors, including labor shortages as people become sick or are prevented to go to work due to containment policies and to disruptions in supply chains due to logistics bottlenecks within countries and at borders. While demand for some food products may decrease, for instance as restaurants cannot operate, this effect might be outweighed by government policies, including stimulus packages, aimed at supporting demand and by fears of food scarcity that can generate an increase in demand due to consumers' hoarding. As the global supply of food shrinks and inventories decline, world prices would eventually rise as the gap with global food demand widens. Evidence based on high-frequency data points to an increase in export prices of rice since February 2020 for several exporters (Figure 2).

Figure 2: Evolution of prices for rice (January 2020 – April 2020)



Source: ITC Market Price Information.

We provide a first assessment of the initial shock that Covid-19 could have on world food markets, which considers its potential heterogeneous effects across food products. Intuitively, supply conditions will impact food products differently, as workers' morbidity and the need for social distancing will affect more the supply of products that are more labor intensive, such as paddy rice, or the supply of products that have crucial labor-intensive stages, such as the processing of fish. For these products, Covid-19 may be expected to cause shortages to be more severe than in food sectors that do not require workers to be in close proximity, for instance due to more extensive automation (World Bank, 2020a). Moreover, as the extent of automation to produce the same food product varies widely across countries, we would expect for the same product larger reduction in supplies in countries with less automation.

To account for the heterogenous impact of Covid-19 on food supply across countries and products, we rely on data at the country-product level on the share of low-skill workers in the total value added in exports (Auguiar et al., 2019). We assume that the initial shock in supply proportionally increases with the weight of low-skill labor in total value added in exports. In our baseline scenario, we use information from Chinese food exports in January and February 2020 to define the potential upper bound for the decrease in supply across food products in the quarter following the outbreak of the pandemic for the 50 most affected countries.[3] Given the substantial uncertainty about the extent of the current health crisis, in a sensitivity analysis we consider an upward scenario, where initial export supply shocks are 10 percent higher compared to the observed declines in China's food exports, and a downward scenario where we assume that the initial decreases in supply across countries are 10 percent lower compared to the observed declines in Chinese exports of food. These scenarios roughly imply that shocks in the 50 countries most affected by Covid-19 could be half or double the initial shock in China.

Under the baseline (China-like) scenario, Covid-19 is estimated to lower the world's export supply of food by 12.7 percent, on average in the quarter following the outbreak of the pandemic. Many important staple foods, including rice, wheat and potatoes have drops in export supplies of over 15 percent. Price changes for individual country-products will depend on the concentration of their imports from countries most affected by Covid-19 and on the elasticity of import demand. Using product-level elasticities estimated from a gravity analysis covering 152 countries by Fontagné et al. (2019), we find that lower export supplies would lead world food prices to increase by 4.0 percent on average. In the downward and upward scenarios for the initial supply shocks caused by Covid-19, decreases in overall food export supply would range between 5.7 and 19.7 percent and price increases between 1.8 and 6.3 percent on average. These effects should be considered as initial impacts, as the longer-term effects of Covid-19 will largely depend on the length of the health crisis -something that it is difficult to predict at this stage.

We next quantify the potential impact on export supplies and global food prices of export restrictions. As of the end of April, more than 20 governments had imposed some form of restrictions on food exports (EUI-GTA-WB, 2020). As food prices increase due to the initial Covid-19 shock, governments may be tempted to use trade policy to stabilize domestic prices. These measures can lead to retaliation and rising food prices (Giordani, Rocha and Ruta, 2020). The basic insights from the theory are presented in Section 2. Intuitively, export restrictions mitigate pressures on domestic food markets but lead to further declines in supplies in the world market. Food prices would further increase as the shock caused by uncooperative trade policy magnifies the initial supply shock due to Covid-19. In response, other governments would likely retaliate by imposing new export restrictions in the attempt to reduce domestic food price escalation, leading to a multiplier effect.

The analysis finds that food prices could spike as a result of the multiplier effect of (uncooperative) trade policy. Under the baseline scenario for the initial shock, we find that escalation in export restrictions would lead to a decline in the world food export supply by 40.1 percent on average in the quarter following the outbreak of the pandemic. Global food prices increase by 12.9 percent on average. Price increases are highest for key staples such as fish meat (106.2 percent), oats (31.1 percent), vegetables (28.5 percent) and wheat and meslin (25.1 percent). In a sensitivity analysis, where we use demand elasticities estimated at the bilateral-product level for a subset of countries by Kee and Nicita (2020), we find that export restrictions could drive up the average price of food by 49.2 percent. This is driven by products like fresh fruits and vegetables whose import demand is much less elastic vis-à-vis specific producers, leading to higher price increases when they are hit by a supply shock. Finally, in the downward and upward scenarios, global export supply of food under uncooperative trade policies would decrease between 21.0 and 55.4 percent, respectively, during the quarter following the outbreak of the pandemic. Food prices would increase between 6.6 and 17.9 percent on average using Fontagné et al.'s (2019) elasticities.

[3] The most affected countries are the ones with the highest numbers of confirmed Covid-19 cases (see Appendix Table 1 for the list of countries).

While there is significant uncertainty and it is difficult to predict whether the initial shock due to Covid-19 will be closer to the baseline or to the upward or downward scenarios, the results raise some concerns. Regardless of the size of the initial impact of Covid-19, escalating trade restrictions would multiply the initial shock on world export supplies and food prices by a factor of 3. On a yearly basis, and assuming that the shock does not persist beyond a quarter, the total decrease in global export supply of food as a result of uncooperative trade policy ranges between 5.2 percent (downward scenario) and 13.8 percent (upward scenario). These figures are similar to the contraction in world export supply in 2008-09, which was around 11 percent. While today several factors contribute to mitigate food price increases (higher buffer stocks for food staples, lower oil price), poverty could rise as a result of the crisis making even small increases in food prices a larger threat to food security.[4] In fact, as the majority of import food dependent countries are developing and least developed economies, the negative effects of Covid-19 and export restrictions on food markets would be primarily felt by the poorest countries. We find that the most affected import food dependent countries include Tajikistan, Azerbaijan, the Arab Republic of Egypt, the Republic of Yemen and Cuba, which would experience increases in average food prices ranging between 15 and 25.9 percent. For cereals, developing and least developed import food dependent countries would see price increases of up to 35.7 percent.

This paper contributes to the growing, just-in-time literature on the economics of Covid-19 (Baldwin and di Mauro, 2020a and 2020b). Methodologically, this paper is close to two recent studies that use estimates of trade elasticities to assess the global price effects of supply disruptions associated to Covid-19 in China (Kee, 2020) and of export restrictions in countries that produce medical products needed to manage Covid-19 (Espitia, Rocha and Ruta 2020a). A study by Laborde, Martin and Vos (2020) uses a Computable General Equilibrium (CGE) model to quantify the effect of Covid-19 on food security via its impact on poverty in developing countries. Our work also relates to the literature on the role of trade policy in the global food crises of the late 2000s (Martin and Anderson, 2012; Giordani, Rocha and Ruta, 2016), which is further discussed in the next section.

The paper is organized as follows. Section 2 presents a simple version of the theory. Data on Chinese exports of food during January and February 2020 and on world trade flows in food markets are presented in Sections 3 and 4, respectively. The quantification of the impact of Covid-19 and export restrictions on the world export supply of food and food prices is presented in Section 5. Section 6 has the sensitivity analysis. Concluding remarks follow.

2. The “multiplier effect”

This section provides a brief review of the theory on the multiplier effect of trade policy (Giordani, Rocha, and Ruta, 2016). The model builds on developments in the literature on behavioral economics and trade policy that modifies an otherwise standard trade policy model to account for loss aversion -the fact that individuals value losses more than gains (Freund and Ozden, 2008; and Tovar, 2009). In this setting, preventing losses may loom large in the government's objective function, leading to radically different predictions from standard political economy models of trade policy (e.g. Grossman and Helpman, 1994).

The key insight of the literature on trade policy under loss aversion is that, in the absence of other tools, a welfare maximizing government may use trade policy (e.g. export taxes or subsidies) when the

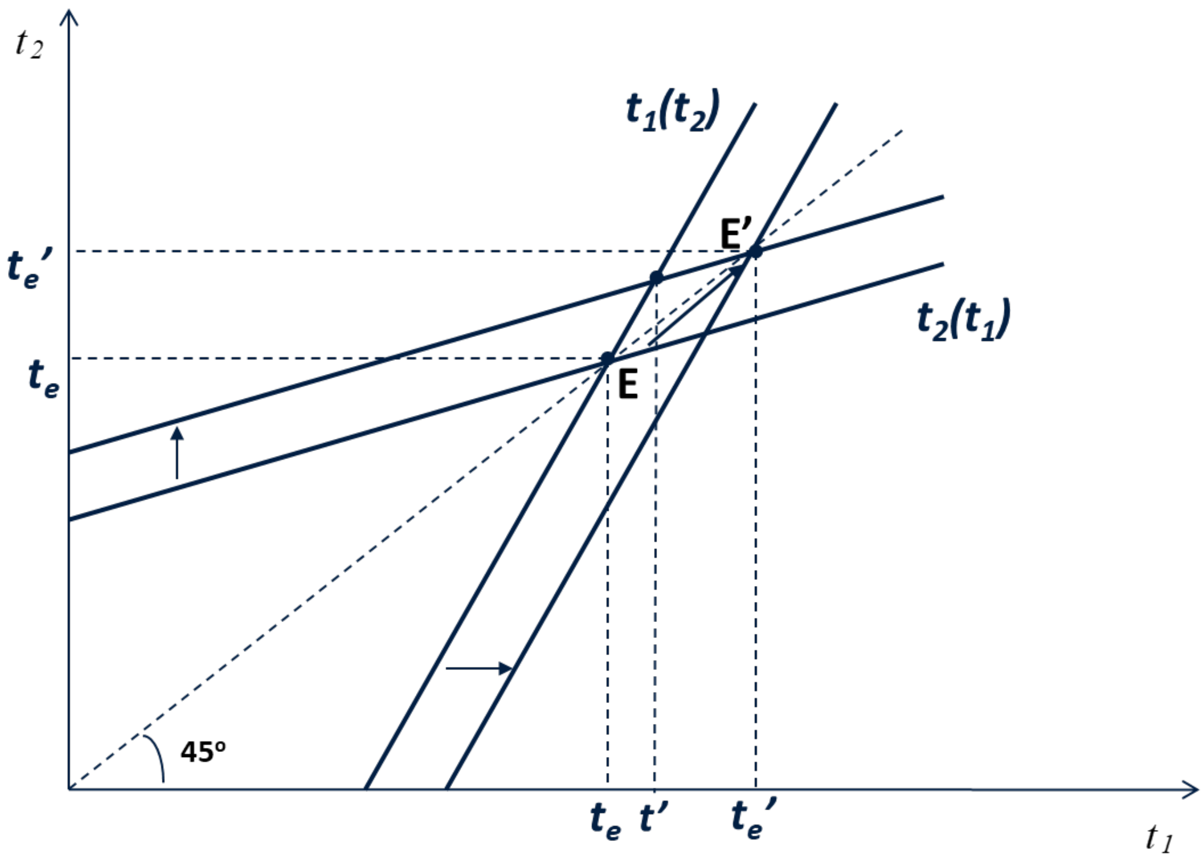
[4] Simulation based on a Computable General Equilibrium (CGE) model finds that 140 million additional people globally could fall into poverty due to Covid-19 (Laborde, Martin and Vos, 2020).

international price of food is low (i.e. below the reservation price of producers) or high (above the reservation price of consumers) in order to address loss aversion. Specifically, in the first case the government of a food exporting country imposes an export subsidy to offset the welfare loss for producers. In the second case, the policy maker sets an export tax aiming at decreasing the negative effect of high food prices on the welfare of consumers. In both cases, the rationale behind trade policy is to offset -completely or in part- the effect that "extreme" conditions in international food markets have on the welfare of domestic constituencies.

These government actions may give rise to a "multiplier effect" of trade policy. When the world food market is hit by a shock that drives up prices above a certain threshold, consumers face a loss and exporting governments respond by imposing an export tax. As different exporters face the same shock and have similar incentives to insulate the domestic food market in the presence of loss aversion, their simultaneous behavior has aggregate consequences. The world price of food rises even further as the world export supply shifts in. The higher international food price, in turn, induces further trade policy utilization as governments strive to maintain stable domestic prices. Differently from the initial response, subsequent policy actions are not driven by fundamentals but are only a reaction to the measures imposed by other governments, what is commonly referred to as a multiplier effect.

This logic can be represented graphically for the case of two large exporters and linear import demand and export supply (the general case is presented in Giordani et al. 2016). As is standard in the literature, large exporters do not take the international price of food as given and choose their trade policy strategically. In this context, when the world food market is hit by a sufficiently large shock, the two countries' trade policies are strategic complements. Intuitively, if a large exporter raises its export tax, it increases the world price of food, which in turn leads the other government to further restrict its exports to avoid consumers' losses. The upward sloping reaction functions capture the strategic complementarity of trade policy (Figure 3). The initial Covid-19 shock drives up the (untaxed) international price and the two reaction functions shift outward. To offset consumers' losses, governments have an incentive to set up higher trade restrictive measures. In the new equilibrium (E'), the total policy response (from the initial trade policy t_e to t_e') is strictly larger than the initial response to the shock (from t_e to t'). In other words, this strategic complementarity of large economies' trade policy creates a multiplier effect that magnifies the consequences of exogenous shocks to the international price of food.

Figure 3: Multiplier effect of export policy



Source: Giordani, Rocha and Ruta (2016).

3. **Initial evidence from China**

China is the first country that was hit by Covid-19 and that enacted containment policies aiming at reducing the spread of coronavirus. The cases were first noticed in December 2019 in Wuhan, Hubei province. Contagion accelerated in January and February 2020, with a deceleration in March thanks to the government's containment policies. In this section, we look at recently published trade data for January and February 2020 as an early indication of the impact that Covid-19 could have on food exports elsewhere in the quarter following the outbreak of the pandemic as production is affected by the health crisis and by the policies aimed to contain it. Because of its large manufacturing base, China's food exports account for less than 1 percent of its total exports. But thanks to its size China is still an important player in the global food market, accounting for 10.8 percent of world food exports. For fish meat, a key staple in many diets, China is the largest exporter, with 16 percent of global exports. For several products, including groundnuts, rice and soya beans, China is among the top-10 world exporters.

Chinese exports to the world decreased by 17 percent year-on-year from January-February 2019 to January-February 2020, while Chinese imports declined by 4 percent year-on-year (World Bank, 2020b).[5] As Covid-19 cases increased and China implemented containment measures, food exports declined by 17 percent. The modest decline in total imports indicates that policies to support incomes in China were able to maintain demand for most goods. Food imports actually increased by 15 percent.[6] China's export contraction is indicative of a decline in food production, although other factors might have played out as well. Over this period, China is not reported to have imposed export restrictions on food, nor were generalized restrictions on food imports from China announced. While there are reports that Indonesia restricted imports of fresh fruits and vegetable from China and a large retailer from the Russian Federation chose to source food away from China, these actions generally affect new orders and would have effects on exports with a lag.[7] Delays at the border, for instance due to enhanced monitoring and inspections, and logistics bottlenecks in addition to the negative impact on food production may have also directly contributed to the decline of Chinese food exports.

Exports of different food products appeared to respond differently as China dealt with Covid-19 in January and February 2020 (Table 1). Exports of all food product categories declined, except for sugar and nuts. Food products that rely heavily on low-skill labor registered the largest percent drops in January and February 2020 relative to the previous year. Exports of fish meat and crustaceans, products that are relatively more labor intensive in their processing stage, declined by 26 and 25 percent, respectively. Products that rely on manual labor, such as rice, groundnuts, vegetables and fruits also recorded substantial declines in exports, ranging between 18 percent for rice and 31 percent for groundnuts. For instance, due to small field/paddy size of less than 1 hectare, manual methods predominate for rice: planting, fertilizing, weeding, harvesting, raking, threshing, usually assisted with small equipment such as rototillers or small tractors.[8] While more data will be needed to investigate the determinants of food export declines in China, this evidence is suggestive of the negative impact of Covid-19 on food supply and exports, and particularly for those products that heavily depend on labor in production.[9]

Table 1: China's food exports and imports, January and Febrary 2020 compared to 2019

	Exports Jan Feb 2019 (USD mn)	Exports Jan Feb 2020 (USD mn)	Percentage change	Imports Jan Feb 2019 (USD mn)	Imports Jan Feb 2020 (USD mn)	Percentage change
Food Total	**1,797**	**1,498**	**-17**	**10,940**	**12,614**	**15**
Fish	862	654	-24	1,292	1,170	-9
Oil-bearing	379	343	-10	154	317	106
Nuts and derived products	79	108	36	253	202	-20

[5] To account for the changing dates of the Chinese New Year, we present the trade data for January and February 2020 combined and relative to their respective levels in 2019.

[6] Data on food production in China for the first two months of 2020 are not yet available. The decline in food exports and the increase in imports over this period are suggestive of disruptions in domestic supply chains and a decline in food production in China. Although, other factors not related to Covid-19 also mattered, such as the swine fever that reduced China's stocks.

[7] See for instance: https://www.freshplaza.com/article/9188594/chinese-exports-and-imports-feel-the-impact-of-coronavirus/

[8] Indeed, news reports indicated that the authorities in China had concerns that the spread of coronavirus and the policies to mitigate it, which reduced the mobility of seasonal workers from northern provinces, would impact planting of rice in Hubei province, the epicenter of the crisis. See: https://www.reuters.com/article/health-coronavirus-china-rice/china-calls-for-expansion-of-rice-production-amid-measures-to-contain-coronavirus-idUSB9N28G03R and https://www.ft.com/content/cafb828e-6423-11ea-b3f3-fe4680ea68b5.

[9] Appendix Figure 1 uses data for China in January and February 2020 and Appendix Figure 2 uses early data for the United States for March 2020 and show the correlation between the change in food exports (year on year) and the unskilled labor shares in total value added in exports for the 10 products that experienced the largest declines.

Cereals	118	94	-20	1,004	786	-22
Meat	103	90	-12	871	2,557	194
Legumes and pulses	94	88	-6	120	113	-6
Vegetable and animal oils	83	68	-19	1,373	1,230	-10
Dairy and eggs	29	23	-22	338	435	28
Fresh Fruits – Vegetables	18	15	-15	5,431	5,629	4
Sugar	12	13	1	54	120	122
Stimulant crops	20	3	-84	49	55	11
Top-10 food products exported by China						
Fish fillets and other fish meat	648	479	-26	56	61	8
Citrus fruit; fresh or dried	328	308	-6	24	22	-8
Crustaceans, meals, pellets	151	113	-25	1,227	1,098	-11
Nuts	79	108	36	192	160	-17
Rice	103	85	-18	235	154	-35
Meat and edible offal of poultry	81	73	-10	184	432	135
Fish, dried, salted, smoked, etc.	63	61	-3	8	11	32
Vegetables, leguminous	74	57	-24	120	113	-6
Groundnuts	50	34	-31	21	125	511
Oil seeds and oleaginous fruits	35	27	-22	264	173	-34
Agriculture (HS 1-24)	10,485	9,274	-12	21,481	23,184	8
Extractive (HS 25-27)	7,170	7,688	7	81,028	87,510	8
Manufacturing (HS 28-97)	333,947	274,123	-18	206,753	187,439	-9
Total	**351,603**	**291,085**	**-17**	**309,262**	**298,133**	**-4**

Source: China customs.

4. Global trade flows in food

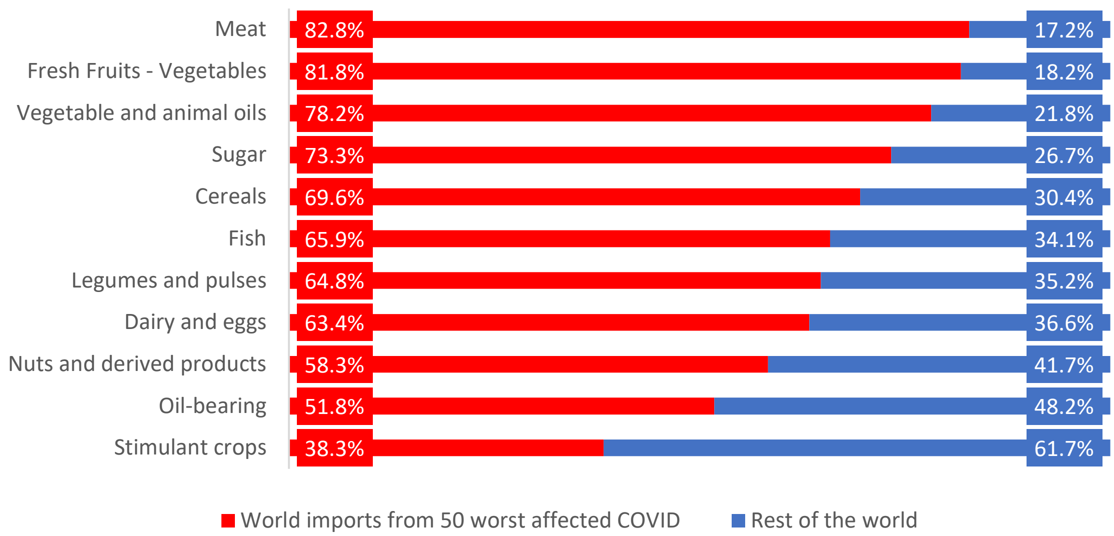
While Covid-19 has been most virulent in China, Europe and North America, the number of new cases has been increasing across the globe. The top-50 countries[10] most affected by Covid-19 represent on average 66 percent of the world export supply of food products. How Covid-19 will impact the supply of different food products in the short term will depend on what these countries produce. In the medium-longer term, as the geography of Covid-19 changes and coronavirus spreads across different countries, the set of food markets potentially affected will change, pointing to the need for continuing monitoring.

The share of world exports by the top-50 most affected Covid-19 countries goes from 38.3 to 51.8 percent in food products such as stimulant crops and oil bearing to more than 75 percent in vegetable and animal oils, fresh fruits and meat (Figure 4). For key staples such as cereals, the European Union, Canada and Australia, (which are among the top-10 economies most affected by Covid-19) represent 91 percent of world exports of oats, 66.1 percent of rye, 62.6 percent of barley and 42.1 percent of wheat and meslin. The United States represents more than 70 percent in world exports of flour and meals (75.9) and grain sorghum (77.1). Other large exporters of cereals include Thailand, which represents 24 percent of world supply of rice; the Russian Federation, with shares of world exports of wheat, rye and barely ranging between 14 and 21 percent; and Brazil, whose exports of corn represent 13.9 percent of total exports. The United States, the European Union and China also represent more than 25 percent of global export

[10] Most affected countries are defined based on information from the World Health Organization coronavirus disease (Covid-19) situation reports on total number of cases per country (https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports). Up to date, the European Union is the region with most affected cases. Therefore all 28 members are included in the top-50 countries most affected by Covid-19. For the rest of the analysis presented in this paper, the European Union is considered as a single country, given that it has a common external trade policy.

supply of other food products such as meat, cheese, milk, and fish. Other affected countries such as Brazil, Ecuador, Malaysia and Indonesia also represent a significant share of world supply of respectively citrus fruit (48.7), bananas (30.4), palm oil (31.8), and coconut oil (46.6) (Appendix Table 1).

Figure 4. World imports from top-50 most affected by Covid-19



Source: Espitia, Rocha, Ruta (2020). "Database on COVID-19 trade flows and policies".

The negative impact of disruptions in food supply as a result of Covid-19 will be potentially higher for import food dependent countries,[11] with high levels of concentration of imports coming from the top-50 most affected countries. Import food dependent developing countries would be particularly vulnerable to supply shocks in key staples such as cereals, meat and fresh fruits, where more than 74 percent of imports on average come from the top-3 exporters that are most affected by Covid-19 (Table 2).[12] Import food dependent developing countries such as Botswana, Mexico and Jamaica import more than 95 percent of rice, wheat and corn from the top-3 exporters most affected by Covid-19. Least developed countries such as Lesotho and Angola have concentration of imports of rice and wheat from the top-3 most affected countries by Covid-19 that are above 95 percent. Almost the totality of imports of poultry for Botswana, Mexico and Lesotho and imports of bovine meat for Jamaica, Bosnia and Herzegovina and The Gambia come from the top-3 most affected Covid-19 countries (Appendix Table 4 and Appendix Table 5).[13]

Table 2: Developing countries' concentration of imports from top-3 Covid-19 most affected countries, by level of food dependence

	Low food dependence	Medium food dependence	High food dependence
Cereals	69.4	71.0	77.5
Dairy and eggs	59.7	63.2	72.0

[11] Import food dependence is calculated as the share of net food imports over domestic food supply: $Food\ dependence_{ik} = 100 \times (Imports - Exports)_{ik}/(production_{ik} + (Imports\ - Exports)_{ik})$, where *i* is importer and *k* is product. This share is positive for net importers and negative for net exporters. For net importers, the share ranges between 0 (no import dependence) and 100 (maximum import dependence). For this analysis, country-products with food dependence higher than 20 percent are considered as import food dependent. See FAO (2018).
[12] See Appendix Table 2 for results at the product level.
[13] For information on the top-10 import food dependent advanced countries in terms of concentration of imports from the most affected Covid-19 countries, see Appendix Table 3.

Fish	56.1	64.0	57.7
Fresh Fruits – Vegetables	72.2	77.1	74.8
Legumes and pulses	67.2	78.9	44.0
Meat	70.0	74.3	78.0
Nuts and derived products	75.8	68.9	89.6
Oil-bearing	49.6	55.8	58.5
Stimulant crops	24.1	42.8	54.1
Sugar	48.8		37.1
Vegetable and animal oils	78.5	71.5	75.3

Source: Espitia, Rocha, Ruta (2020). "Database on COVID-19 trade flows and policies".

Note: The concentration of imports is calculated as the simple average by product group, across all import food dependent countries of that group, of the sum of the import shares from top-3 exporters that are most affected by covid-19. $Imp\ concentration_i = 100 * (\sum_{n=1}^{N} \sum_{k=1}^{K=3} imp_{ijn}/Tot\ imp_{in})/N$, where i, j, k, and n are respectively importer, exporter, exporter rank and product. For definition of import food dependence see footnote 11. Low, medium and high import food dependence corresponds to shares of import food dependence between 0 and 20, 20 and 50 and more than 50 respectively.

5. **Effects of Covid-19 and export restrictions**

In this section we estimate the potential impact on food prices across products as a result of disruptions in supply in the top-50 countries most affected by Covid-19. We also estimate how the impact on prices could potentially be magnified as a result of uncooperative trade policy across exporting countries.

The initial shock on food export supply is captured through the negative impact that Covid-19 has on the food supply chain as a result of workers' morbidity and social distancing practices applied by countries. These effects are difficult to quantify ex-ante, but they are likely to vary across products and countries according to factors such as the intensity of labor in production, as containment policies may limit the mobility of seasonal workers and activities that require larger numbers of individuals working in close proximity may be more affected (World Bank, 2020a). As we are ultimately interested in the trade dimension, we use recent data from Aguiar et al. (2019) to calculate this intensity as the share of unskilled labor in total value added of exports. The data are indicative of large variations across countries and products. For instance, production of animal-based products such as dairy is usually automated across countries and therefore has low levels of low-skill labor intensity. In contrast, cereals such as paddy rice and wheat on average involve significant participation of low-skilled workers in their production processes in developing countries, which is reflected in their high shares of low-skilled labor intensity (Appendix Table 6).

To account for this heterogeneity, we assume that decreases in export supply of a specific country-product depend on the share of low-skill workers in the total value added in exports. Other factors such as delays at the border and disruptions in trade logistics associated to Covid-19 may also contribute to reduce export supply, but their impact is more uniform across country-products. Informed by the magnitudes of decline in food exports in China in January and February 2020 (Section 3), we assume that exports in the most affected Covid-19 countries would decline in the short term (i.e. over the quarter following the outbreak of the pandemic) by a range between 5 percent for the least unskilled intensive country-product and 25 percent for the most unskilled intensive country-product.[14] To match the observed decline in food

[14] Each country-product is assigned to a quintile in the overall distribution of unskilled labor value added over total value added. Decreases in export supply are assumed to be respectively 25, 20, 15, 10 and 5 for quintiles q5 (top 20 percent of the distribution), q4, q3, q2 and q1 (bottom 20 percent of the distribution). An important caveat to this analysis is that it does not explicitly consider other characteristics that vary by country-product, such as the seasonality in agricultural production. The sensitivity analysis in the next section partially accounts for this concern by allowing for smaller and larger initial shocks.

exports for China, we also assume an additional 5 percent decrease in supply across the board to account for factors such as the negative impact of Covid-19 in trade logistics and border management. Given the substantial uncertainty surrounding the current health crisis, the next section analyzes additional scenarios where the initial shock associated to Covid-19 is smaller and larger than for China.

Under this set of assumptions, results on the initial decrease in global export supply due to Covid-19 are presented in Table 3. Covid-19 is estimated to lower the world's export supply of food by 12.7 percent, on average. The negative impact ranges between 2.4 percent for cocoa beans to 23.6 percent for rice. Many important staple foods, including most cereals such as barley, oats, rye and wheat and meslin and other products such as eggs, poultry, swine meat and potatoes are estimated to have sizeable drops in export supply of over 15 percent. These estimated effects should be considered as initial impacts, as the longer-term effects of Covid-19 on the export supply of food will largely depend on how long it will take the health crisis to be contained -something that it is difficult to predict at this stage. With this caveat in mind, we next study the impact of changes in export supply on food prices under different trade policy scenarios.

To calculate the impact of an initial shock in export supply on international prices, the percentage change in the export supply of each food product-country is divided by the import elasticity of that product.[15] Elasticities at the HS 4-digit product level are estimated for a panel covering 152 importing countries by Fontagné, Guimbar and Orefice (2019) and are assumed to be constant.[16] Price changes for individual country-products will depend on the concentration of their imports from the top-50 countries most affected by Covid-19 and on the demand elasticities. Aggregate results on the impact on prices of an initial decrease in export supply due to Covid-19 are presented in Table 3 (column 4). On average, food prices rise by 4.0 percent. Increases in prices for different food categories range between 1.2 for stimulant and oil-bearing crops to 15.1 for fish. Within food categories, cereals such as oats and wheat and meslin experience increase in prices of 11.4 percent and 7.5 percent. Prices of other key staples such as fish fillets and other fish meat, vegetables, potatoes and poultry increase respectively by 33.8, 9.0, 5.9 and 5.1 percent.

In a second scenario, we assume that exporters may use trade policy to respond to this initial shock in an attempt to mitigate domestic food prices as global prices rise as described in Section 2. Specifically, to illustrate a propagation mechanism, we assume that food exporters restrict their export supply by an amount that is equivalent to the total decreases in imports from countries where supply was disrupted by Covid-19. Results illustrating the impact of export restrictions on world supply and prices are presented in columns 2 and 5 of Table 3 respectively. Average export supply decreases roughly 50 percent compared to the initial shock. Price increases are highest for key staples such as fish fillets and other fish meat (59.9 percent), oats (18.3 percent), vegetables (16.1 percent) and wheat and meslin (15.8 percent).

Last, a third scenario is considered where exporting countries impose further restrictions in retaliation to the actions taken by their trade partners. As described in Section 2, as food prices increase due to the first set of restrictions, exporters could further use trade policy to insulate domestic markets from the policies imposed by others -the multiplier effect. In this third scenario, global export supply decreases by 40.1 percent on average across all food products. Global food prices increase by 12.9 percent on average as a result of retaliation. Within cereals, oats experience the highest price increase equivalent to 31.1

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[15] The formula used to compute the changes in prices is: $Direct\ Price\ effect_{ik} = {}^{\Delta Quantity_i}/_{Elasticity_k}$, where i is the importer and k is the product.

[16] The next section provides a sensitivity analysis based on estimates of import demand elasticities from Kee and Nicita (2020).

percent, followed by wheat and meslin (25.1 percent), rye (18.0 percent) and barely (16.5 percent). Significant price increases are also experienced by other key staples such as fish meat (106.2 percent), vegetables (28.5 percent), potatoes (18.5 percent) and poultry (13.1 percent). These results suggest that even if the impact of a supply shock due to Covid-19 on prices of food products is relatively contained, the potential escalation in prices as a result of the multiplier effect of (uncooperative) trade policy can be significant. Indeed, the multiplier effect of trade policy leads to a shock to the export supply and the price of food more than three times higher than the initial Covid-19 shock.

Table 3: Food export supply and price effects of Covid-19 under different trade policy scenarios (percentage change)

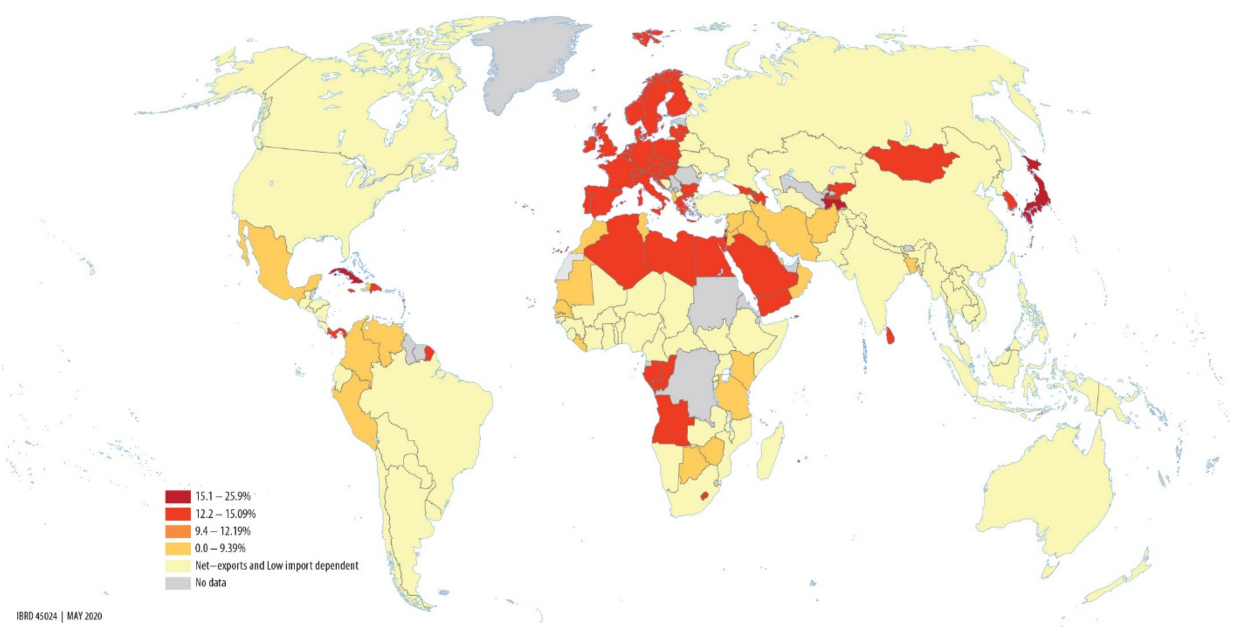
	Export supply			Price effect		
	i. Covid-19 shock	ii. Export restrictions	iii. Retaliation	i. Covid-19 shock	ii. Export restrictions	iii. Retaliation
	(1)	(2)	(3)	(4)	(5)	(6)
Cereals	**17.0**	**33.6**	**55.0**	**4.9**	**9.9**	**16.1**
Barley	16.9	30.6	51.8	5.4	9.7	16.5
Buckwheat	9.0	21.1	37.8	2.6	6.2	11.0
Flours and meals	17.2	26.9	46.5	3.9	6.1	10.5
Grain sorghum	9.1	11.1	20.9	2.3	2.8	5.2
Maize (corn)	9.0	21.1	37.7	2.5	5.9	10.6
Oats	18.9	30.2	51.3	11.4	18.3	31.1
Rice	23.6	39.8	63.8	3.6	6.1	9.8
Rye	21.6	40.1	64.1	6.1	11.3	18.0
Wheat and meslin	19.6	41.4	65.6	7.5	15.8	25.1
Dairy and eggs	**10.6**	**21.5**	**38.0**	**2.2**	**4.4**	**7.8**
Butter and other fats	4.7	12.1	22.7	1.5	3.9	7.4
Cheese and curd	11.5	23.7	41.8	2.1	4.3	7.6
Eggs	19.3	33.4	55.7	5.1	8.8	14.6
Milk and cream	10.1	19.4	35.1	1.2	2.4	4.3
Fish	**10.3**	**19.0**	**34.2**	**15.1**	**27.0**	**47.9**
Crustaceans	7.8	15.0	27.8	1.4	2.7	5.0
Fish filets & other fish meat	12.8	22.8	40.3	33.8	59.9	106.2
Fish, dried, salted, smoked, etc	13.7	24.7	43.4	1.2	2.2	3.8
Fresh Fruits – Vegetables	**11.6**	**17.1**	**31.2**	**1.7**	**2.4**	**4.5**
Bananas, excluding plantains	10.5	21.1	37.8	0.8	1.6	3.0
Citrus fruit, fresh or dried	11.8	16.2	29.8	1.9	2.6	4.8
Legumes and pulses	**12.7**	**23.2**	**40.8**	**7.8**	**14.2**	**24.9**
Leguminous vegetables	2.8	9.2	17.6	0.7	2.3	4.5
Potatoes; fresh or chilled	16.4	30.5	51.7	5.9	10.9	18.5
Vegetables, leguminous	13.0	23.2	41.0	9.0	16.1	28.5
Meat	**15.1**	**25.6**	**44.5**	**2.7**	**4.5**	**7.9**
Poultry	16.2	23.4	41.4	5.1	7.4	13.1
Bovine animals	13.9	23.7	41.8	1.7	2.9	5.1
Sheep or goats	9.8	21.8	38.8	3.1	6.9	12.3
Swine	16.9	30.6	51.8	1.1	2.1	3.5
Nuts and derived products	**9.5**	**16.7**	**30.2**	**3.0**	**5.0**	**9.0**
Nuts	13.6	22.5	40.0	4.6	7.7	13.7
Nuts, edible	3.4	8.1	15.6	0.5	1.1	2.1
Oil-bearing crops	**9.8**	**21.3**	**38.0**	**1.2**	**2.6**	**4.6**
Groundnut	7.2	15.4	28.4	1.2	2.5	4.5
Soya beans broken	13.5	24.8	43.5	1.9	3.4	6.0
Sunflower, safflower or cotton	6.3	19.2	34.7	0.5	1.7	3.0
Stimulant crops	**6.9**	**15.2**	**27.8**	**1.2**	**2.7**	**4.9**
Cocoa beans	2.4	7.8	15.1	0.2	0.6	1.2
Coffee	8.4	17.7	32.3	1.6	3.4	6.2
Sugar	**9.5**	**19.8**	**35.8**	**2.5**	**5.3**	**9.6**
Cane or beet sugar	9.5	19.8	35.8	2.5	5.3	9.6
Vegetable and animal oils	**14.4**	**24.3**	**42.3**	**1.8**	**3.0**	**5.2**

Coconut, palm or babassu oil	16.2	26.2	45.5	1.2	2.0	3.5
Fats and oils	9.9	17.3	31.6	5.2	9.0	16.5
Groundnut oil	6.2	14.1	26.3	0.9	2.0	3.8
Olive oil and its fractions	8.0	19.5	35.3	0.6	1.4	2.5
Other oil seeds	11.8	15.6	28.8	1.7	2.3	4.2
Palm oil and its fractions	17.5	29.4	50.2	2.1	3.6	6.1
Rape, colza or mustard oil	13.1	26.5	45.9	1.8	3.6	6.2
Soya-bean oil	7.5	11.8	22.2	0.7	1.1	2.0
Food	**12.7**	**23.1**	**40.1**	**4.0**	**7.4**	**12.9**

Note: The formula used to compute the changes in prices is: $Direct\ Price\ effect_{ik} = {}^{\Delta Quantity_i}/_{Elasticity_k}$. Where i is the importer and k is the product. Elasticities at the HS4 digit product level are from Fontagné, Guimbar and Orefice (2019) and are assumed to be constant. For each product-group and for the category food, results are aggregated using weighted averages with weights equal to the share of imports of a product over all food imports.

The direct price effect of export restrictions can be particularly costly for many poor countries that are import food dependent (Figure 5). Specifically, roughly half of the top-50 countries experiencing the highest price increases are import food dependent, of which 17 (around 74 percent) are developing countries and 3 are least developed countries. A majority of import food dependent countries in the Middle East and North Africa, and to a lesser extent in Sub-Saharan Africa and Latin America and the Caribbean, experience food price increases of 12 percent or more. The most affected import food dependent developing countries include Tajikistan, Azerbaijan, Egypt, Yemen and Cuba, which would experience increases in food prices of respectively 25.9, 17.5, 16.4 16 and 15 percent on average. The direct price effect across product categories for the 50 countries with the highest increases is presented in Appendix Table 7. Variations across countries reflect their vulnerability in terms of concentration from the top-50 most affected Covid-19 countries or from countries imposing export restrictions. For instance, when we focus on cereals, import food dependent developing countries such as Nigeria, Uzbekistan, Armenia and Georgia would experience price increases for this food category between 24.9 and 35.7 percent.

Figure 5: Trade-weighted increases in food prices for import food dependent countries, retaliation scenario



Note: The formula used to compute the changes in prices is: $Direct\ Price\ effect_{ik} = {}^{\Delta Quantity_i}/_{Elasticity_k}$. Where *i* is the importer and k is the product. Direct price effects are calculated at the country-product level using HS4 digit product elasticities from Fontagné, Guimbar and

Orefice (2019) and are assumed to be constant. For each country, results are aggregated using weighted averages with weights equal to the share of imports of a certain product over total food imports.

6. Sensitivity

In this section, we perform two sensitivity analyses. First, we use a different set of import demand elasticities from Kee and Nicita (2020) to assess the impact of changes in export supply on food prices. Second, we consider different scenarios of the initial shock that Covid-19 and containment policies could have on food export supply. For those scenarios, in turn, we recalculate the impact on world food prices with no trade policy intervention and with uncooperative trade policies.

Estimates of trade elasticities tend to vary across different studies due to different methodological approaches. Hence, as a first sensitivity test, we calculate the impact of the export supply shocks on world food prices with the elasticity estimates from Kee and Nicita (2020) and compare the findings at the aggregate level and at the food category level with the results based on the elasticities from Fontagné et al. (2019). The Kee and Nicita (2020) elasticities are estimated for a group of 40 countries, which makes it less suitable for the purpose of this exercise. But differently from the Fontagné et al. (2019), which are estimated at the product level, the Kee and Nicita (2020) elasticities are estimated at the bilateral-product level.

The results for the baseline scenario in Section 5 are reported in Table 4. Under this different set of elasticities, the impacts of the Covid-19 shock and of escalating export restrictions on food prices are significantly larger compared with the findings in Section 5. In particular, the average effect on food prices of escalating export restrictions is 39.1 percent with the Kee and Nicita (2020) import demand elasticities compared to 12.9 percent based on Fontagné et al. (2019). At the food category level, the results can be quite different. For fresh fruits and vegetables, the finding that escalating restrictions would lead to limited price increases is reversed and the estimated price increase is up to 71.0 percent (as opposed to 4.5 percent with the elasticities from Fontagné et al. (2019)). In addition to the different sample of countries and methodology used in the estimation, this finding is telling of the possible underlying economic mechanism. The Kee and Nicita (2020) elasticities capture that it could be difficult in the short term to substitute away from certain sources of imports when producers are hit by a shock, thus leading to larger price increases. This effect may be larger for certain food products, for instance as they are perishable as in the case of fresh fruits and vegetables.[17]

Table 4: Price effects of Covid-19 under different trade policy scenarios using different import elasticities (percentage change)

	Price effect using product level elasticities from fontgane et al (2019)			Price effect using product level elasticities from Kee and Nicita (2020)		
	i. Covid-19 shock	ii. Export restrictions	iii. Retaliation	i. Covid-19 shock	ii. Export restrictions	iii. Retaliation
Cereals	4.9	9.9	16.1	12.1	25.9	44.4
Dairy and eggs	2.2	4.4	7.8	2.5	4.8	8.4

[17] This insight is similar to the finding in Kee (2020) that the supply shock in China leads to larger price effects for products that are inputs into global value chains, as they are likely to have less elastic import demands.

Fish	15.1	27.0	47.9	16.2	29.0	51.6
Fresh Fruits - Vegetables	1.7	2.4	4.5	27.8	38.7	71.0
Legumes and pulses	7.8	14.2	24.9	2.6	5.1	8.9
Meat	2.7	4.5	7.9	16.9	29.5	50.6
Nuts and derived products	3.0	5.0	9.0	6.7	11.3	20.1
Oil-bearing	1.2	2.6	4.6	5.5	11.1	19.8
Stimulant crops	1.2	2.7	4.9	0.7	1.6	3.0
Sugar	2.5	5.3	9.6	2.6	5.4	9.7
Vegetable and animal oils	1.8	3.0	5.2	11.5	18.6	34.4
Food	4.0	7.4	12.9	12.9	22.0	39.1

Note: The formula used to compute the changes in prices is: $Direct\ Price\ effect_{ik} = {}^{\Delta Quantity_i}/_{Elasticity_k}$. Where i is the importer and k is the product. Direct price effects are calculated at the country-product level using HS4 digit product elasticities from Fontagné, Guimbar and Orefice (2019) and Kee and Nicita (2020) and are assumed to be constant. For each product-group, results are aggregated using the share of country-products imports of global imports as weights.

The initial shock of Covid-19 and containment policies on the food export supply in the previous section has been informed by the early data for Chinese exports in 2020 (Section 3). These data indicate a decline in food exports in January and February 2020 year on year of 17 percent. While this is a logical first scenario, there is significant uncertainty on the size of the Covid-19 shock. On the one hand, there are reasons to believe that the shock could be larger for other countries as the health crisis now affects a large fraction of the world economy simultaneously. First, the more global nature of the shock could imply that supply effects through food value chains could be larger, for instance as key imported inputs could be delayed or foreign seasonal workers could be denied entry. Second, the global nature of the shock could also drive a larger number of firms into financial problems or bankruptcy. Both may lead to larger effects on food supply (upward scenario). On the other hand, a downward scenario where the initial shock could be smaller than the baseline is also possible. This could be the case if the disruptions in production across countries are staggered over time, thus mitigating the effect on the global export supply. As a second sensitivity test, we therefore consider upward and downward scenarios where we assume that the initial supply shock across all products is respectively 10 percent higher and 10 percent lower, compared to the baseline.[18]

The results for this sensitivity exercise are reported in Table 5. We present the initial shock to the global export supply of food due to Covid-19 and the impact on export supply as governments impose restrictions (columns 1 to 3). The overall decrease in food export supply in the short term (i.e. over the quarter following the outbreak of the pandemic) ranges between 5.7 and 19.7 percent in the downward and upward scenarios respectively. Under escalating trade restrictions, the world food export supply would decline by 21 percent (downward scenario) and 55.4 percent (upward scenario). On a yearly basis, the total decrease in the global export supply of food ranges between 5.2 percent (downward scenario) and 13.8 percent (upward scenario).[19] These results suggest that the potential decrease in food export supply due to Covid-19 and uncooperative trade policy actions could be similar in magnitude to the 11 percent drop experienced during the 2008-2009 food crisis.

Columns 4 to 6 show the corresponding effects on world food prices. In the downward scenario, food prices would increase less than 2 percent as a result of Covid-19. Uncooperative trade policy could still increase prices by up to 6.6 percent. A larger initial Covid-19 shock on export supply would lead to higher

[18] Specifically, for the upward and downward scenarios, we shift the distribution of the shock to different products up or down by 10 percent, respectively.

[19] Under the assumption that the Covid-19 shock is temporary (i.e. the world export supply of food contracts only during 3 months after the pandemic takes place and then goes back to normal) and that trade flows are proportional across quarters, export supply under uncooperative trade policies would decrease by 5.25 (21/4) percent in the downward scenario and by 13.8 (55.4/4) percent in the upward scenario on a yearly basis.

initial food price surges -up to 6.3 percent on average. Under escalating export restrictions, the ultimate impact on world food prices would be 17.9 percent on average. While results are sensitive to the size of the initial shock, in all cases uncooperative trade policy makes the impact on export supplies and food prices around three times higher than what would happen under no trade policy change.

Table 4: Food export supply and price effects of Covid-19 under different trade policy scenarios and different initial shocks (percentage change)

	Supply shock			Price effect using product level elasticities from Fontagne et al (2019)		
	i. Covid-19 shock	ii. Export restriction	iii. Retaliation	i. Covid-19 shock	ii. Export restriction	iii. Retaliation
Downward scenario (supply shock 10 lower)	5.7	11.5	21.0	1.8	3.6	6.6
Baseline	12.7	23.1	40.1	4.0	7.4	12.9
Upward scenario (supply shock 10 higher)	19.7	33.9	55.4	6.3	10.9	17.9

Note: The formula used to compute the changes in prices is: $Direct\ Price\ effect_{ik} = {\Delta Quantity_i}/{Elasticity_k}$. Where i is the importer and k is the product. Direct price effects are calculated at the country-product level using HS4 digit product elasticities from Fontagné, Guimbar and Orefice (2019) and are assumed to be constant. For each scenario, results are aggregated using the share of country-products imports over global imports of food. Supply shocks are calculated comparing pre and post shock global imports.

7. Conclusions

This paper takes a first look at how Covid-19 might affect global food markets. We provide a quantification of the initial impact of the spreading of the virus and government containment policies on food export supply based on the assumption that sectors that require more labor would be more affected. We show that escalating export restrictions would multiply by a factor of 3 the decline in export supplies and surge in global food prices caused by the initial shock. Import food dependent countries, which are to a large extent developing and least developed countries, are expected to be most at risk of these developments in food markets.

Governments can limit these negative outcomes. Restrictions to exports are inherently beggar-thy-neighbor policies: as a result of these measures, the domestic supply of food increases in the short term by an amount equal to the reduction in global export supply. This is the reason why export restrictions induce retaliation rather than cooperation. A first-best approach to address the challenges that Covid-19 presents to food security would consist in actions aimed at minimizing the disruption to food supply, such as ensuring that workers in food sectors can continue producing under good and secure health conditions, removing bottlenecks that impair food supply chains, and ensuring that trade in key inputs in food production can smoothly flow across borders. This approach, by increasing the domestic supply of food, would reduce global supply shortages and mitigate price surges, thus having a positive spillover effect on other countries.

This is admittedly a first attempt at quantifying the implications of the current crisis on food markets. There are several avenues for future research. First, the analysis on the sectoral impact of Covid-19 could be enriched to take into account other factors that differ across food products, such as differences in time sensitivity or in the production cycle of different crops. Similarly, the impact of supply shocks on prices would be mitigated by factors that vary by sector, such as the availability of buffer stocks. Second, our analysis is based on a partial equilibrium model that does not consider the fact that demand for food would be affected by the crisis. While, as noted by Baldwin (2020), governments' stimulus packages are directly (and correctly) aimed at avoiding that demand falls too much and consumers' hording may move demand for food up, future work could use general equilibrium models to quantify this channel. Finally, we abstracted in this paper from changes in import policy. Tariffs and other barriers to imports are high on food products and governments may lower them as food prices rise. While reduction in trade barriers is generally efficient, short-term policy changes such as tariff suspensions may contribute to price escalation by shifting out demand in the short term without bringing the longer-term benefits of more open food markets (Martin and Anderson, 2012).

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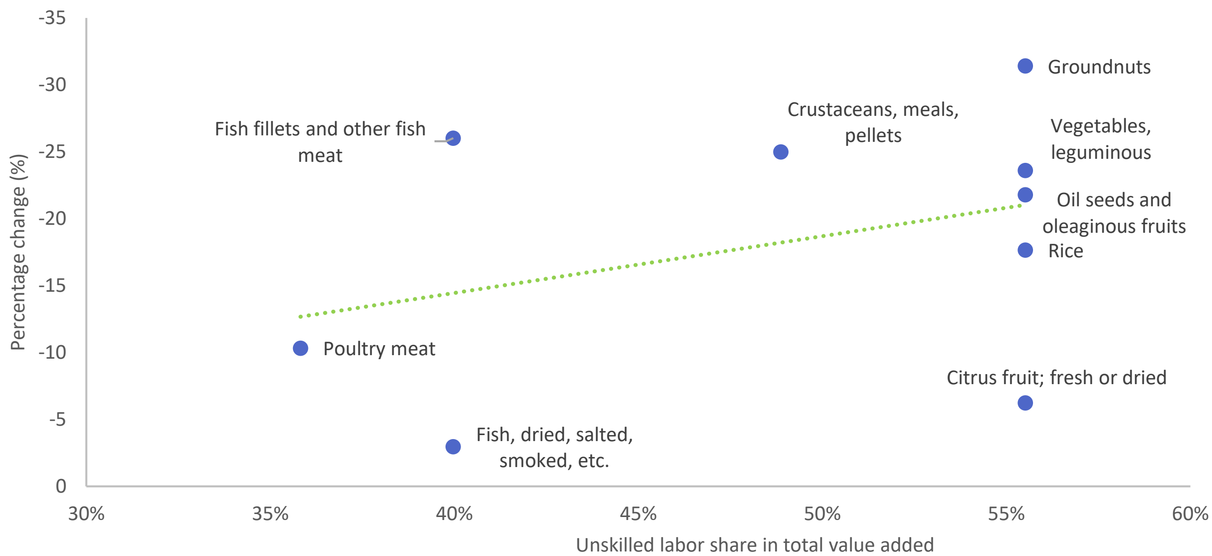
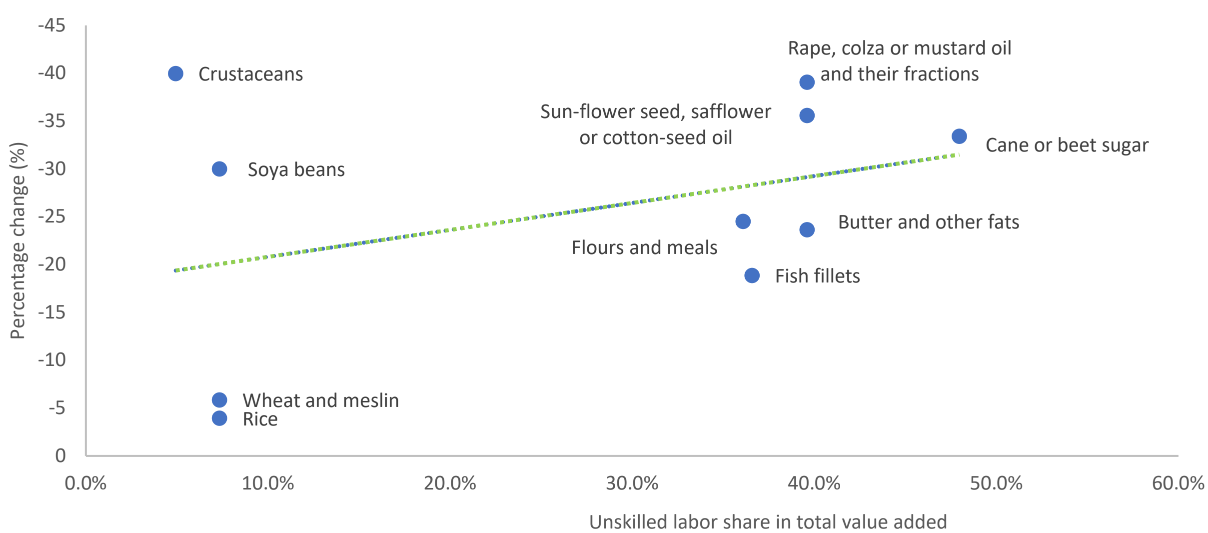
Appendix

Appendix Figure 1: China's unskilled labor share in total value-added vs variation in top food exports, Jan and Feb 2020 year on year



Source: China Customs and Aguiar et al (2019) - The GTAP Data Base: Version 10.

Appendix Figure 2: United States unskilled labor share in total value-added vs variation in top food exports, Mar 2020 year on year



Source: United States Census and Aguiar et al (2019) - The GTAP Data Base: Version 10.

Appendix Table 1: Share of world exports of top-50 countries most affected by Covid-19, by product

	Cereals									Dairy and eggs				Fresh Fruits - Vegetables		Oil-bearing crops			Nuts and derived products		Sugar
	Barley	**Buckwheat**	**Flour**	**Grain sorghum**	**Maize (corn)**	**Oats**	**Rice**	**Rye**	**Wheat and meslin**	**Butter and other fats**	**Cheese and curd**	**Eggs**	**Milk and cream**	**Bananas, excluding plantains**	**Citrus fruit, fresh or dried**	**Groundnut**	**Soya beans**	**Sunflower, safflower or cotton-seed oil**	**Nuts**	**Coconuts, Brazil nuts and cashew**	**Cane or beet sugar**
European Union	22.3	3.3	3.0	0.2	3.0	6.1	1.1	27.7	13.7	22.3	39.6	26.1	33.4	0.1	0.1	0.4	5.7	5.3	2.1	0.5	4.3
United States	0.6	12.6	75.9	77.1	40.0	1.9	7.6	5.0	16.9	2.7	12.9	18.4	2.5	0.0	35.6	17.4	10.7	1.4	54.1	0.2	0.3
China	0.0	6.4	4.3	0.1	0.0	0.1	3.4	0.0	0.0	0.2	0.0	5.7	0.8	0.1	0.2	14.8	6.3	0.1	3.4	0.1	0.4
Iran, Islamic Rep.	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.1	1.7	0.5	6.3	0.0	0.0	0.0	0.2	0.1	6.2	0.0	0.1
Switzerland	2.3	0.1	0.0	0.0	2.5	0.0	0.1	0.0	0.3	0.2	5.7	0.0	0.4	0.0	0.9	0.0	0.0	1.6	0.0	0.0	0.4
Korea, Rep.	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.7
Turkey	0.1	0.2	0.1	0.0	0.3	0.0	0.2	0.0	0.1	0.3	1.4	18.8	1.0	1.2	0.1	0.1	10.2	5.0	9.1	0.0	0.1
Canada	10.7	15.8	1.2	0.0	1.3	64.5	0.0	38.3	16.8	0.2	0.5	2.9	0.3	0.0	3.4	0.0	0.0	0.0	0.1	0.0	0.1
Australia	29.6	0.3	0.5	7.6	0.1	20.4	0.5	0.1	11.7	2.1	6.3	0.5	6.7	0.0	0.0	0.2	4.3	0.1	4.3	0.0	6.8
Israel	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.1		0.0	0.0	0.0	0.9	2.4	0.0	0.0	0.0	0.0
Norway	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brazil	0.0	0.2	0.6	0.1	13.9	0.2	1.7	0.0	0.4	0.0	0.1	3.2	0.5	0.2	48.1	7.8	1.3	0.1	0.1	1.7	42.0
Malaysia	0.0	0.0	1.5	0.0	0.0	0.0	0.1		0.0	0.6	0.0	6.1	0.2	0.1	0.0	0.3	0.1	0.9	0.1	0.3	0.2
Chile	0.0	0.1	0.0	0.0	0.5	3.1	0.0	0.2	0.0	0.3	0.3	0.0	0.1	0.0	0.0	0.0	5.0	0.0	3.8	0.0	0.0
Ecuador	0.0	1.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0		0.0	30.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Japan	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.7	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Russian Federation	14.2	5.2	0.6	0.3	2.7	1.0	0.3	20.5	21.4	0.2	0.6	1.7	0.9	0.4	0.4	0.1	0.1	19.1	0.3	0.0	1.2
Pakistan	0.0	0.1	0.0	0.0	0.0	0.0	8.8	0.1	0.9	0.0	0.0	0.5	0.9	0.2	0.0	0.0	2.4	0.0	0.3	0.0	1.8
Thailand	0.0	0.2	0.1	0.1	0.5	0.0	24.1	0.1	0.0	0.0	0.0	1.5	2.5	0.3	0.0	0.1	0.2	0.0	0.2	2.1	12.2
Saudi Arabia	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.6	1.8	0.5	5.9	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.5
South Africa	0.0	0.8	1.5	0.5	1.8	0.3	0.2	1.4	0.2	0.2	0.3	0.5	1.6	0.1	0.0	0.5	19.5	0.8	2.1	0.0	1.6
Indonesia	0.0	0.1	0.0		0.1		0.0		0.0	0.1	0.0	0.1	0.2	0.1	0.0	0.1	0.0	0.0	1.2	5.7	0.0
Philippines	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	14.9	0.0	0.0	0.0	0.0	0.0	3.7	0.5

Appendix Table 1 (continued): Share of world exports of top-50 countries most affected by Covid-19, by product

	Meat				Fish			Vegetable and animal oils								Legumes and pulses			Stimulant crops	
	Poultry	Bovine animals	Sheep or goats	Swine	Crustaceans.	Fish fillets	Fish	Coconut, palm kernel	Fats and oils	Ground-nut oil	Olive oil and its fractions	Other oil seeds	Palm oil and its fractions	Rape, colza or mustard	Soya-bean oil	Leguminous vegetables	Potatoes	Vegetables	Cocoa beans	Coffee
European Union	10.5	3.9	2.6	39.0	2.4	3.9	12.1	0.5	14.1	2.2	4.4	71.4	0.3	5.7	7.2	3.1	24.1	3.2	0.4	6.7
United States	22.2	24.4	0.1	26.3	4.3	7.6	2.1	0.5	10.2	4.2	5.0	0.4	0.1	2.1	9.9	5.6	10.1	8.4	0.0	2.6
China	3.1	0.0	0.5	1.2	4.4	19.8	11.3	0.0	3.3	6.6	9.5	0.0	0.1	0.5	2.0	2.2	6.0	4.9	0.0	1.1
Iran, Islamic Rep.	0.2	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	2.9	0.1	0.0	0.0	0.0	0.0	0.1	6.7	0.2	0.0	0.0
Switzerland	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.9	0.1	0.2	0.0	0.0	0.0	1.3	0.0	0.2	0.0	0.0	9.7
Korea, Rep.	0.1	0.0		0.0	0.3	1.6	0.5	0.0	0.3	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0
Turkey	3.3	0.0	0.0	0.0	0.0	1.5	1.1	0.0	1.6	0.0	2.2	4.5	0.0	0.1	0.7	0.2	1.3	2.7	0.1	0.0
Canada	1.1	12.1	0.0	16.1	13.0	1.6	4.2	0.1	1.7	0.0	4.6	0.0	0.0	66.3	1.5	0.7	11.2	25.7	0.0	1.9
Australia	0.2	19.9	45.8	0.6	1.7	0.1	0.1	0.1	3.3	0.2	2.4	0.3	0.0	3.0	0.0	0.6	1.3	16.7	0.0	0.1
Israel	0.1		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.0	0.0	0.0	0.0	4.5	0.0	0.0	0.0
Norway	0.0	0.0	0.0	0.1	0.7	13.1	28.9	0.0	10.3	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Brazil	42.8	6.7	0.0	9.0	0.4	0.1	2.6	0.0	0.1	19.2	0.5	0.0	0.1	0.0	12.6	0.0	0.1	0.8	0.0	20.1
Malaysia	0.1	0.0	0.0	0.0	0.9	0.2	0.4	17.3	0.2	0.6	0.0	0.0	31.8	1.8	1.5	0.9	0.3	0.1	1.4	0.4
Chile	2.1	0.1	0.6	2.7	0.4	17.0	2.0	0.0	6.5	0.0	0.8	1.6	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Ecuador		0.0			8.0	0.5	0.2	0.4	1.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.1	8.2	0.1
Japan	0.1	0.7	0.0	0.1	0.3	1.1	0.6	0.0	2.4	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Russian Federation	1.0	0.0	0.2	0.4	6.7	3.5	3.7	0.0	0.0	0.0	1.9	0.0	0.1	7.7	5.4	0.0	1.9	3.9	0.0	0.1
Pakistan	0.0	1.4	0.3	0.0	0.5	0.1	0.5	0.0	0.0	0.0	3.4	0.0	0.0	0.0	0.0	0.2	5.6	0.1	0.0	0.0
Thailand	4.1	0.0	0.0	0.1	3.9	0.8	3.2	2.5	1.0	0.0	0.9	0.0	0.9	0.0	0.7	0.5	0.0	0.4	0.0	0.0
Saudi Arabia	0.8	0.0	0.0		0.2	0.0	0.0	0.0		2.1	0.0	0.0	0.0	0.0	0.5	0.2	0.0	0.0	0.0	0.0
South Africa	0.4	0.5	0.1	0.1	0.3	0.7	0.3	0.0	0.6	0.2	0.0	0.1	0.1	0.0	1.1	0.1	2.4	0.2	0.0	0.1
Indonesia	0.0	0.0	0.0	0.0	6.4	2.6	2.6	46.6	0.1	0.1	0.7	0.0	55.9	0.0	0.4	0.5	0.2	0.2	1.4	4.6
Philippines	0.0	0.0	0.0	0.0	0.5	0.6	0.4	21.2	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0

Source: Espitia, Rocha, Ruta (2020). “Database on COVID-19 trade flows and policies”.
Note: Data for the 28 members of the European Union are aggregated and exclude intra-EU trade.

Appendix Table 2: Developing countries' concentration of imports from top-3 Covid-19 most affected countries, by product and level of food dependence

	Low food dependence	Medium food dependence	High food dependence
Cereals	**69.4**	**71.0**	**77.5**
Barley	59.8	84.6	83.1
Buckwheat	63.8	76.4	67.7
Flours and meals	-	-	-
Grain sorghum	68.7	88.6	75.7
Maize (corn)	39.2	74.7	59.5
Oats	96.6	83.2	90.3
Rice	52.0	41.8	64.1
Rye	96.4		99.3
Wheat and meslin	78.5	47.7	80.3
Dairy and eggs	**59.7**	**63.2**	**72.0**
Butter and other fats	40.9	35.8	47.4
Cheese and curd			
Eggs	71.2	71.2	86.3
Milk and cream	67.1	82.7	82.4
Fish	**56.1**	**64.0**	**57.7**
Crustaceans	67.9	68.2	51.9
Fish filets & other fish meat	50.8	48.3	49.9
Fish, dried, salted, smoked, etc	49.7	75.6	71.1
Fresh Fruits – Vegetables	**72.2**	**77.1**	**74.8**
Bananas, excluding plantains	49.1	63.7	77.5
Citrus fruit, fresh or dried	95.3	90.5	72.1
Legumes and pulses	**67.2**	**78.9**	**44.0**
Leguminous vegetables	68.2	91.4	0.2
Potatoes; fresh or chilled	74.6	86.7	80.1
Vegetables, leguminous	58.7	58.4	51.6
Meat	**70.0**	**74.3**	**78.0**
Poultry	63.6	62.8	65.8
Bovine animals	74.3	82.7	79.2
Sheep or goats	58.4	70.8	80.2
Swine	83.7	81.1	86.6
Nuts and derived products	**75.8**	**68.9**	**89.6**
Nuts	75.8	68.9	89.6
Nuts, edible	-	-	-
Oil-bearing crops	**49.6**	**55.8**	**58.5**
Groundnut	43.7	31.2	42.1
Soya beans broken	60.5	60.8	71.0
Sunflower, safflower or cotton	44.7	75.5	62.4
Stimulant crops	**24.1**	**42.8**	**54.1**
Cocoa beans	0.1	44.4	42.4
Coffee	48.1	41.2	65.7
Sugar	**48.8**		**37.1**
Cane or beet sugar	48.8		37.1
Vegetable and animal oils	**78.5**	**71.5**	**75.3**
Coconut, palm or babassu oil	99.4	95.2	82.4
Fats and oils and their fractions	65.8	85.4	74.7
Groundnut oil and its fractions	63.4	74.4	95.5
Olive oil and its fractions			43.5
Other oil seeds	95.0	86.7	77.9
Palm oil and its fractions	74.6	72.3	84.0
Rape, colza or mustard oil	66.4	33.9	79.2
Soya-bean oil and its fractions	84.7	52.6	65.2

Source: Espitia, Rocha, Ruta (2020). "Database on COVID-19 trade flows and policies".

Note: The concentration of imports is calculated as the average by product , across all import food dependent countries of that product, of the sum of the import shares from top-3 exporters that are most affected by Covid-19. $Imp\ concentration_i = 100 * (\sum_{n=1}^{N} \sum_{k=1}^{K=3} imp_{ijn}/Tot\ imp_{in})/N$, where i, j, k, and n are respectively importer, exporter, exporter rank and product. For definition of import food dependence see footnote 11. Low, medium and high import food dependence corresponds to shares of import food dependence between 0 and 20, 20 and 50 and bigger than 50 respectively.

Appendix Table 3: Top-10 food import dependent advanced countries - concentration of imports from most affected Covid-19 countries

	Canada	Hong Kong SAR, China	Israel	Japan	Korea, Rep.	New Zealand	Norway	Panama	Switzerland	United States
Cereals	**83.5**	**79.9**	**48.7**	**87.1**	**86.3**	**78.5**	**76.6**	**84.4**	**84.1**	**65.0**
Barley	99.8	92.0	74.0	84.0	98.9	99.5	99.8	100.0	98.8	95.5
Buckwheat	22.4	46.1	7.7	81.8	95.8	30.0	65.6	50.0	49.9	11.3
Grain sorghum	93.7	69.3	17.8	51.2	100.0	98.4	43.8	77.5	85.6	2.2
Maize (corn)	96.8	80.7	77.2	97.5	69.0	96.9	56.1	99.3	85.9	47.6
Oats	99.1	84.5	17.0	92.9	94.1	50.4	90.3	94.8	95.4	99.9
Rice	72.2	69.2	64.4	93.5	71.9	59.6	63.8	68.9	71.8	64.0
Rye	100.0	99.9	54.4	98.0	98.2	100.0	100.0		90.8	99.9
Wheat and meslin	83.7	97.7	77.5	98.2	62.1	93.4	93.7	100.0	95.0	99.1
Dairy and eggs	**84.5**	**58.3**	**90.3**	**72.9**	**73.3**	**85.1**	**98.2**	**47.8**	**98.5**	**69.1**
Butter and other fats	53.8	37.6	87.8	39.5	53.3	59.0	94.9	24.5	95.6	64.0
Eggs	99.9	78.8	94.4	80.6	76.8	97.8	99.8	99.1	100.0	95.3
Milk and cream	99.8	58.4	88.8	98.5	89.8	98.4	100.0	19.9	100.0	48.0
Fish	**69.5**	**35.6**	**70.6**	**43.5**	**50.9**	**56.0**	**74.8**	**63.5**	**62.7**	**52.0**
Crustaceans	46.4	39.7		17.5	43.5	37.5	49.1	42.1	19.1	34.3
Fish filets & other fish meat	73.1	48.9	71.6	55.8	30.6	39.8	78.5	49.8	70.7	53.5
Fish, dried, salted, smoked, etc.	88.9	18.0	69.6	57.2	78.6	90.6	96.6	98.6	98.3	68.2
Fresh Fruits - Vegetables	**48.9**	**98.1**	**55.1**	**96.0**	**89.9**	**92.3**	**66.7**	**51.3**	**23.0**	**19.2**
Bananas, excluding plantains	13.1	96.9	30.8	93.8	87.6	88.4	35.6	4.6	15.7	15.0
Citrus fruit, fresh or dried	84.7	99.2	79.4	98.3	92.3	96.2	97.8	97.9	30.3	23.4
Legumes and pulses	**75.5**	**64.2**	**71.1**	**86.0**	**63.0**	**86.5**	**81.8**	**75.5**	**70.5**	**75.2**
Leguminous vegetables	44.3	32.7	88.0		25.3	92.3	51.0	45.7	43.5	
Potatoes; fresh or chilled	99.9	87.2	100.0	99.9	99.5	89.2	98.0	97.5	86.6	99.9
Vegetables, leguminous	82.2	72.7	25.2	72.0	64.3	78.2	96.3	83.2	81.6	50.5
Meat	**69.5**	**71.9**	**72.3**	**85.0**	**61.7**	**77.5**	**57.9**	**62.2**	**55.2**	**65.2**
Poultry	49.6	77.7	49.9	96.3	44.2	93.4	49.7	97.1	48.8	98.9
Bovine animals	94.9	79.9	74.6	93.4	99.9	99.5	54.2	18.4	67.3	61.9
Sheep or goats	54.5	50.2	87.1	63.5	92.6	100.0	37.7	97.9	66.4	72.7
Swine	99.1	79.5	100.0	86.7	44.7	47.1	98.2	48.7	50.0	46.2
Nuts and derived products	**92.3**	**91.7**	**94.7**	**89.7**	**96.7**	**89.0**	**88.3**	**98.7**	**85.9**	**16.8**
Nuts	92.3	91.7	94.7	89.7	96.7	89.0	88.3	98.7	85.9	16.8
Oil-bearing	**78.6**	**46.8**	**54.5**	**81.0**	**79.9**	**63.5**	**81.6**	**53.3**	**59.0**	**36.0**
Groundnut	96.5	31.3	74.3	89.4	80.3	63.6	66.5	92.2	40.6	
Soya beans	47.6	75.1	25.9	82.6	95.4	99.5	84.4	44.1	92.7	30.7
Sunflower-seed, safflower or cottonseed	91.8	34.0	63.3	71.1	64.1	27.3	93.9	23.6	43.7	41.2
Stimulant crops	**27.5**	**81.1**	**59.4**	**19.7**	**14.5**	**23.9**	**51.6**	**39.9**	**33.2**	**18.3**
Cocoa beans	9.6	88.2	47.0	11.3	3.4		49.6	64.6	23.4	12.0
Coffee	45.5	74.1	71.7	28.1	25.6	23.9	53.6	15.3	43.0	24.6
Sugar	**62.9**	**86.8**	**97.0**	**95.8**	**97.4**	**26.4**	**99.4**	**28.5**	**75.5**	**11.1**
Cane or beet sugar	62.9	86.8	97.0	95.8	97.4	26.4	99.4	28.5	75.5	11.1
Vegetable and animal oils	**73.4**	**72.6**	**69.9**	**75.1**	**85.5**	**81.8**	**85.0**	**64.1**	**65.0**	**77.6**
Coconut, palm kernel or babassu oil	75.5	59.1	39.5	96.9	97.0	85.5	90.6	95.6	33.7	93.4
Fats and oils and their fractions	28.0	80.3	96.4	34.3	62.0	61.4	46.0	56.4	65.7	39.9
Ground-nut oil and its fractions	82.4	79.2	90.8	81.5	99.4	89.4	99.9	100.0	15.7	
Olive oil and its fractions	33.1	9.2	4.1	8.3	62.3	40.9	58.7	1.2	70.4	36.5
Other oil seeds	78.6	96.2	82.4	98.3	98.6	84.2	99.1	96.9	96.8	83.5
Palm oil and its fractions	95.3	94.7	54.8	99.7	99.5	98.9	98.1	45.5	60.0	95.2
Rape, colza or mustard oil	96.0	96.3	95.3	96.5	99.2	98.2	87.7	96.2	85.7	99.7

Soya-bean oil and its fractions	98.6	66.2	95.6	85.3	66.0	95.9	100.0	21.2	92.2	94.7

Source: Espitia, Rocha, Ruta (2020). "Database on COVID-19 trade flows and policies".

Note: The concentration of imports is calculated as the simple average by product of the sum of the import shares from top-3 exporters that are most affected by Covid-19. $Imp\ concentration_i = 100 * (\sum_{n=1}^{N} \sum_{k=1}^{K=3} imp_{ijn} / Tot\ imp_{in})/N$, where i, j, k, and n are respectively importer, exporter, exporter rank and product. Missing values refer to products that are not imported from top-50 most affected countries by Covid-19. Shaded cells represent country-products with medium and high levels of import food dependence.

Appendix Table 4: Top-10 food import dependent developing countries -concentration of imports from most affected Covid-19 countries

	Bosnia and Herzegovina	Botswana	Cameroon	Cuba	Jamaica	Mexico	Moldova	Mongolia	Namibia	Nigeria
Cereals	**92.5**	**99.0**	**86.8**	**81.1**	**95.0**	**96.2**	**98.3**	**94.1**	**79.3**	**91.2**
Barley	100.0	100.0	100.0	100.0	99.8	100.0	100.0	100.0	100.0	99.9
Buckwheat	85.8	99.9	97.3	100.0	80.6	91.6	97.2	91.6	14.9	99.9
Grain sorghum	83.5	96.6	77.6		100.0	99.9	100.0		92.6	100.0
Maize (corn)	95.7	96.8	50.6	24.9	100.0	100.0	99.6	99.8	92.7	87.0
Oats	100.0	100.0	100.0	100.0	100.0	99.9	100.0	98.9	100.0	99.8
Rice	75.3	98.5	86.7	61.7	85.0	78.3	89.3	68.8	61.6	66.2
Rye	100.0	100.0				100.0	100.0	100.0	97.6	100.0
Wheat and meslin	100.0	99.9	95.6	100.0	100.0	100.0	100.0	100.0	74.6	76.6
Dairy and eggs	**99.8**	**72.8**	**96.2**	**93.4**	**65.5**	**72.5**	**87.4**	**67.4**	**79.6**	**80.4**
Butter and other fats	99.8	99.5	99.8	82.8	22.8	21.4	70.4	22.2	98.9	44.3
Eggs	100.0	19.4	99.1	100.0	99.3	99.8	100.0	100.0	40.1	97.2
Milk and cream	99.7	99.5	89.8	97.3	74.4	96.3	91.9	79.9	100.0	99.8
Fish	**80.1**	**80.8**	**73.8**	**84.1**	**88.4**	**77.8**	**80.3**	**83.3**	**79.0**	**76.6**
Crustaceans	71.4	74.1	100.0	100.0	75.7		89.1	96.9	81.1	99.6
Fish filets & other fish meat	68.8	69.0	100.0	52.2	90.8	57.7	91.6	95.4	61.1	35.8
Fish, dried, salted, smoked, etc.	100.0	99.3	21.5	100.0	98.7	97.9	60.1	57.6	94.7	94.4
Fresh Fruits - Vegetables	**70.0**	**51.1**	**17.5**	**100.0**	**50.0**	**60.5**	**100.0**	**98.6**	**99.9**	**99.1**
Bananas, excluding plantains	39.9	99.4			0.1	23.6	100.0	97.5	99.7	98.3
Citrus fruit, fresh or dried	100.0	2.7	17.5	100.0	100.0	97.5	100.0	99.8	100.0	100.0
Legumes and pulses	**59.6**	**99.1**	**99.6**	**99.0**	**96.9**	**96.1**	**86.9**	**79.7**	**99.7**	**67.6**
Leguminous vegetables	56.0	99.9	100.0		100.0	88.5	100.0	74.7	100.0	94.3
Potatoes; fresh or chilled	78.6	100.0	100.0	100.0	98.0	100.0	62.3	98.5	100.0	80.7
Vegetables, leguminous	44.2	97.3	98.8	98.1	92.6	99.7	98.4	65.8	99.1	27.7
Meat	**65.6**	**76.2**	**79.9**	**65.9**	**65.3**	**69.6**	**79.2**	**66.6**	**62.7**	**97.9**
Poultry	46.6	99.3	49.8	48.4	50.0	100.0	97.0	49.9	40.9	91.7
Bovine animals	99.9	83.9	100.0	99.4	99.9	94.4	100.0	100.0	97.7	100.0
Sheep or goats	34.9	97.7	100.0	100.0	91.9	53.8	100.0	100.0	99.0	100.0
Swine	100.0	50.0	100.0	49.8	50.0	50.0	49.4	50.0	48.9	100.0
Nuts and derived products	**51.7**	**99.9**	**92.1**	**100.0**	**99.6**	**98.8**	**97.5**	**54.0**	**99.6**	**12.8**
Nuts	51.7	99.9	92.1	100.0	99.6	98.8	97.5	54.0	99.6	12.8
Oil-bearing	**75.4**	**99.5**	**97.1**	**85.6**	**69.4**	**65.6**	**85.4**	**66.9**	**99.3**	**94.8**
Groundnut	43.7	99.6	100.0	100.0	100.0	79.0	62.2	75.1	97.8	98.7
Soya beans	82.9	99.1	100.0	56.8	14.9	90.0	94.0	30.0	100.0	94.4
Sunflower-seed, safflower or cottonseed	99.7	99.9	91.3	100.0	93.3	27.8	100.0	95.5	100.0	91.4
Stimulant crops	**77.8**	**100.0**	**70.3**	**98.8**	**19.6**	**42.8**	**98.5**	**84.9**	**99.7**	**46.7**
Cocoa beans		100.0				61.7	100.0	100.0	100.0	
Coffee	77.8	100.0	70.3	98.8	19.6	24.0	97.0	69.7	99.3	46.7
Sugar		**82.4**	**93.6**	**100.0**		**57.1**	**39.4**		**79.2**	**99.9**
Cane or beet sugar		82.4	93.6	100.0		57.1	39.4		79.2	99.9
Vegetable and animal oils	**86.1**	**98.1**	**88.3**	**83.1**	**99.2**	**80.5**	**98.5**	**83.4**	**86.3**	**91.4**
Coconut, palm kernel or babassu oil	73.9	88.9	97.3	100.0	99.6		98.7	76.4	99.9	
Fats and oils and their fractions	77.1	100.0	100.0	100.0	100.0	70.8	100.0	96.8	99.9	90.0
Ground-nut oil and its fractions	100.0	100.0	100.0	100.0		57.8		100.0	89.8	100.0
Olive oil and its fractions	43.7	98.0	60.8	100.0	97.2	57.5	91.1	50.2	38.2	81.5
Other oil seeds	98.9	99.4	97.4	100.0	100.0	98.9	100.0	91.6	96.5	98.4
Palm oil and its fractions	95.7	100.0	99.5	63.4	98.6		100.0	98.5	65.9	81.7

Rape, colza or mustard oil	99.2	98.9	92.7	1.7	99.8	100.0	100.0	92.0	100.0	91.4
Soya-bean oil and its fractions	100.0	99.6	58.4	100.0	99.5	98.4	100.0	61.4	99.8	96.9

Source: Espitia, Rocha, Ruta (2020). "Database on COVID-19 trade flows and policies".

Note: The concentration of imports is calculated as the simple average by product of the sum of the import shares from top-3 exporters that are most affected by Covid-19. $Imp\ concentration_i = 100 * (\sum_{n=1}^{N} \sum_{k=1}^{K=3} imp_{ijn} / Tot\ imp_{in})/N$, where i, j, k, and n are respectively importer, exporter, exporter rank and product. Missing values refer to products that are not imported from top-50 most affected countries by Covid-19. Shaded cells represent country-products with medium and high levels of import food dependence.

Appendix Table 5: Top-10 food import dependent least developed countries -concentration of imports from most affected Covid-19 countries

	Afghanistan	**Angola**	**Benin**	**Central African Republic**	**Chad**	**Gambia, The**	**Guinea-Bissau**	**Lesotho**	**Sierra Leone**	**Togo**
Cereals	**78.7**	**86.7**	**70.6**	**59.2**	**90.9**	**70.7**	**92.6**	**99.5**	**75.4**	**81.5**
Barley	0.0	100.0				100.0	100.0	100.0	100.0	
Buckwheat	88.3	98.2	100.0	100.0			100.0	100.0	98.7	91.7
Grain sorghum	100.0	73.1			100.0			100.0	100.0	100.0
Maize (corn)	96.3	33.2	13.0	0.0	63.5	10.3	100.0	99.7	14.0	53.2
Oats		99.9				100.0		100.0		100.0
Rice	87.8	90.1	69.6	36.7	100.0	49.4	70.4	96.4	39.9	51.4
Rye	100.0	100.0						100.0		
Wheat and meslin		98.9	100.0	100.0	100.0	93.8		100.0	99.9	92.5
Dairy and eggs	**73.2**	**96.8**	**99.0**	**83.4**	**99.4**	**80.8**	**81.2**	**100.0**	**90.0**	**97.4**
Butter and other fats	95.9	94.7	99.7	50.9	100.0	51.0	81.5	100.0	71.6	92.2
Eggs	24.8	99.2	100.0	99.2	100.0	97.8	100.0	100.0	98.5	100.0
Milk and cream	99.0	96.4	97.2	100.0	98.3	93.7	62.2	100.0	100.0	100.0
Fish	**99.7**	**78.7**	**69.5**	**100.0**	**90.2**	**100.0**	**100.0**	**100.0**	**77.9**	**52.2**
Crustaceans		72.9	8.6	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Fish filets & other fish meat	99.5	63.8	100.0	100.0	100.0	100.0	100.0	100.0	33.8	44.8
Fish, dried, salted, smoked, etc.	100.0	99.6	100.0	100.0	70.7	100.0	100.0	100.0	100.0	11.7
Fresh Fruits - Vegetables	**49.1**	**87.6**	**100.0**	**100.0**			**100.0**	**100.0**	**100.0**	**96.5**
Bananas, excluding plantains	96.3	87.2		100.0			100.0	100.0		100.0
Citrus fruit, fresh or dried	1.9	87.9	100.0	100.0			100.0	100.0	100.0	92.9
Legumes and pulses	**63.8**	**96.4**	**86.9**	**83.4**	**87.5**	**76.7**	**99.7**	**99.8**	**62.0**	**96.5**
Leguminous vegetables	27.7	99.5		100.0			100.0	99.5	0.3	100.0
Potatoes; fresh or chilled	100.0	98.0	76.7	100.0	100.0	99.5	99.2	100.0	100.0	92.1
Vegetables, leguminous		91.7	97.1	50.3	75.0	53.9	99.9	100.0	85.9	97.3
Meat	**78.1**	**69.5**	**66.2**	**79.8**	**80.0**	**79.7**	**75.0**	**80.0**	**75.8**	**66.3**
Poultry	46.1	92.2	48.6	49.6	50.0	49.3	50.0	100.0	97.8	48.9
Bovine animals	100.0	93.5	100.0	100.0	100.0	100.0		100.0	92.7	100.0
Sheep or goats	98.3	64.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Swine	100.0	48.5	50.0	100.0	100.0	100.0	100.0	50.0	44.3	50.0
Nuts and derived products	**81.9**	**92.9**	**98.9**	**100.0**	**100.0**	**98.9**	**99.2**	**100.0**	**10.2**	**52.4**
Nuts	81.9	92.9	98.9	100.0	100.0	98.9	99.2	100.0	10.2	52.4
Oil-bearing	**62.5**	**55.6**	**67.1**	**100.0**	**94.1**	**94.6**	**75.8**	**100.0**	**96.7**	**74.9**
Groundnut	0.6	10.4		100.0		100.0	100.0	100.0	98.1	
Soya beans	99.6	96.0	50.6	100.0	100.0	100.0	83.3	100.0	99.9	74.9
Sunflower-seed, safflower or cottonseed	87.3	60.5	83.5		88.2	83.8	44.1	100.0	92.2	
Stimulant crops	**98.0**	**97.9**	**90.5**	**61.8**	**97.6**	**54.3**	**98.9**	**100.0**	**89.6**	**57.3**
Cocoa beans	100.0	100.0						100.0	100.0	
Coffee	96.1	95.8	90.5	61.8	97.6	54.3	98.9	100.0	79.3	57.3
Sugar	**99.2**	**98.5**	**96.7**	**0.4**	**92.4**		**94.0**	**99.4**	**86.6**	**80.2**
Cane or beet sugar	99.2	98.5	96.7	0.4	92.4		94.0	99.4	86.6	80.2
Vegetable and animal oils	**95.0**	**79.1**	**92.9**	**91.2**	**88.5**	**71.3**	**80.0**	**100.0**	**71.8**	**80.7**
Coconut, palm kernel or babassu oil	94.6	95.1	100.0	100.0		92.8	12.3	100.0	53.3	91.8
Fats and oils and their fractions	100.0	100.0	100.0					100.0	100.0	100.0
Ground-nut oil and its fractions	100.0	42.1	100.0	100.0	100.0	3.2	100.0	100.0		81.8

Olive oil and its fractions	79.4	30.8	77.9	86.6	45.2	55.4	98.8	100.0	89.1	19.6
Other oil seeds	99.9	99.8	97.3	83.3	98.6	94.7	100.0	99.8	63.0	96.8
Palm oil and its fractions	89.9	81.5	96.8	89.5	99.0	99.8	90.6	100.0	99.4	98.1
Rape, colza or mustard oil	96.2	93.7	93.8	100.0		60.4		100.0	87.7	91.0
Soya-bean oil and its fractions	100.0	89.4	77.4	78.9	100.0	92.9	78.3	100.0	9.8	66.2

Source: Espitia, Rocha, Ruta (2020). "Database on COVID-19 trade flows and policies".

Note: The concentration of imports is calculated as the simple average by product of the sum of the import shares from top-3 exporters that are most affected by Covid-19. $Imp\ concentration_i = 100 * (\sum_{n=1}^{N}\sum_{k=1}^{K=3} imp_{ijn}/Tot\ imp_{in})/N$, where i, j, k, and n are respectively importer, exporter, exporter rank and product. Missing values refer to products that are not imported from top-50 most affected countries by Covid-19. Shaded cells represent country-products with medium and high levels of import food dependence.

Appendix Table 6: Summary statistics of unskilled labor share in total value added

	Overall				Advanced countries				Developing countries			
GTAP Sector	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Animal products n.e.c.	0.45	0.15	0.03	0.71	0.44	0.16	0.03	0.67	0.48	0.14	0.23	0.71
Bovine meat prods	0.29	0.12	0.00	0.81	0.31	0.10	0.11	0.66	0.25	0.14	0.00	0.81
Cereal grains n.e.c.	0.45	0.15	0.03	0.71	0.44	0.15	0.03	0.67	0.47	0.13	0.23	0.71
Crops n.e.c.	0.46	0.14	0.03	0.71	0.45	0.14	0.03	0.67	0.47	0.13	0.23	0.71
Dairy products	0.26	0.11	0.00	0.70	0.26	0.09	0.07	0.70	0.27	0.14	0.00	0.52
Fishing	0.19	0.13	0.00	0.59	0.15	0.09	0.00	0.43	0.24	0.15	0.00	0.59
Food products n.e.c.	0.28	0.11	0.02	0.81	0.27	0.09	0.07	0.66	0.29	0.13	0.02	0.81
Meat products n.e.c.	0.29	0.12	0.01	0.85	0.29	0.10	0.11	0.62	0.29	0.15	0.01	0.85
Oil seeds	0.45	0.14	0.03	0.71	0.44	0.16	0.03	0.67	0.47	0.13	0.23	0.71
Paddy rice	0.46	0.14	0.03	0.71	0.44	0.15	0.03	0.67	0.47	0.13	0.23	0.71
Sugar	0.24	0.12	0.00	0.58	0.23	0.12	0.01	0.53	0.26	0.13	0.00	0.58
Vegetable oils and fats	0.25	0.12	0.02	0.66	0.24	0.11	0.08	0.63	0.25	0.13	0.02	0.66
Vegetables, fruit, nuts	0.46	0.14	0.03	0.71	0.44	0.15	0.03	0.67	0.47	0.13	0.23	0.71
Wheat	0.46	0.15	0.03	0.71	0.44	0.16	0.03	0.67	0.50	0.13	0.23	0.71

Source: *Aguiar et al (2019) - The GTAP Data Base: Version 10*

Appendix Table 7: Top-50 countries most affected by increases in food prices, retaliation scenario

	Food	Cereals	Dairy and eggs	Fish	Fresh Fruits - Vegetables	Legumes and pulses	Meat	Nuts and derived products	Oil-bearing	Stimulant crops	Sugar	Vegetable and animal oils
Tajikistan	25.9	36.9	11.9	36.6	4.3	29.0	14.0	14.8	4.8	9.0	9.4	4.4
Israel	22.5	18.5	9.7	100.4	5.0	25.6	6.9	10.1	3.4	6.8	9.3	4.2
Malawi	19.8	23.3	8.2	18.7	3.0	20.2	9.5	8.1	3.7	7.1	7.6	4.2
United States	19.4	16.2	8.1	49.2	2.4	19.3	6.9	6.1	5.1	5.3	8.4	5.2
Turkmenistan	19.4	34.1	7.0	41.1	7.1	22.0	11.3	16.1	4.4	8.9	7.0	4.9
Japan	19.0	14.1	7.7	62.0	4.7	30.1	5.8	10.8	5.3	5.8	11.0	5.0
Nigeria	18.6	24.9	9.3	7.0	5.1	24.4	10.0	9.5	4.4	6.8	10.5	5.8
Uzbekistan	18.1	35.7	8.6	72.7	4.6	18.2	9.4	17.4	4.5	7.9	10.3	3.6
Brazil	17.6	16.0	7.0	62.2	3.9	26.2	5.8	11.0	4.6	3.3	9.5	4.2
Azerbaijan	17.5	30.6	7.8	43.8	4.5	21.2	10.2	12.5	5.2	8.3	9.1	5.8
Burundi	17.0	21.1	4.2	62.5	3.3	15.8	12.5	10.3	2.3	8.2	5.6	5.8
Thailand	16.6	21.6	7.4	55.4	4.9	22.0	9.1	5.9	5.5	5.4	8.5	5.9
Egypt, Arab Rep.	16.4	23.8	7.2	76.1	5.0	28.6	11.5	9.1	3.7	6.7	10.2	5.6
Yemen, Rep.	16.0	19.2	6.3	65.3		30.1	11.6	5.4	3.3	4.1	10.4	6.0
Ecuador	15.8	20.6	10.1	67.1	4.6	30.0	4.9	15.5	2.6	4.9	6.9	2.9
Ethiopia (excludes Eritrea)	15.2	21.2	8.3	64.4	5.1	28.6	13.1	12.4	3.2	8.4	7.5	6.1
Belarus	15.1	19.5	8.8	75.5	5.0	23.9	5.2	10.3	5.1	6.1	9.0	5.5
Cameroon	15.1	16.3	10.3	51.7	3.5	28.6	11.0	11.7	4.8	7.5	9.7	6.0
Philippines	15.1	16.8	7.0	91.6	5.1	27.3	7.7	7.0	5.8	5.0	8.7	5.7
Libya	15.0	20.3	8.1	60.9	2.9	26.9	13.4	16.1	3.4	5.7	8.1	2.6

Cuba	15.0	15.7	7.9	85.4	5.4	32.0	14.0	13.8	3.2	8.0	9.4	2.7
Sri Lanka	14.9	17.0	7.5	6.1	4.5	26.5	12.2	9.1	4.9	4.1	8.2	5.8
European Union	14.8	13.4	8.3	58.8	3.9	19.8	8.2	10.9	4.6	4.5	8.3	5.3
Australia	14.5	9.8	7.4	53.5	6.1	25.7	3.7	6.8	3.9	6.4	9.4	5.3
Canada	14.4	10.9	9.4	48.6	3.2	18.4	8.0	10.3	5.3	5.3	9.6	6.6
Georgia	14.1	27.5	7.5	68.0	3.8	25.0	11.8	12.5	4.7	7.8	10.0	5.9
Costa Rica	14.1	12.9	7.6	69.2	5.1	24.6	7.4	8.7	3.9	5.0	10.1	3.8
Algeria	14.1	18.5	7.7	83.5	4.5	25.6	5.1	10.6	3.9	5.6	10.5	2.8
Switzerland	14.0	18.3	8.8	58.8	3.2	19.1	9.3	13.5	5.7	5.6	9.0	5.5
Mozambique	13.9	17.3	9.8	48.7	4.3	17.9	8.9	10.9	3.1	7.9	7.6	4.2
Lesotho	13.7	17.1	6.0	94.3	2.7	26.0	13.1	11.3	3.6	7.3	8.5	4.8
Turkey	13.5	24.6	9.6	74.1	4.7	28.2	8.5	12.1	3.4	4.0	8.9	5.8
Mongolia	13.5	22.8	11.6	17.1	4.0	20.7	12.1	13.4	4.0	7.5	8.5	5.0
Kyrgyz Republic	13.5	33.1	7.4	28.6	4.1	24.9	11.0	16.1	5.3	9.0	11.6	4.6
Armenia	13.4	28.3	7.5	35.1	3.7	26.8	9.8	11.8	5.2	6.2	9.7	5.5
Congo, Rep.	13.4	22.1	8.8	44.6	4.4	22.4	12.8	13.5	3.7	7.7	8.3	6.0
Uganda	13.4	22.6	4.7	5.9	3.8	17.6	8.1	5.0	3.3	6.5	8.4	6.2
Panama	13.3	13.4	7.6	69.2	3.9	27.5	8.6	12.0	4.6	5.3	8.0	3.7
Morocco	13.3	19.0	7.5	8.2	4.3	27.4	11.0	12.2	3.0	5.7	10.4	2.7
Indonesia	13.2	20.8	7.2	13.8	5.1	22.2	7.4	7.8	5.2	2.1	9.4	6.6
Chad	13.1	11.5	7.2	96.5		27.9	11.0	15.6	3.8	8.2	8.8	6.1
Norway	13.1	20.9	8.3	45.7	4.5	25.5	5.7	9.6	6.0	6.7	9.2	10.9
Ghana	13.0	16.7	6.8	29.9	3.7	21.4	13.1	8.6	3.2	2.3	9.7	5.8
Côte d'Ivoire	13.0	14.2	9.3	36.6	6.7	18.6	6.6	5.4	3.5	7.4	8.8	5.6
Jamaica	12.9	16.2	10.2	18.3	5.3	25.2	12.8	10.3	4.3	4.9	8.0	4.1
Afghanistan	12.7	19.2	7.5	51.2	3.0	22.0	13.9	12.6	5.2	8.2	12.0	5.9
Rwanda	12.7	19.9	6.0	30.5	3.2	12.4	8.6	12.9	2.6	7.9	6.2	5.5
Colombia	12.6	14.3	8.8	62.7	5.1	29.2	6.8	9.5	3.2	6.2	7.8	3.7
Kenya	12.6	16.1	3.2	73.0	3.0	20.5	7.8	10.5	3.9	5.1	8.2	6.2
Korea, Rep.	12.5	14.8	7.7	35.2	4.5	27.3	5.3	9.6	5.2	5.9	11.2	4.7

Source: Espitia, Rocha, Ruta (2020). "Database on COVID-19 trade flows and policies".

Note: The formula used to compute the changes in prices is: $Direct\ Price\ effect_{ik} = {}^{\Delta Quantity_i}/_{Elasticity_k}$. Where i is the importer and k is the product. Direct price effects are calculated at the country-product level using HS4 digit product elasticities from Fontagné, Guimbar and Orefice (2019) and are assumed to be constant. For each country, results are aggregated using weighted averages where the weighted represent the share of imports of product k over total food imports. Shaded cells represent country-products with medium and high levels of import food dependence. .