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*Te Pūtahi Rangahau Umanga o Aotearoa*

# Impacts of Agricultural Domestic Supports on Developing Economies

**Prepared for NZ Ministry for Primary Industries by**

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WAIKATO MANAGEMENT SCHOOL
TE RAUPAPA

# Impacts of Agricultural Domestic Supports on Developing Economies

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# Executive Summary

Agricultural price and trade policies were highly distortive of world food, feed and fibre markets in the latter half of the 20th century, but many reforms began in the 1980s and continued following the implementation over 1995-2004 of the Uruguay Round Agreement on Agriculture. Some import tariffs have since come down further, and export subsidies were outlawed by WTO members in 2015.

However, domestic support has replaced the assistance previously provided to farmers by tariffs, which is prompting WTO members to place them on the agenda for the next biennial WTO Trade Ministerial to begin in late November 2021. Over the past 20 years, export subsidies have been largely abolished and import tariffs on farm products have fallen considerably, while domestic subsidies to farmers have more than doubled in OECD countries and are starting to emerge in emerging economies.

To inform discussions, the present study was commissioned by the New Zealand Ministry for Primary Industries. It seeks to estimate the impacts of agricultural domestic supports globally and in both farm-supporting countries and other – especially developing – economies. It does so by calibrating the database of the global economywide GTAP (Global Trade Analysis Project) model to 2019 and then simulating the removal of food and agricultural domestic supports globally.

The estimated impacts of globally removing domestic support are of course negative for supported farmers, who are primarily in Western Europe, Northeast Asia and South Asia, but they are positive for most farmers in the rest of the world (and for the global economy). Impacts vary across product groups, consistent with the considerable variations in levels of support across agricultural industries.

The global economic welfare benefit from removing all domestic support to farmers is conservatively estimated to be US$4.7 billion per year. The most assisted farmers would be worse off if not compensated, but all other farmers would gain from higher output prices, including those in supporting countries who currently receive little or no support.

A side benefit of removing domestic supports is that it boosts government budgets in reforming countries. That allows society to re-purpose that spending to achieve more socially desirable objectives. Examples include investing in growth-enhancing rural public goods such as education, health, agricultural research, and transport and communication infrastructure. It could also include paying farmers for their provision of ecosystem services. Targeted income supplements fully decoupled from production, via generic social safety nets/trampolines, are another possible use of savings from removing distortionary domestic supports and instead reducing poverty and inequality directly.

# 1 Introduction and Background

This study, commissioned by the New Zealand Ministry for Primary Industries (MPI), estimates the impacts of agricultural domestic supports in farm-supporting countries and in other – especially developing – economies (see Appendix Table A1).

The study provides new estimates of the trade and other economic effects of agricultural domestic support to farmers in countries competing in the global marketplace with other countries whose farmers are unsubsidised or only lightly assisted. While those policies harm the world economy in aggregate, their impacts differ across groups within the two sets of countries. Our research sheds light on which groups and which countries would gain or lose from removing those farm assistance measures. This may help to assist in prioritising areas for domestic support reform within multilateral negotiations.

# 2 Extent of Agricultural Domestic Supports

At the start of the WTO's Doha round of multilateral trade negotiations in 2001, it was agriculture where the main remaining barriers to global merchandise trade were to be found (Anderson & Martin, 2005, 2006). Import restrictions were the main instrument of farm support, accounting for 93% of the global welfare cost of farm-support policies while domestic supports contributed just 5% (Anderson, Martin & Valenzuela, 2006). In the two decades since then, export subsidies have been almost completely abolished and import tariffs on farm products have fallen considerably. However, the share of domestic subsidies in total support to farmers in OECD countries has more than doubled. It is thus time to revisit this issue and re-estimate the extent and effects of these measures of assistance to farmers globally, leading up to the 12th WTO Trade Ministerial Conference in November-December 2021.

In this section, we present some key insights into agricultural market interventions by governments from the OECD Producer and Consumer Support Estimates (PSE and CSE) up to 2020, updating the work of Anderson and Valenzuela (2020). We focus on 2019 which will be the base year for our modelling, since 2020 was an unrepresentative year given the impacts of Covid-19 on the global economy. We also show data for 2014, which is the baseline year we draw on from the Global Trade Analysis Project (GTAP) model's global economywide database.

## 2.1 Measuring the extent of farmer assistance and food consumer taxation

We draw primarily on the OECD (2021) to consolidate its information on government budgetary transfers and other forms of support for farmers by policy instrument for 41 OECD member countries and 13 major emerging economies of agricultural significance.[1] Together these 54 countries account for two-thirds of global agricultural production. In addition to market price support estimates by product, the OECD also provides estimates of other product-specific and non-product-specific assistance both to farmers and to services assisting farmers.

[1] Australia, New Zealand, China, Japan, Korea, Indonesia, Philippines, Viet Nam, India, Canada, US, Mexico, Argentina, Brazil, Chile, Colombia, Costa Rica, EU27, Iceland, Switzerland, Norway, Russian Federation, Ukraine, Kazakhstan, Turkey, Egypt, Israel and South Africa.

That allows us to rank countries by the extent of their agricultural subsidies and market access restrictions. We also disaggregate assistance by policy instrument and, where product-specific, by each of the most important product groups.

The OECD's indicators of the extent of domestic price distortions make it possible to estimate their effects on domestic markets, prices, trade and producer, consumer and national economic welfare. It is also possible to attribute the aggregate impacts into those due to each of the three WTO pillars of farmer assistance (import market access, export subsidies, and domestic support). However, these differ from the concepts that trade negotiators developed and used in the WTO following the Uruguay Round Agreement on Agriculture (URAA). As pointed out in the OECD's PSE Manual (OECD 2016), the WTO's Aggregate Measure of Support (AMS) is a unique concept not based on standard economic criteria and narrower than the PSE. Specifically, the AMS does not include support to producers via trade policies (import tariffs and export subsidies) but only the market price support (MPS) where administered prices exist. Nor does it include support via the Blue Box (programs that meet specific production-limiting requirements, see Article 6 of the URAA), the Green Box exemptions (Annex 2 of the URAA), the investment and input subsidy programs in developing countries listed for Special and Differential Treatment (Article 15 of the URAA), and the policy support that is excluded because it falls under specified *de minimus* levels (Article 6 of the URAA) of 5% of the value of production for developed countries and 10% for developing countries (and 8.5% for China). Moreover, the MPS component of the AMS simply compares the domestic administered price each year with a fixed reference price, usually the average border price in domestic currency in 1986-88. Hence it does not reflect the actual support being received by producers each year. It is the latter that matters for estimating the trade and other effects of current policies, hence our reliance in this study on the PSE as estimated by the OECD.

While the OECD does not separate the contributions of domestic price subsidies versus border restrictions (e.g. import licences, tariffs and tariff rate quotas) in causing the domestic price to exceed the border price of a like product (so-called Market Price Support), contributors to the protection database of the global economywide GTAP Model do make that distinction, by carefully drawing on detailed national databases. The latest version of that database currently is for 2014. Assistance rates have risen considerably in some key countries since then, so 2014 numbers have been projected to 2019 for analysis. The latest year of OECD estimates reported here is 2020, but to avoid the effects of COVID-19 we focus on 2019 as our baseline.

The study then estimates the effects of domestic support provided by budgetary transfers (and of the subsidy equivalents of farm trade policies, for comparative purposes) using the GTAP model. From the 2019 database, this modelling framework is able to provide estimates of the impacts on various countries of each major producing country's policies, and of their combined global market effects, to gain insights into farm incomes, agricultural and food exports, and national economic welfare.

A vast suite of policy indicator estimates is provided by the OECD. The key ones at the commodity level are what it calls single commodity transfers to producers and to consumers, both measured at the farm gate. As well, OECD provides a producer support estimate (PSE) for each country's farm sector in US dollars and in percentage terms. The sector's PSE includes some measures that are not commodity specific. Also provided by the OECD, but not included in the PSE, are general services support estimates (GSSE) to the sector as a whole.

The single commodity transfers to producers and the sectoral PSE, when expressed in percentage terms, can also be expressed as a nominal rate of assistance (NRA) to parts or all of the agricultural sector. The NRA differs from and is larger than the PSE in that it reflects the percentage by which producer incentives is above what it would be without intervention, whereas the PSE reflects the percentage of the producers' actual gross earnings (including assistance) that are due to farm support measures and so is always smaller than the NRA and cannot be greater than 100%. That is, NRA = PSE/((100-PSE)/100).

The OECD's total support estimate is the sum of all transfers from consumers and taxpayers to producers and consumers of farm products. In almost all cases the annual net value of transfers to the sector (PSE + GSSE) has been positive in recent years.

Trade is also affected by the extent to which consumer prices of farm products are distorted by policies, as captured by a consumer tax equivalent (CTE). The CTE is generally positive and the opposite sign to the OECD's consumer support estimate (CSE). The most common instrument of such distortion is an import restriction such as a tariff or tariff rate quota and, in the past, export subsidies. A subset of countries directly subsidise food prices for some groups of consumers, in which case the CTE could be negative.

The 14 individual products within the sub-sectors for which subsidy estimates are available in OECD (2021) are:

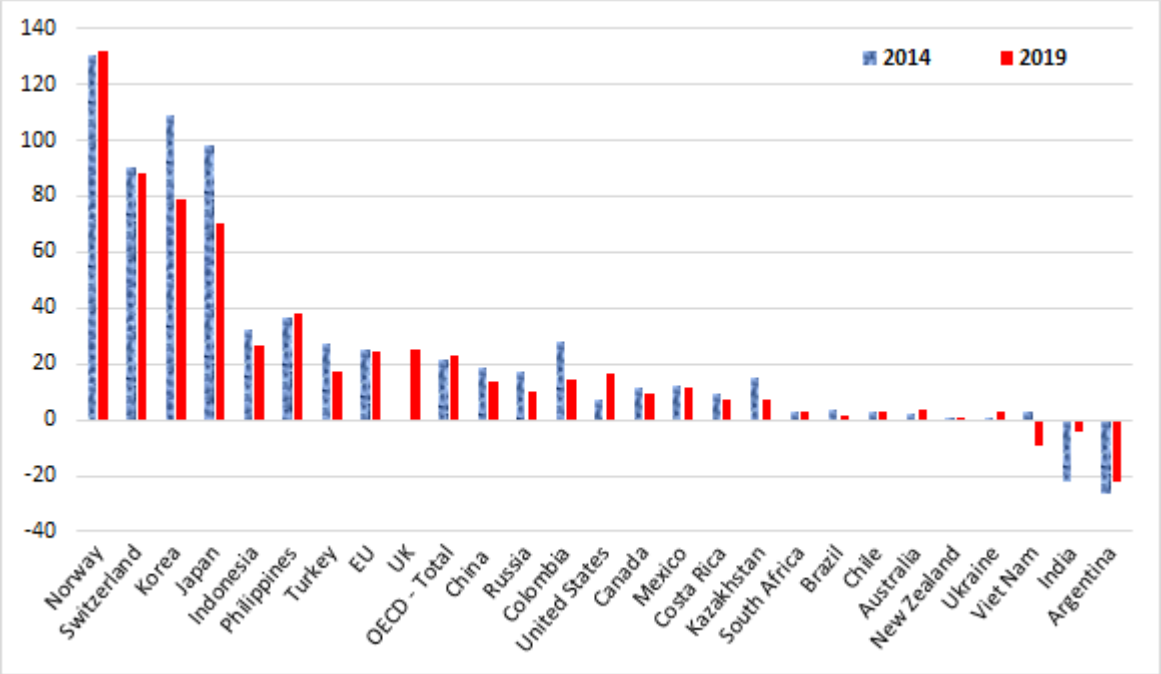
- Crops: wheat, barley, maize, rice, soybean, canola (or other oilseed), cotton and sugar; and
- Livestock products: beef, sheepmeat, pork, poultry, eggs and milk.

In most of the top-consuming countries, market demands can and mostly are met – or exceeded – by local production. Those countries for which self-sufficiency exceeds 100% are direct competitors to other agricultural-exporting countries. Assistance to their farmers obviously makes it more difficult for developing countries' farmers to compete there and elsewhere. But supports to farmers in self-sufficient or net-food-importing countries also reduce opportunities for developing country exporters. Hence the need to examine producer assistance policies in all countries of consumption significance, regardless of whether they are currently net exporters, self-sufficient or net importers of farm products.

## 2.2 Estimates of the extent of farmer assistance

The national aggregate NRAs are shown in Figure 1 for 2014 and 2019. The small changes in international prices for agricultural products between those two periods contributed to the average NRA for all OECD countries rising slightly from 22% to 23%. However, over the same period, the NRA for numerous individual countries fell somewhat. The biggest exceptions are the United States, whose NRA rose from 7% to 17%, and India, which has reduced its effective taxation of farmers (NRA moving from -22% to -5%).

*Figure 1 Aggregate agricultural NRA, by country, 2014 and 2019 (%, weighted average using value of production without assistance as weights)*

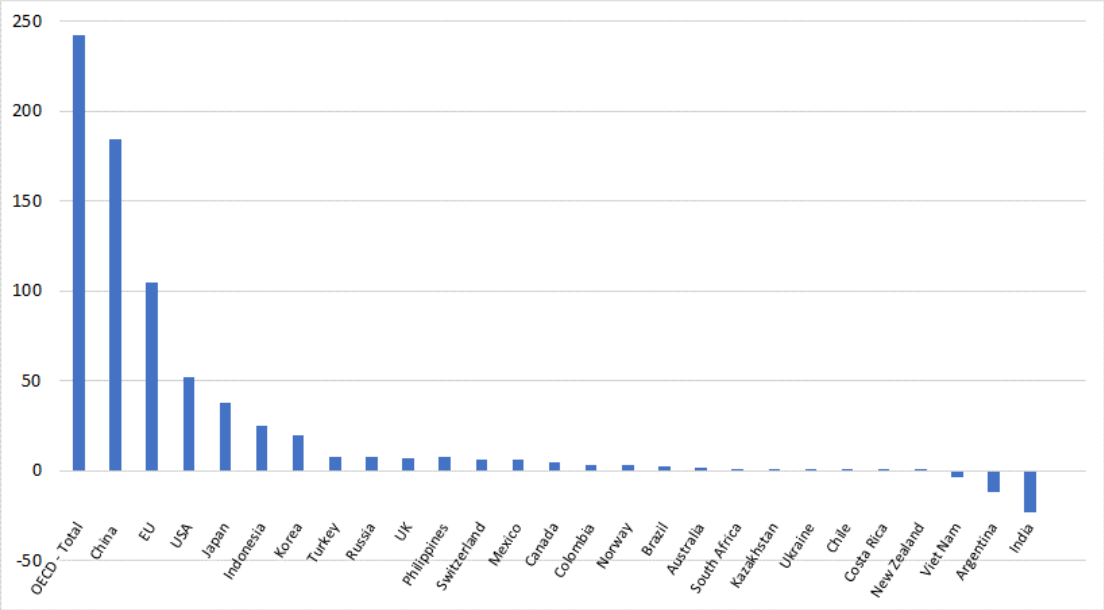



** Indonesia refers to 2015 in place of 2016-18.*
*Source: OECD (2021).*

The rate of assistance to farmers is highest in the coolest European and East Asian countries. Apart from Japan, those countries are very small producers. To get a fuller picture of where the assistance is greatest, the gross value of production also needs to be considered. Figure 2 shows the aggregate annual value of agricultural assistance in US$ terms. It reveals that assistance to farmers in 2019 amounted to US$184 billion for China (up from just $14b in 2000-02) compared with US$243b for all OECD member countries. The US support (US$52b) is only half that of the EU's US$105b. Japan (US$38b), Indonesia (US$25b) and Korea (US$20b) together provide barely four-fifths as much aggregate farmer assistance per year as the EU.

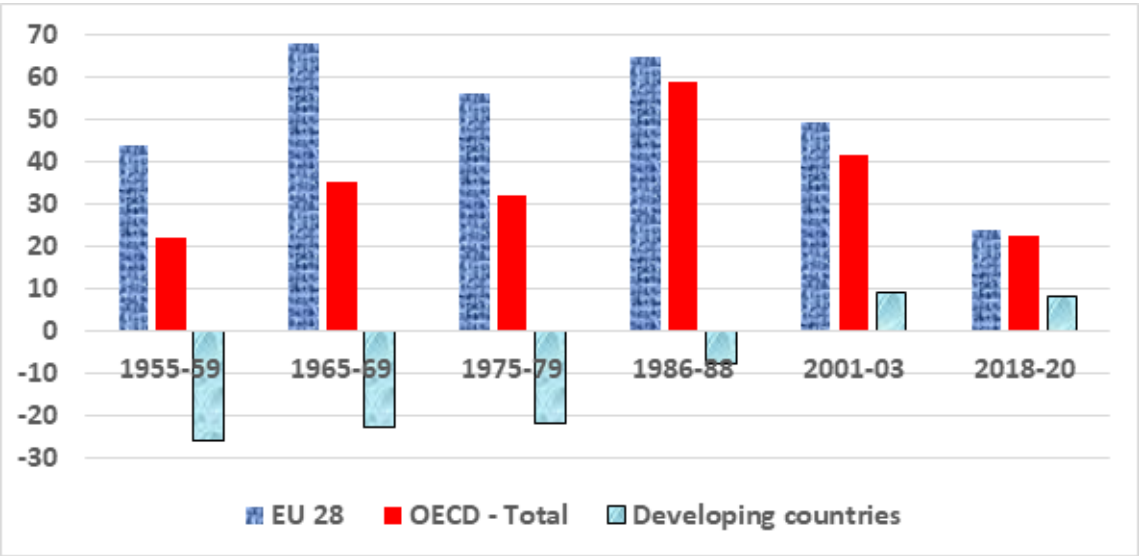
Once developing countries became independent from the 1950s, many effectively taxed their farmers rather than assist them through to the 1980s, before gradually opening their economies and phasing out their export taxes and other disincentives. Meanwhile, high-income countries increasingly assisted their farmers through to the mid-1980s (apart from a small dip in the mid-1970s when international food prices spiked), before reforms set in and rates of assistance progressively fell. More recently, some middle-income countries have transitioned from taxing to subsidizing their farmers, including populous China, Indonesia and the Philippines, so the average NRA for developing countries is converging on that for high-income countries (Figure 3). Hence the need to examine current policies of both sets of countries in this study.

*Figure 2 Aggregate value of agricultural assistance, by country, 2019 (current US$ billion)*




** Indonesia refers to 2015.*
*Source: OECD (2021).*

*Figure 3 Agricultural NRAs for developing countries[a] European Union and all OECD, 1955 to 2020 (%, weighted average using value of production without assistance as weights)*




*[a] The pre-1986 five-year average estimates are from Anderson (2009), as are the later developing country average rates which are for 1985-89, 2000-04 and 2014 (the latter from www.ag-incentives.org). Prior to 1986 the rates are for Western Europe and all high-income countries rather than the EU and OECD, respectively.*
*Source: OECD (2019), Anderson (2009), and www.ag-incentives.org.*

Table 1 shows the extent of these transitions in agricultural support/taxation since the mid-1980s for each of the countries monitored by the OECD. Only three countries in that 54-country sample still had negative agricultural NRAs in 2019: Argentina (-22%), India (-5%), and Viet Nam (-9%).

*Table 1 Agricultural NRA by country, 1986-88, 2001-03, 2017-19, 2019 and 2020 (%, weighted average using value of production without assistance as weights)*

| | 1986-88 | 2001-03 | 2017-19 | 2019 | 2020 |
|---|---|---|---|---|---|
| Norway | 247 | 238 | 145 | **132** | 104 |
| Switzerland | 328 | 196 | 95 | **88** | 108 |
| Korea | 165 | 95 | 86 | **79** | 91 |
| Japan | 135 | 111 | 71 | **70** | 69 |
| Philippines[a] | na | 23 | 37 | **38** | 37 |
| Indonesia[a] | na | 10 | 30 | **27** | 25 |
| UK | na | na | 26 | **25** | 26 |
| European Union | 63 | 43 | 24 | **24** | 24 |
| Turkey | 29 | 33 | 22 | **17** | 24 |
| US | 26 | 21 | 13 | **17** | 12 |
| Colombia[a] | na | 28 | 14 | **14** | 15 |
| China[a] | na | 7 | 16 | **14** | 14 |
| Mexico[a] | na | 31 | 11 | **11** | 11 |
| Russian Federation[a] | na | 12 | 12 | **10** | 7 |
| Canada | 53 | 23 | 9 | **9** | 11 |
| Kazakhstan | na | 3 | 5 | **7** | 3 |
| Costa Rica | na | 8 | 6 | **7** | 8 |
| Australia | 11 | 4 | 3 | **3** | 2 |
| South Africa[a] | na | 8 | 4 | **3** | 3 |
| Ukraine[a] | na | 1 | 1 | **3** | 1 |
| Chile[a] | na | 6 | 3 | **3** | 3 |
| Brazil[a] | na | 8 | 2 | **2** | 1 |
| New Zealand | 12 | 1 | 1 | **1** | 1 |
| India[a] | na | -5 | -5 | **-5** | -7 |
| Viet Nam[a] | na | 8 | -6 | **-9** | -6 |
| Argentina[a] | na | -13 | -17 | **-22** | -16 |

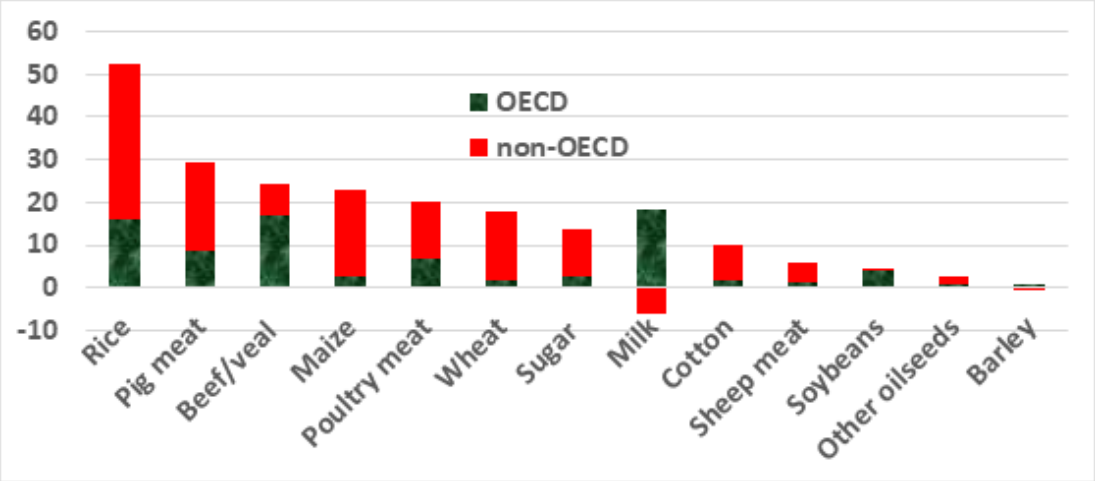
*[a] In the 1986-88 column, the estimates for developing countries are for 1985-89 and the estimates for Russia and Ukraine are for 1992-95, all from Anderson (2009).*
*Source: OECD (2021) and Anderson (2009).*

A subset of that assistance is product-specific. In OECD countries, dairy (US$18 billion per year) and beef cattle (US$17b) are the largest recipients in 2016-18, while in emerging economies it is rice (US$36b) that receives by far the most assistance followed by pigs (US$21b), maize (US$20b) and wheat (US$16b) (Figure 4). Full commodity details are provided in Appendix Tables A5 and A6.

In addition to much change in the total support to farmers over the past three decades, there have also been substantial changes in the types of support. The key forms of assistance in the PSE include market price supports (such as import tariffs and quotas plus domestic price subsidies) and payments based on outputs or input use, payments based on cropped area or livestock numbers where production is required, payments based on cropped area or livestock

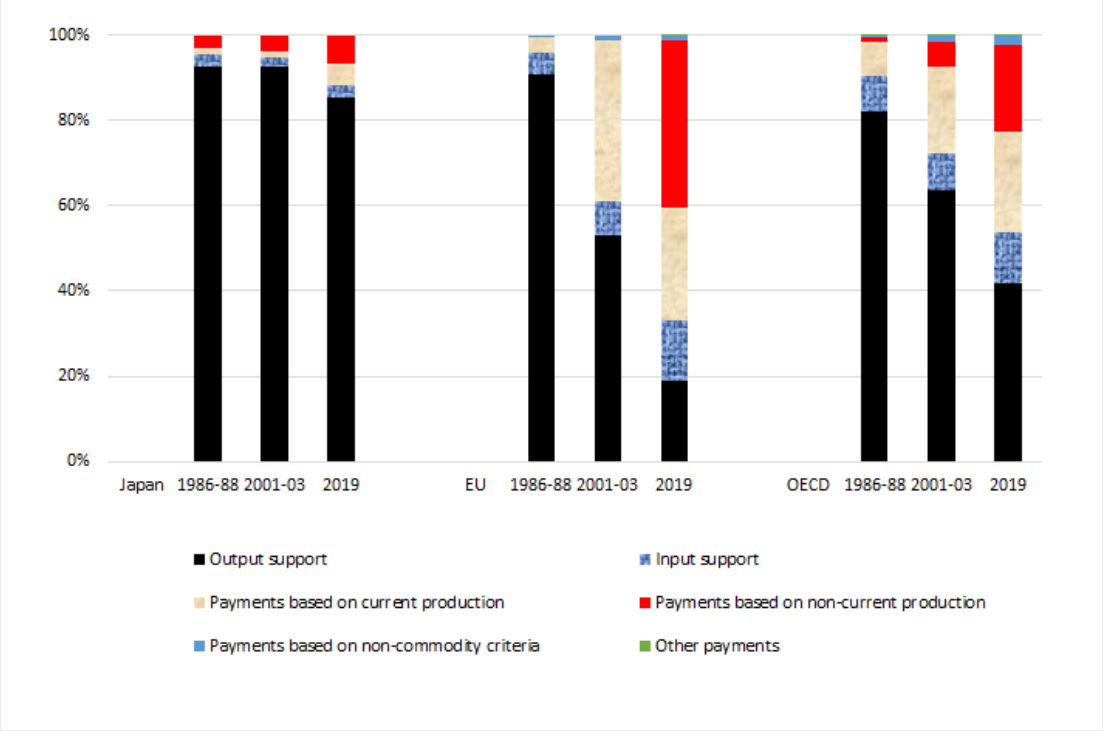
numbers where production is not required, and payments for environmental services. For the OECD as a group, the extent of assistance coming directly from support to outputs has declined substantially this century, from 63% to 41%, meaning the share of other budgetary payments has more than doubled. While for the EU it has plummeted from 95% to 33%, it is still nearly 90% in Japan (Figure 5). For most other countries, the vast majority of support still comes from those two direct forms of support (Table 2).

*Figure 4 Aggregate value of agricultural assistance, by product, 2016-18 (current US$ billion per year)*




*Source: OECD (2019).*

*Figure 5 Component shares of PSE, Japan, EU and all OECD, 1986-88, 2001-03 and 2019 (%)*




*Source: OECD (2021).*

*Table 2 Component shares of PSE, by country, 2019 (%)*

| | Output support (A) | Input support (B) | Payments based on current production (C) | Payments based on non-current production (D+E) | Payments for environment services and resource conservation (F) | Other payments (G) | TOTAL |
|---|---|---|---|---|---|---|---|
| Argentina | 101 | -1 | 0 | 0 | 0 | 0 | 100 |
| Australia | 0 | 55 | 23 | 21 | 1 | 0 | 100 |
| Brazil | 3 | 92 | 5 | 0 | 0 | 0 | 100 |
| Canada | 46 | 12 | 35 | 6 | 0 | 1 | 100 |
| Chile | 2 | 92 | 6 | 0 | 0 | 0 | 100 |
| China | 67 | 10 | 15 | 7 | 1 | 0 | 100 |
| Colombia | 90 | 10 | 0 | 0 | 0 | 0 | 100 |
| Costa Rica | 92 | 8 | 0 | 0 | 0 | 0 | 100 |
| European Union | 19 | 14 | 26 | 27[a] | 14[a] | 0 | 100 |
| India | 276 | -145 | 0 | -29 | 0 | -2 | 100 |
| Indonesia | 89 | 11 | 0 | 0 | 0 | 0 | 100 |
| Japan | 85 | 3 | 5 | 7 | 0 | 0 | 100 |
| Kazakhstan | -7 | 102 | 5 | 0 | 0 | 0 | 100 |
| Korea | 91 | 3 | 3 | 4 | 0 | 0 | 100 |
| Mexico | 56 | 22 | 1 | 9 | 12 | 0 | 100 |
| New Zealand | 86 | 14 | 0 | 0 | 0 | 0 | 100 |
| Norway | 51 | 6 | 31 | 11 | 0 | 0 | 100 |
| Philippines | 97 | 3 | 0 | 0 | 0 | 0 | 100 |
| Russian Fed | 50 | 33 | 10 | 0 | 0 | 8 | 100 |
| South Africa | 70 | 29 | 1 | 0 | 0 | 0 | 100 |
| Switzerland | 46 | 2 | 17 | 20 | 12 | 4 | 100 |
| Turkey | 77 | 9 | 13 | 0 | 0 | 0 | 100 |
| UK | 25 | 12 | 10 | 47 | 1 | 5 | 100 |
| Ukraine | 67 | 12 | 21 | 0 | 0 | 0 | 100 |
| US | 21 | 17 | 46 | 12 | 4 | 0 | 100 |
| Viet Nam | 113 | -11 | -2 | 0 | 0 | 0 | 100 |

[a] *The EU's Greening Payments (PHNR12) in E have been shifted to F.*
*Source: OECD (2021).*

The general services support estimate (GSSE), which is not included in the preceding Figures but is part of the OECD's Total Support Estimate (PSE+GSSE), tends to be non-product-specific. It is dominated by investments in agricultural research and rural infrastructure; but it does not include broader investments in rural education and health. GSSE has averaged less than 5% of the gross value of agricultural production over the past three decades but is more important now than early this century and proportionately much more important in lightly-assisting countries (some of which provide no domestic support). GSSE is mostly made up of

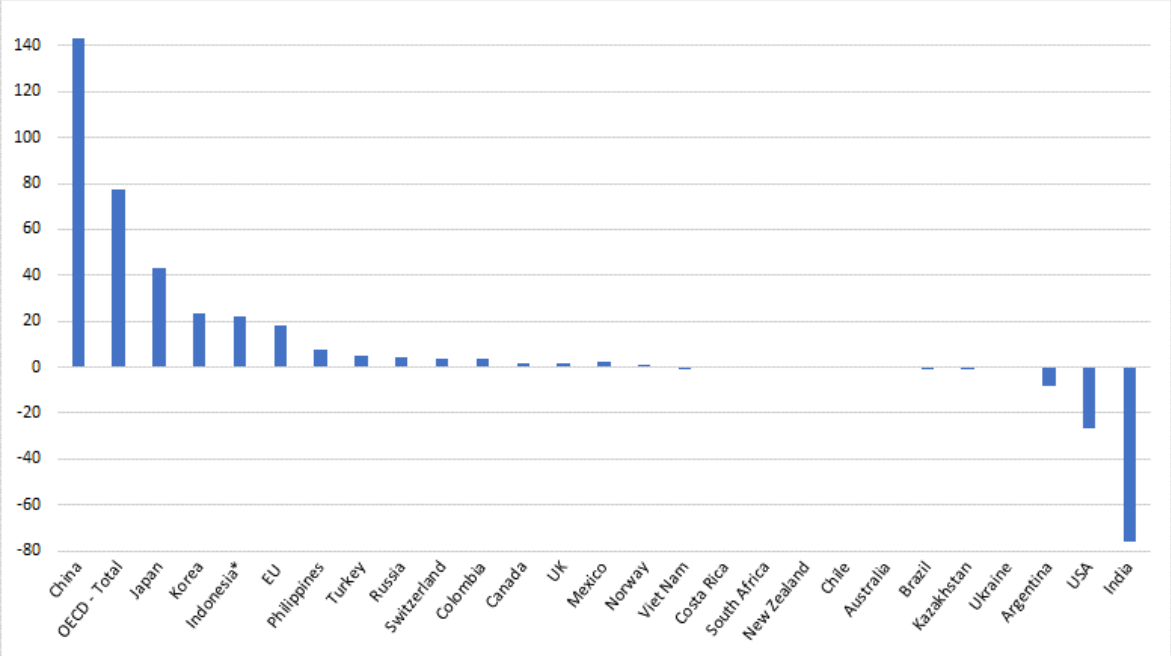
expenditures on agricultural research, development and extension (R, D&E) and infrastructure, but inspection and control expenditure is also non-trivial. Marketing and promotion, and public stockholding, are relatively minor. Those component shares have not changed much over the past 15 years, although they varied considerably across countries as of 2019.

## 2.3 Estimates of the extent of food consumer taxation

Data on the value of transfers from consumers are equally as important as the producer NRAs, because insofar as they discourage consumption of farm products they reduce net imports and hence export prospects for developing country farmers. In most countries these transfers are generated by import restrictions: a tariff (or quantitative import restriction) is the equivalent of a subsidy to the domestic producer of a like good and a tax on domestic consumers of such products.

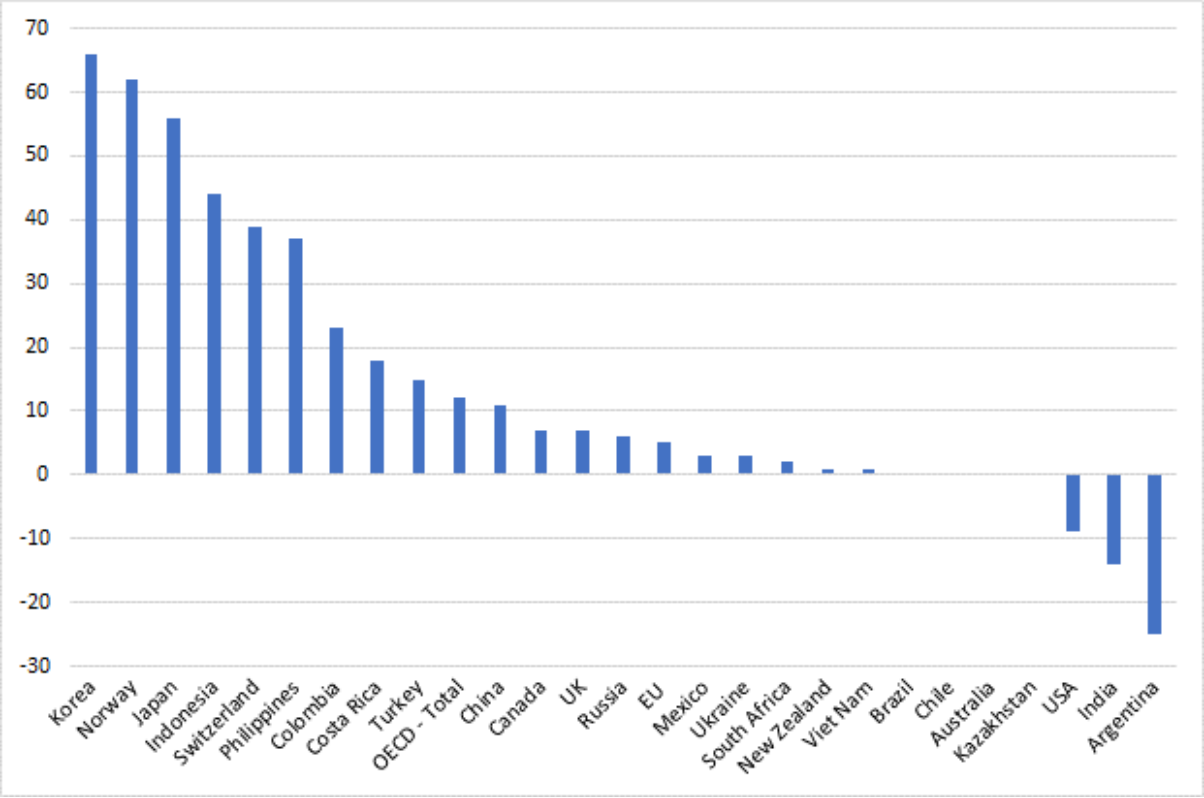
Figure 6 and Figure 7 summarise those CTE data, details of which are in Appendix Table A3 and Table A4. The tax on Chinese consumers (US$143b) is twice as large as that on all OECD consumers (US$78b) in aggregate terms, and in percentage terms at 10% it is above the OECD average at 8% and far above the EU's 4% (Figure 7). Particularly striking are the negative values for the United States (US$27b or -9%) and India (US$76b or -14%). The US spends a lot on food stamps and the like for low-income families, while in India the rise in staple food consumer subsidies was enormous earlier this century: spending rose from US$12 billion in 2000 to $152 billion in 2013 before slipping back to $76 billion in 2019. Similarly in the US, expenditure rose from less than $2 billion in 2000 to $40 billion at the peak of the price spike in 2011-12, and was still $27 billion in 2019. For the full sample of 54 countries, though, the percentage CTE has more than doubled since the early 2000s, from 5% to 12%, as the negative impact on consumers of market access barriers far outweighs any positive effects of food subsidies. Australia and other food-exporting countries nonetheless benefit from direct consumer subsidies insofar as they expand the global demand for farm products – although there is evidence for India that consumers simply switch from less-preferred coarse grains to now-subsidized rice and wheat rather than expand their overall food intake greatly (Jensen & Miller, 2011). Breakdowns by product of those consumer supports are provided in Appendix Table A3 and Table A4.

*Figure 6 Aggregate agricultural consumer tax equivalent (CTE) at farm gate, by country, 2019 (current US$ billion)*




*Source: OECD (2021).*

*Figure 7 Percentage agricultural consumer tax equivalent (CTE) at farm gate, by country, 2019 (%)*




*Source: OECD (2021).*

# 3 Basic Economics of Reducing Domestic Supports

## 3.1 Effects in supporting countries

The economics of lowering domestic supports are similar to the effects of opening to trade via lowering border restrictions, insofar as they promote domestic production and hence reduce net imports. The gains from such reform can come from more production specialization, the value of which is becoming greater as global value chains increase in importance (Reardon & Minton 2021). As well, lowering domestic supports expands the scope for raising the variety of products available to domestic consumers and thus for increasing diet diversity and food safety and quality, the demands for which rise with per capita income. These benefits are more important the smaller a country is. This is because with less trade there is less scope in a small country for consumers to secure out-of-season fresh produce, and less likelihood that a weather shock (e.g. to crops) in one part of the country will be countered by an offsetting shock in the rest of the country. Reducing domestic support is thus becoming more important because weather shocks are becoming greater and more frequent thanks to climate change.

A cut to a domestic subsidy that supports production of a good in a large country, or in numerous smaller countries, raises global import demand for and hence the international price of that product. Unlike an import tariff, which applies only to imported goods, domestic subsidies can also support production of exported goods. A cut to domestic support to an exported good's production will still raise its international price, but it will do so through reducing its supply in international markets (just as does a cut in an export subsidy).

A difference to note between an import tariff and a production (or export) subsidy is that the former raises government revenue whereas a subsidy depletes government revenue. Thus by lowering domestic support, a reforming government opens the possibility of re-purposing those subsidy payments: instead of them lowering national economic welfare they can be invested in growth-enhancing public goods (e.g., rural education, health, R&D and infrastructure) or be used to provide targeted income transfers to reduce poverty and inequality directly.

## 3.2 Effects in non-reforming or non-assisting countries

The effect of reforms in subsidising countries on non-subsidising countries depends on how open the latter are to transmitting international price changes to their domestic markets and whether they are net importers or net exporters of the products concerned. Assuming they allow at least some price transmission, a rise in the international price of such products will reduce national economic welfare in countries importing those goods and raise it for countries exporting them.[2] But within each of those countries, net sellers of those goods will benefit from the price rise while net buyers will lose.

[2] A small exception is that if a country switches sufficiently from being a net importer to being a net exporter of a product subject to reduced assistance abroad, its national economic welfare will rise rather than fall in responding to the change in international prices (Anderson & Tyers 1993).

# 4 Modelling Framework and Data

## 4.1 Global trade model used

Our simulations to demonstrate the potential impact of removing domestic subsidies use the Global Trade Analysis Project Recursive Dynamic (GTAP-RD) model (Aguiar, Corong & van der Mensbrugghe 2019), based on the GTAP model (Hertel 1997; Corong et al. 2017). Use of this global computable general equilibrium (CGE) model enables us to capture inter-sectoral linkages within each country as well as between countries via international trade. The recursive dynamic specification enables us to project the global economy from the baseline 2014 database to 2019, including with upward sloping supply curves for land and specific natural resources (Aguiar, Corong & van der Mensbrugghe 2019).[3]

We use the latest available GTAP version 10.1 Data Base, with a base year of 2014 (Aguiar et al. 2019). The GTAP Data Base is available for 65 sectors in 147 countries and regions, which we aggregate to 56 countries/regions and 30 sectors in the current modelling. We further aggregate to 10 regions and 5 sectors when reporting many of the results. In addition, the countries are separated into high-income countries (HICs) and developing countries (DCs). Full details of the regional and sectoral aggregation are in Appendix Table A1 and A2.

## 4.2 Baseline data

Our focus is on running simulations from 2019 to demonstrate the impact of changes in domestic subsidy payments. The GTAP Data Base includes OECD domestic support data for 2014, which we update to 2019 (OECD 2021), the latest full year for which domestic support data are available pre-COVID19. The years 2020 and 2021 are unlikely to be representative years on because of disruptions to markets caused by COVID-19 and the economic stimulus policy responses to it.

The GTAP Data Base includes domestic support from the OECD for 12 sectors and 28 regions.[4] The data include payments based on output (A2), intermediate input payments (B1+B3) and factor payments (B2, C, D, and E) (Huang & Aguiar 2019; Boulanger, Philippidis & Jensen 2019).[5] Payments vary in the extent to which they are decoupled from current production, and some of them may even be welfare-improving for society (such as rewards for providing ecosystem services), in which case they likely fall into the WTO's 'Green Box' (see Section

[3] With no upward slopes in the policy simulation year. The model is solved using GEMPACK software (Harrison et al. 2014).

[4] Data are included for paddy, wheat, coarse grains, oilseeds, raw sugar, cotton, cattle & sheep, other animal products, raw milk, vegetables & fruit, other crops and wool. Regions included are Australia, New Zealand, China, Japan, Korea, Indonesia, Philippines, Viet Nam, India, Canada, US, Mexico, Argentina, Brazil, Chile, Colombia, Costa Rica, EU27, Iceland, Switzerland, Norway, Russian Federation, Ukraine, Kazakhstan, Turkey, Egypt, Israel and South Africa.

[5] The OECD classifies policy measures into seven broad categories, A to G, based on whether the basis is explicitly linked or not to current outputs or inputs and whether production is a prerequisite for receiving the payment (OECD 2021a). Category A1 covers market price support, A2 covers payments based on output, B covers payments based on input use, C covers payments based on current production, D covers payment based on non-current production with production required, E covers payments based on non-current production with production not required, F covers payments based on non-commodity criteria and G is miscellaneous payments (see OECD 2021a for details). The GTAP Data Base does not include OECD data for categories F and G, and market price support (A1) is excluded to avoid double counting with tariffs already in the GTAP Data Base (Boulanger, Philippidis & Jensen 2019).

2.1 above). For subsidies not tied to specific sectoral output, integration in the GTAP Data Base requires that assumptions be made to allocate these subsidies across sectors (Huang & Aguiar 2019; Boulanger, Philippidis & Jensen 2019).

We first project the global economy to 2019, from the latest currently available GTAP data for 2014, drawing on macroeconomic data on real GDP, population and workforce from the World Bank (2021). We start with the subsidies in the 2014 GTAP Data Base, including assumptions made in the database for integrating the OECD domestic support data.[6] For example, where subsidies are not allocated to a particular sector in the OECD database, they need to be distributed across sectors in the GTAP Data Base using OECD production shares and GTAP factor shares, and we use these 2014 distributions as a starting point. Where updated data are available from the OECD database,[7] we update subsidy rates for each country to 2019 by applying the appropriate proportional changes in the output, intermediate input and primary factor subsidy payments, relative to the value of production.[8] For the farm sectors covered by the OECD database, this enables us to develop an updated GTAP database of domestic support payments that is more representative of 2019. For sectors not covered by the OECD database, we maintain the existing tax/subsidy rates (based on country input-output tables or IMF's government finance statistics).

## 4.3 Caveats

As with all modelling, numerous assumptions necessarily have to be made for the exercise to be tractable, and the values of myriad parameters such as elasticities have to be best guesses when reliable econometric estimates are unavailable. The modelling also assumes fixed aggregate employment, thereby overlooking national employment changes that could be associated with agricultural expansion in developing countries. In addition to the earlier discussion of GTAP and OECD domestic support data, two offsetting caveats in particular are worth mentioning here.

The first has to do with the extent to which the various forms of domestic support to farm households are decoupled from current production requirements. The most decoupled are often direct income payments, for example. In the GTAP Data Base, it is assumed all budgetary payments to farmers' outputs, inputs and primary factors encourage more output. This assumption means the results are overstated to some extent.[9]

The second caveat has the opposite bias and so offsets the first. It has to do with the price, income and Armington elasticities in the model. In the current study, we use the standard GTAP parameters (Aguiar et al. 2019). However, there is an argument that these may be too low for simulating permanent policy shocks. We undertook some sensitivity analysis with just the Armington elasticities of substitution in consumption between imported goods and domestic

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[6] We first correct a GTAP v10.1 Data Base issue that led to the overstatement of wool subsidies in the EU. We also modify the GTAP model code to separate primary factor subsidies from primary factor taxes, enabling us to directly target reductions in primary factor subsidies (rather than subsidies net of any taxes on primary factors, as in the standard GTAP model code).

[7] http://www.oecd.org/agriculture/topics/agricultural-policy-monitoring-and-evaluation/

[8] In a small number of cases, where this approach would lead to the value of subsidies significantly deviating from OECD support values, we apply a smaller proportional change or maintain 2014 subsidy rates.

[9] Boysen-Urban et al. (2020) provide an estimate of that for an earlier period (2007) for the European Union.

products and between imported goods from different sources: by doubling those elasticities, the estimated price effects are slightly diminished but the change in quantities traded are far bigger, leading to significantly higher net exports by many developing countries. In this sense, our current results may be regarded as conservative.

# 5 Scenario Modelled and Results

## 5.1 Reform scenario

The scenario we focus on is full removal of domestic agricultural support in all countries from the 2019 updated GTAP Data Base. This includes elimination of production subsidies as well as domestic subsidies on primary factors and intermediate inputs (both domestically produced and imported) on all primary agriculture and processed food sectors (see sectors 1-19 in Appendix Table A2). The extent of domestic support to farmers is compared to the average applied import tariff equivalents at the border as a percent of imports in the updated GTAP Data Base (Table 3 and Table 4).[10]

*Table 3 Subsidies and tariffs by aggregate region in the updated GTAP Data Base, primary agriculture and processed foods (%)*

| Region[a] | Domestic subsidies, 2019[b] | | | Tariffs, 2014[c] | | |
|---|---|---|---|---|---|---|
| | Primary agriculture | Processed foods | Total Ag&food | Primary agriculture | Processed foods | Total Ag&food |
| Oceania | 1.9 | 0.2 | 0.9 | 0.5 | 2.1 | 1.8 |
| North East Asia | 5.1 | 0.1 | 2.5 | 15.0 | 11.7 | 13.3 |
| South East Asia | 1.2 | 0.0 | 0.6 | 4.9 | 6.7 | 6.0 |
| South Asia | 5.8 | 3.0 | 4.7 | 13.7 | 29.7 | 22.5 |
| North America | 9.7 | 0.0 | 3.3 | 0.2 | 1.7 | 1.2 |
| Europe | 15.5 | 0.4 | 5.3 | 3.2 | 7.0 | 5.6 |
| Latin America | 1.7 | 0.0 | 0.8 | 3.4 | 4.8 | 4.3 |
| FSU | 2.7 | 0.2 | 1.3 | 4.5 | 9.7 | 7.7 |
| MENA | 0.4 | 0.2 | 0.3 | 6.5 | 5.7 | 6.0 |
| SSA | 0.2 | 0.4 | 0.3 | 6.5 | 11.1 | 9.8 |
| **HICs** | **12.8** | **0.2** | **4.2** | **2.9** | **6.2** | **5.1** |
| **DCs** | **3.4** | **0.4** | **1.9** | **9.6** | **9.2** | **9.4** |
| **WORLD** | **5.7** | **0.3** | **2.7** | **7.3** | **7.9** | **7.7** |

[a] *See Appendix Table A1 for details of regions, including the classification of high-income and developing countries.*
[b] *Average subsidy on output (including total subsidy payments on output, intermediate inputs and primary factor inputs), weighted by the value of output at market prices.*
[c] *Average tariff weighted by imports at cif prices, excluding intra-EU trade.*
*Source: Authors' calculations from updated 2019 GTAP database.*

[10] The applied tariffs are import-weighted averages over each bilateral trade, many of which are below MFN rates because of a customs union or free trade agreement. These are not updated in the current study, so remain at their 2014 GTAP levels.

*Table 4 Average domestic support and tariffs in the updated GTAP Data Base, by agricultural sector (%)*

| | Domestic subsidies, 2019[a] | | | Tariffs, 2014[b] | | |
|---|---|---|---|---|---|---|
| | **HICs** | **DCs** | **WORLD** | **HICs** | **DCs** | **WORLD** |
| Rice[c] | 5.0 | 2.8 | **3.0** | 15.9 | 10.7 | **11.5** |
| Wheat | 14.4 | 5.1 | **7.9** | 29.1 | 6.8 | **9.4** |
| Coarse grains | 14.2 | 3.9 | **6.9** | 6.9 | 26.8 | **22.0** |
| Vegetable oils[c] | 5.7 | 1.4 | **2.4** | 1.4 | 11.5 | **8.9** |
| Sugar[c] | 2.2 | 1.8 | **1.9** | 9.8 | 10.4 | **10.3** |
| Cotton | 25.3 | 11.0 | **13.6** | 0.5 | 0.6 | **0.6** |
| Beef & lamb[c] | 3.4 | 0.8 | **1.8** | 11.6 | 7.5 | **9.1** |
| Pork & poultry[c] | 4.2 | 1.2 | **2.3** | 12.8 | 8.1 | **10.0** |
| Dairy[c] | 3.8 | 0.9 | **2.3** | 8.8 | 6.6 | **7.1** |
| Wool | 4.8 | 2.4 | **2.8** | 1.9 | 3.4 | **2.8** |
| Other crops and processed food[d] | 3.2 | 1.8 | **2.3** | 3.2 | 7.9 | **5.4** |

[a] *Average subsidy applied on output, weighted by the value of output at market prices.*
[b] *Average tariff weighted by imports at cif prices, excluding intra-EU trade.*
[c] *Includes the raw and processed sectors.*
[d] *Includes the vegetables & fruit, other crops and other food sectors.*
*Source: Source: Authors' calculations from updated 2019 GTAP Data Base.*

Clearly there is a wide range of domestic support levels across products and across regions. They are mostly on primary products rather than processed food.[11] The largest rates of domestic support are in high-income countries plus China and India, whereas tariffs on farm products are spread across both high-income and developing countries.

We present some overall macroeconomic results, including impacts on real GDP, output, trade and farm incomes, before turning to a range of sectoral results for various agricultural and food sectors. Interpreting the results is helped by being aware of the shares of each region in global production and consumption of each sector's output. Those shares are summarised in Appendix Tables A7 and A8.

## 5.2 Macroeconomic results

Removing all domestic supports to farmers globally would boost real global GDP by US$4.7 billion per year. While this is a trivial share of global GDP, its proportional impact on the GDP of some regions is considerably higher because there is a substantial cross-country spread in the economic consequences of this reform (column 1 of Table 5). These changes in GDP are the net result of removal of own-country domestic support programs plus removal of domestic support programs in the rest of the world. Regions reducing domestic support generally experience increases in real GDP, including Europe, North America and South Asia (due to India). For the North East Asia region, there is a reduction in real GDP for China, where the positive impact on net exports is not sufficient to offset the reduction in investment and

[11] As earlier discussed, all OECD subsidies need to be allocated to specific primary sectors to integrate domestic support into the GTAP Data Base.

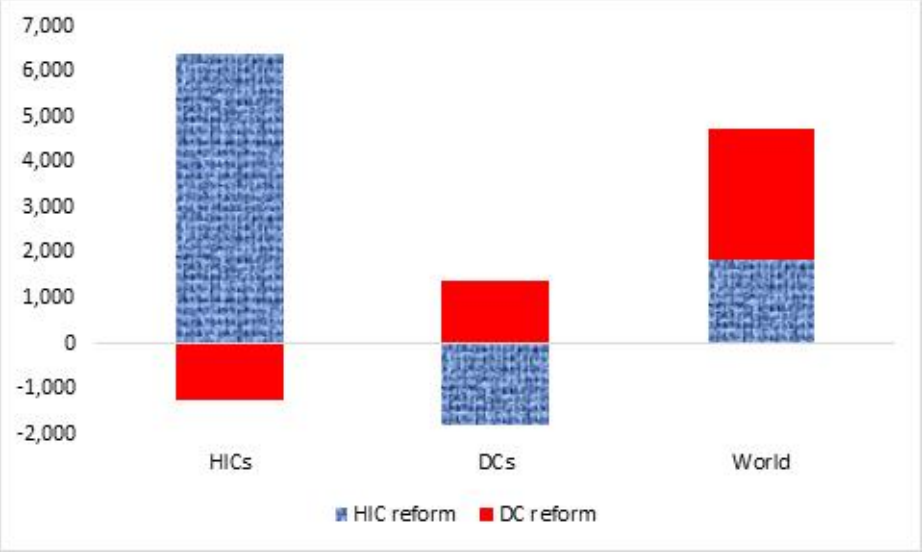
household consumption and in the country's international terms of trade (shown in Appendix Table A9). Figure 8 decomposes the total impact on GDP into the proportion due to reforms in HICs and DCs. Of the total global gains from eliminating farm product subsidies, approximately 60% is due to reform by developing countries.

*Table 5 Simulated change in real GDP for aggregate regions, 2019 (US$m and %)*

| | US$m | % |
|---|---|---|
| Oceania | 356 | 0.02 |
| North East Asia | -1,350 | -0.01 |
| South East Asia | -382 | -0.01 |
| South Asia | 2,031 | 0.06 |
| North America | 2,058 | 0.01 |
| Europe | 2,036 | 0.01 |
| Latin America | 1,166 | 0.02 |
| FSU | -482 | -0.02 |
| MENA | -251 | -0.01 |
| SSA | -464 | -0.02 |
| **HICs** | **5,134** | **0.01** |
| **DCs** | **-417** | **0.00** |
| **WORLD** | **4,717** | **0.01** |

*Source: Authors' simulation results.*

*Figure 8 Approximate contribution of HIC and DC reform to total GDP change, 2019 (%)*




*Source: Authors' simulation results.*

Removal of own-country policies generally adds to own-country GDP gains, but removal of those policies globally raises agricultural prices in international markets. This could be an extra benefit, or lower the gain to a country, depending on whether it is a net exporter or net importer

of the farm products whose prices have risen. Those price rises range from 3 to 11% depending on the product. There is an expansion of farm output in non-subsidising countries in response to the rise in the international prices but, since the reform is a net reduction in producer incentives, global output shrinks. The shrinkage is small though: just 1% in total for food and agriculture. High-income countries' output shrinks by several times that global average while output in developing countries expands, especially in Latin America (Table 6). Removal of domestic supports causes both primary agriculture and processed food production to fall most in Europe and next in North America, and to expand most (proportionately) in Oceania but also in most developing country regions (the main exception being South Asia). This is consistent with the high incidence of domestic support in the former regions and India and their near-absence in Oceania (Table 4).

*Table 6 Simulated change in real output by aggregate region and sector, 2019 (%)*

| | **Primary agriculture** | **Processed foods** |
|---|---|---|
| Oceania | 2.3 | 1.4 |
| North East Asia | -0.2 | -0.3 |
| South East Asia | 0.4 | 0.6 |
| South Asia | -1.1 | -2.1 |
| North America | -1.9 | -0.5 |
| Europe | -7.2 | -3.6 |
| Latin America | 1.8 | 0.1 |
| FSU | 0.6 | 0.0 |
| MENA | 2.9 | 0.6 |
| SSA | 1.8 | 0.4 |
| **HICs** | **-5.0** | **-2.3** |
| **DCs** | **0.5** | **0.0** |
| **World** | **-0.9** | **-1.0** |

*Source: Authors' simulation results.*

Most of the national economic gains from removing domestic supports accrue to the reforming countries, notably North America and Europe. However, developing countries, including those that have no such support programs are affected by the reform's impact on their international terms of trade (see Table A9). The non-subsidising countries that are net importers of those products that are no longer supported elsewhere lose economic welfare, because of the rise in the price of those imports, while those that are net exporters of supported products gain. In terms of real GDP, East Asia would be a net loser (-$1.7b) as would Africa, the Middle East and the former Soviet Union (-$1.2b) while South Asia would gain more than $2b and Latin America $1.2b (Table 5).

The aggregate trade effects of domestic support reforms are not huge, because they occur in both exporting and importing countries and so offset each other somewhat, unlike for tariffs which by design all reduce trade. Table 7 shows the change in real exports and imports of primary agricultural and processed foods for each aggregate region. These results indicate that DCs increase primary agricultural exports by 10.2%, with a smaller 1.2% increase in exports of processed foods. HICs, on the other hand, reduce primary agricultural exports by 8.5% and

processed food exports by 3.4%. While imports of primary agricultural products increase by 2.8% in HICs, they reduce by 1.9% in DCs, with processed food imports reducing globally by 1.4%. The changes in each country's international terms of trade affect trade of all sectors: exports of primary agricultural, processed foods and all exports from each aggregate region to the other aggregate regions are reported in Appendix Table A10.

*Table 7 Simulated change in export and import volumes of farm products, aggregate regions, 2019 (%)*

| | Real exports | | Real imports | |
|---|---|---|---|---|
| | Primary agriculture | Processed foods | Primary agriculture | Processed foods |
| Oceania | 5.7 | 3.5 | 0.8 | -1.3 |
| North East Asia | 4.9 | 3.4 | -1.2 | -0.8 |
| South East Asia | 6.6 | 2.5 | -0.8 | -0.6 |
| South Asia | 3.9 | -10.1 | -0.7 | 0.1 |
| North America | -3.3 | 1.9 | 0.9 | -1.3 |
| Europe | -12.8 | -5.3 | 3.4 | -1.7 |
| Latin America | 8.3 | 1.6 | -0.9 | -0.6 |
| FSU | 7.9 | 1.5 | -2.8 | -2.3 |
| MENA | 22.3 | 4.3 | -4.3 | -1.4 |
| SSA | 19.9 | 3.1 | -3.7 | -2.3 |
| **HICs** | **-8.5** | **-3.4** | **2.8** | **-1.3** |
| **DCs** | **10.2** | **1.2** | **-1.9** | **-1.5** |
| **WORLD** | **0.2** | **-1.4** | **0.2** | **-1.4** |

*Source: Authors' simulation results.*

How would these reforms affect net farm incomes in the world's various regions as prices and quantities of factors employed on farms change as a result of these global farm policy reforms? Table 8 shows very considerable differences in impacts across regions. For Southeast Asia farmers' incomes would be 3% higher on average, in Sub-Saharan Africa they would be 4% higher, and in Latin America and the Middle East (and Oceania) they would be about 6% higher. Of course that reform would lower net farm incomes in Europe (by one-sixth) and North America (by one-eighth), but there would be a fall (4%) in South Asia as well, because of the removal of India's massive farm input subsidies.

*Table 8 Simulated change in net farm income,[a] aggregate regions, 2019 (US$m and %)*

| | US$m | % |
|---|---|---|
| Oceania | 2,262 | 6.6 |
| North East Asia | -32,318 | -3.5 |
| South East Asia | 8,225 | 3.3 |
| South Asia | -18,678 | -4.3 |
| North America | -24,166 | -12.4 |
| Europe | -54,639 | -17.4 |
| Latin America | 15,441 | 6.1 |
| FSU | 2,553 | 2.7 |
| MENA | 5,358 | 5.5 |
| SSA | 10,185 | 4.2 |
| **HICs** | **-79,907** | **-15.3** |
| **DCs** | **-5,869** | **-0.3** |
| **WORLD** | **-85,776** | **-3.0** |

[a] *Total factor returns from primary agriculture sectors.*
*Source: Authors' simulation results.*

## 5.3 Select sectoral results

How the global gain from removing agricultural domestic supports ($4.7b) is contributed to by various commodity programs can be seen by examining the relative impact of reform in different sectors. It reveals that crops account for 60% of that global gain from domestic support reform, and livestock products 22% (of which beef & lamb contribute 18%), with other processed foods responsible for the remaining 18%. Crops dominate the gain to North America and South Asia, while livestock (especially pork & chicken) dominate Europe's gain. The losses to East Asia, Africa and the Middle East are predominantly due to the removal of crop supports.

The effects of reform on global outputs (which equal intermediate input and final good consumption), exports (which equal imports) and international prices are reported by sector in Table 9. Global output/consumption declines by less than 2% in any sector, while average export prices rise by between 3 and 11%. International trade alters, as countries respond to the new incentives that allow them to more easily exploit their comparative advantages. With domestic support removed, the sectoral trade changes are less than 4% and are negative for some sectors while tariffs remain in place.

In what follows we further disaggregate those sectoral results from removing domestic supports so as to show their effects on various regions. Six case studies are reported: cotton, rice, beef & lamb, coarse grains plus oilseeds (because they are major inputs into livestock production), along with processed vegetable oils, pork & poultry (because it is consumed so much in developing countries) and dairy products.

*Table 9 Simulated change in world real output, real exports and export prices by sector, 2019 (%)*

| | Real output | Real exports | Export prices |
|---|---|---|---|
| Rice[a] | -0.7 | -0.6 | 5.1 |
| Wheat | -0.5 | -1.8 | 9.1 |
| Coarse Grains | -0.7 | -1.1 | 7.6 |
| Vegetable Oils[a] | -0.7 | -0.5 | 4.3 |
| Sugar[a] | -0.6 | -0.6 | 2.9 |
| Cotton | -1.2 | -0.6 | 10.8 |
| Beef & Lamb[a] | -1.3 | 0.6 | 4.6 |
| Pork & Poultry[a] | -1.4 | -2.9 | 7.1 |
| Dairy[a] | -1.6 | -3.9 | 5.2 |
| Vegetables & Fruit | -0.5 | 1.7 | 9.9 |
| Other Crops | -1.2 | 2.3 | 7.9 |
| Wool | -0.7 | -0.8 | 3.3 |
| Other Food | -0.7 | -1.2 | 2.6 |

[a] *Aggregated raw and processed commodity.*
*Source: Authors' simulation results.*

### *5.3.1 Cotton*

Cotton production receives a great deal of domestic support in several large countries, most notably the United States and China, while tariff protection for this sector is minimal (Table 4). Because those supportive countries are so important in the global cotton market, the removal of their supports has a large impact on the price of cotton in the international market. In fact, at 11%, it is the largest of all the commodity price rises in column 3 of Table 9. That estimate is very similar to the 10 to 13% price rise estimates in Anderson and Valenzuela (2007) and a number of other analyses cited therein.

In our 2019 database, cotton comprises less than 0.1% of total global merchandise exports and so the impact of subsidy elimination is very minor globally. However, for countries such as the Sub-Saharan African cotton producers of Burkina Faso, Benin and the Rest Cotton SSA countries (including Chad and Mali: see Appendix Table A1), the impact of cotton subsidies is substantial. These countries contributed almost 10% of global cotton exports in 2019. Cotton comprises just over 2% of total exports from this region, while for Burkina Faso and Benin more than 10% of their national exports earnings come from cotton.

Table 10 summarises some results of the impacts of removing global cotton subsidies on this set of SSA countries and on select South Asian and MENA countries. Cotton output increases by one-eighth in those African countries, and their real cotton exports increase by one-quarter, with the value of cotton exports increasing by US$622m per year net. The expansion of the cotton industry along with increased prices lead to a 19% or US$442m increase in cotton farm net incomes in those African countries. The results are not as dramatic for South Asia because that region is far less focused on exporting raw cotton, much of which is destined for the domestic textile industry.

*Table 10 Simulated impact of domestic support removal on cotton in select export-increasing Sub-Saharan African, Asian and MENA countries, 2019 (US$m and %)*

| | Burkina Faso | Benin | All SSA cotton countries[b] | Pakistan | Bangladesh | Rest South Asia[c] | Egypt | All MENA |
|---|---|---|---|---|---|---|---|---|
| Real output (%) | 13.3 | 14.3 | **12.1** | 1.4 | 13.5 | 11.3 | 7.9 | **5.9** |
| Export price (%) | 5.4 | 6.0 | **4.5** | 3.0 | 7.8 | 5.5 | 2.7 | **3.7** |
| Real exports (%) | 22.3 | 16.6 | **24.9** | 31.4 | 19.4 | 20.2 | 42.5 | **43.6** |
| Real imports (%) | 8.9 | 4.4 | **-5.8** | -12.7 | -0.7 | -4.0 | -16.6 | **-10.5** |
| Value of net exports ($m) | 153 | 88 | **622** | 108 | 14 | 44 | 83 | **185** |
| Cotton net farm income (%)[a] | 22.0 | 22.3 | **18.7** | 5.1 | 24.3 | 20.0 | 11.9 | **10.6** |
| Cotton net farm income ($m)[a] | 110 | 67 | **442** | 214 | 137 | 30 | 88 | **135** |

[a] *Change in value of total factor returns.*
[b] *Includes Burkina Faso, Benin, and RestCottonSSA (an aggregation of Côte d'Ivoire, Cameroon, Togo and the GTAP composite regions Rest of Western Africa including Mali and Rest of Central Africa including Chad).*
[c] *Includes Nepal, Sri Lanka and the GTAP composite region Rest of South Asia (Afghanistan, Bhutan and Maldives).*
*Source: Authors' simulation results.*

### *5.3.2 Rice*

Removing domestic supports globally leads to rice output and exports expanding in some Asian countries (notably Pakistan and Thailand) and also in South America (but less so, see Table 11). Net incomes from rice production are higher in all countries shown in Table 11, again most notably in Pakistan and Thailand but also non-trivially in other SE Asian and Latin American countries.

*Table 11 Simulated impact of domestic support removal on rice in select export-increasing Asian and Latin American countries, 2019 (US$m and %)*

| | Thailand | Select SE Asia (RestSEAsia)[b] | Pakistan | Argentina | Brazil | Rest South America[c] |
|---|---|---|---|---|---|---|
| Real output (%) | 2.6 | 0.1 | 6.4 | 2.6 | 0.3 | 1.1 |
| Export price (%) | 3.1 | 1.5 | 2.5 | 2.2 | 3.1 | 3.0 |
| Real exports (%) | 6.5 | 13.0 | 13.5 | 17.7 | 9.1 | 7.3 |
| Real imports (%) | 0.5 | -3.4 | 5.0 | -2.6 | 0.2 | 0.0 |
| Value of net exports ($m) | 613 | 51 | 425 | 67 | 53 | 90 |
| Paddy rice net farm income (%)[a] | 10.1 | 1.8 | 10.0 | 9.9 | 4.2 | 6.1 |
| Paddy rice net farm income ($m)[a] | 578 | 215 | 268 | 15 | 86 | 122 |

[a] *Change in value of total factor returns.*
[b] *Brunei Darussalam, Cambodia, Lao PDR and the GTAP composite region Rest of Southeast Asia (Myanmar and Timor-Leste)*
[c] *Bolivia, Ecuador, Paraguay, Peru, Uruguay, Venezuela and the GTAP composite region Rest of South America.*
*Source: Authors' simulation results.*

### *5.3.3 Beef and sheepmeat*

Removing domestic cattle and sheep subsidies would benefit much of non-subsidising Latin America, which in 2019 accounted for around one-eighth of global production and almost one-fifth of global exports of those ruminant meats.

Specifically, domestic support removal raises Latin American export prices for these meats by 2 to 3%. That leads to increased real exports and lower real imports for the countries shown in Table 12, with the value of net exports increasing by more than $600m for Latin America. There are also sizeable increases in net income from raising these livestock, with farm incomes increasing by almost $900m for the region.

*Table 12 Simulated impact of domestic support removal on the beef and sheepmeat sector in select export-increasing Latin American countries, 2019 (US$m and %)*

| | Argentina | Caribbean | Rest South America[b] | All Latin America |
|---|---|---|---|---|
| Real output (%) | 0.3 | 0.9 | 1.5 | **-0.1** |
| Export price (%) | 3.2 | 1.8 | 2.1 | **3.1** |
| Real exports (%) | 4.2 | 9.7 | 8.1 | **1.9** |
| Real imports (%) | -3.3 | -3.7 | -0.2 | **-1.0** |
| Value of net exports ($m) | 107 | 88 | 282 | **624** |
| Cattle and sheep net farm income (%)[a] | 5.1 | 6.1 | 5.5 | **3.0** |
| Cattle and sheep net farm income ($m)[a] | 161 | 80 | 226 | **883** |

[a] *Change in value of total factor returns.*
[b] *Bolivia, Ecuador, Paraguay, Peru, Uruguay, Venezuela and the GTAP composite region Rest of South America.*
*Source: Authors' simulation results.*

### *5.3.4 Coarse grains*

Coarse grains (the vast majority of which is maize) are important export items in numerous Latin American and other developing countries. Removal of coarse grain domestic supports globally leads to export price rises and output expansions in those industries in the countries shown in Table 13. Not surprisingly the net farm income from these activities also rises, by between 5% and 11%.

*Table 13 Simulated impact of domestic support removal on the coarse grain sector in select export-increasing countries, 2019 (US$m and %)*

| | Argentina | Brazil | Chile | Ukraine | Thailand |
|---|---|---|---|---|---|
| Real output (%) | 2.5 | 1.0 | 5.1 | 2.0 | 1.2 |
| Export price (%) | 4.1 | 4.8 | 5.3 | 5.9 | 4.6 |
| Real exports (%) | 3.9 | 2.5 | 6.9 | 2.2 | 2.0 |
| Real imports (%) | -2.0 | 0.3 | 1.1 | -0.8 | -0.1 |
| Value of net exports ($m) | 398 | 354 | 30 | 380 | 20 |
| Coarse grain net farm income (%)[a] | 8.1 | 4.5 | 11.2 | 9.1 | 7.9 |
| Coarse grain net farm income ($m)[a] | 358 | 324 | 24 | 225 | 44 |

[a] *Change in value of total factor returns.*
*Source: Authors' simulation results.*

### *5.3.5 Oilseeds, oils and meal*

Results for oilseeds and derivative products are in Tables 14 and 15. Table 14, for the unprocessed form such as soybean, reveals that farm incomes would rise by as much as 14% and exports would rise considerably too. In Table 15, oils are included because they are additional to seeds export in South America and are the main form of export item (palm oil) for Southeast Asia. For those five countries alone, the value of net exports of these products would be higher by $5.8 billion per year.

*Table 14 Simulated impact of domestic support removal on the oilseed sector in select export-increasing Latin American and African developing countries, 2019 (US$m and %)*

| | Caribbean | Rest South America[b] | Nigeria | Mozambique | All SSA |
|---|---|---|---|---|---|
| Real output (%) | 2.7 | 7.0 | 0.8 | 8.5 | **1.4** |
| Export price (%) | 5.3 | 3.5 | 0.9 | 2.8 | **2.4** |
| Real exports (%) | 3.7 | 10.5 | 21.8 | 13.0 | **14.1** |
| Real imports (%) | 0.4 | 0.2 | -4.6 | 4.3 | **-0.2** |
| Value of net exports ($m) | 22 | 624 | 63 | 22 | **418** |
| Oilseed net farm income (%)[a] | 8.8 | 13.7 | 1.7 | 11.7 | **3.9** |
| Oilseed net farm income ($m)[a] | 92 | 462 | 70 | 20 | **658** |

[a] *Change in value of total factor returns.*
[b] *Bolivia, Ecuador, Paraguay, Peru, Uruguay, Venezuela and the GTAP composite region Rest of South America.*
*Source: Authors' simulation results.*

*Table 15 Simulated impact of domestic support removal on the oilseed and processed vegetable oils & fat sectors in select export-increasing Asian and South American countries, 2019 (US$m and %)*

| | Indonesia | Malaysia | Philippines | Argentina | Brazil |
|---|---|---|---|---|---|
| Real output (%) | 1.6 | 1.7 | 3.2 | 0.4 | 2.0 |
| Export price (%) | 2.4 | 2.5 | 1.9 | 3.3 | 4.5 |
| Real exports (%) | 2.6 | 2.6 | 8.8 | 1.0 | 3.2 |
| Real imports (%) | -1.9 | -0.6 | -1.3 | 1.5 | 0.5 |
| Value of net exports ($m) | 1,026 | 715 | 78 | 985 | 2,951 |
| Oilseed net farm income (%)[a] | 3.9 | 6.0 | 5.3 | 7.0 | 6.0 |
| Oilseed net farm income ($m)[a] | 766 | 702 | 124 | 698 | 1,278 |

[a] *Change in value of total factor returns.*
*Source: Authors' simulation results.*

### *5.3.6 Pork and poultry*

Non-ruminant meat production and consumption is common in most developing countries. Subsidies to its production are not huge but they are larger than for beef & sheepmeat and again are mostly in high-income countries (Table 4). The impact on farmer net incomes from these activities range from 2 to 12% for the countries shown in Table 16.

*Table 16 Simulated impact of domestic support removal on the pork and poultry sector in select export-expanding countries, 2019 (US$m and %)*

| | Indonesia | Malaysia | Thailand | Ukraine | Morocco |
|---|---|---|---|---|---|
| Real output (%) | 0.2 | 0.6 | 4.9 | 2.0 | 0.6 |
| Export price (%) | 1.7 | 2.6 | 2.9 | 4.8 | 3.1 |
| Real exports (%) | 14.9 | 5.3 | 21.3 | 4.9 | 21.9 |
| Real imports (%) | -4.2 | -4.2 | 0.3 | -8.4 | -10.1 |
| Value of net exports ($m) | 75 | 31 | 743 | 50 | 18 |
| Other animals net farm income (%)[a] | 1.7 | 4.2 | 12.1 | 8.5 | 4.9 |
| Other animals net farm income ($m)[a] | 127 | 130 | 395 | 73 | 53 |

[a] *Change in value of total factor returns.*
*Source: Authors' simulation results.*

### *5.3.7 Dairy products*

The rate of subsidization of dairy is similar to that for pork&poultry, so its removal has a similar positive effect on exports and farm incomes of many developing countries, three of which are shown in Table 16, again just by way of illustration.

*Table 17 Simulated impact of domestic support removal on the dairy sector in select export-expanding countries, 2019 (US$m and %)*

| | Argentina | Chile | Ukraine |
|---|---|---|---|
| Real output (%) | 0.5 | 0.3 | 0.8 |
| Export price (%) | 2.3 | 1.9 | 2.5 |
| Real exports (%) | 3.7 | 6.0 | 4.1 |
| Real imports (%) | -2.5 | -2.8 | -7.1 |
| Value of net exports ($m) | 80 | 20 | 28 |
| Raw milk net farm income (%)[a] | 5.1 | 4.3 | 7.2 |
| Raw milk net farm income ($m) [a] | 103 | 23 | 69 |

[a] *Change in value of total factor returns.*
*Source: Authors' simulation results.*

# 6 Concluding Comments

It is nearly two decades since the end of the 1995-2004 implementation of the Uruguay Round Agreement on Agriculture (URAA) by WTO member countries. That Agreement brought disciplines to market access barriers (which were tarrified and bound), to export subsidies, and to domestic support to farmers in member countries. Tariffs have been lowered further in numerous countries since then, and remaining export subsidies on farm products were removed for most countries in 2015 or soon thereafter. Domestic support to farmers has risen in some countries, however, sometimes as a way of re-instrumenting the support to producers that was eroded by tariff reform. Such supports are now the focus of attention at the WTO, and will be on the agenda of the biennial WTO Trade Ministerial meeting in late 2021.

It is possibly going to become increasingly important to bring stronger disciplines to domestic support to ensure such measures don't become a substitute for tariffs. That is why the present study, commissioned by the New Zealand Ministry for Primary Industries, sought to estimate the impacts of agricultural domestic supports globally and in both farm-supporting countries and other – especially developing – economies. It has done so by calibrating the database of the global economywide GTAP model to 2019 and then shocking the model by removing domestic supports globally.

The estimated impacts of globally removing domestic support are non-trivial. The negative impacts on farmers are confined to just North America, Europe, Northeast Asia and India whereas farmers in most other regions gain. As well, removing domestic supports benefits government budgets and thus would allow society to re-purpose that spending to achieve more socially desirable objectives, even after compensating losing farmers (World Bank & IFPRI 2021; FAO, UNDP & UNEP 2021). That could include investing in growth-enhancing rural public goods such as education, health, transport and communication infrastructure, and agricultural research. It could also include paying farmers and others for their provision of more ecosystem services if they are currently under-provided – although care in incentive design is required to ensure optimal provision (see Wunder et al. 2020). For these reasons it may be easier to multilaterally negotiate cuts in domestic support than cuts in tariffs on farm products.

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# Appendix Tables

*Table A1 Regions modelled*

| No. | Regions modelled | Original GTAP regions[a] | Aggregated regions for reporting | High Income/ Developing Country status |
|---|---|---|---|---|
| 1 | Australia | aus | Oceania | HIC |
| 2 | New Zealand | nzl | Oceania | HIC |
| 3 | Pacific Islands | xoc | Oceania | DC |
| 4 | China | chn | North East Asia | DC |
| 5 | Hong Kong | hkg | North East Asia | DC |
| 6 | Japan | jpn | North East Asia | HIC |
| 7 | Korea | kor | North East Asia | DC |
| 8 | Taiwan | twn | North East Asia | DC |
| 9 | Rest East Asia | mng xea | North East Asia | DC |
| 10 | Indonesia | idn | South East Asia | DC |
| 11 | Malaysia | mys | South East Asia | DC |
| 12 | Philippines | phl | South East Asia | DC |
| 13 | Singapore | sgp | South East Asia | DC |
| 14 | Thailand | tha | South East Asia | DC |
| 15 | Viet Nam | vnm | South East Asia | DC |
| 16 | Rest SE Asia | brn khm lao xse | South East Asia | DC |
| 17 | Bangladesh | bgd | South Asia | DC |
| 18 | India | ind | South Asia | DC |
| 19 | Pakistan | pak | South Asia | DC |
| 20 | Rest South Asia | npl lka xsa | South Asia | DC |
| 21 | Canada | can | North America | HIC |
| 22 | US | usa | North America | HIC |
| 23 | Mexico | mex | Latin America | DC |
| 24 | Argentina | arg | Latin America | DC |
| 25 | Brazil | bra | Latin America | DC |
| 26 | Chile | chl | Latin America | DC |
| 27 | Colombia | col | Latin America | DC |
| 28 | Costa Rica | cri | Latin America | DC |
| 29 | Caribbean | gtm hnd nic pan slv xca dom jam pri tto xcb | Latin America | DC |
| 30 | Rest South America | bol ecu pry per ury ven xsm | Latin America | DC |
| 31 | EU27 | aut bel bgr hrv cyp cze dnk est fin fra deu grc hun irl ita lva | Europe | HIC |

| No. | Regions modelled | Original GTAP regions[a] | Aggregated regions for reporting | High Income/ Developing Country status |
|---|---|---|---|---|
| | | ltu lux mlt nld pol prt rou svk svn esp swe | | |
| 32 | UK | gbr | Europe | HIC |
| 33 | Switzerland | che | Europe | HIC |
| 34 | Norway | nor | Europe | HIC |
| 35 | Russian Federation | rus | FSU | DC |
| 36 | Ukraine | ukr | FSU | DC |
| 37 | Res tEurope | xef srb alb xer | Europe | DC |
| 38 | Kazakhstan | kaz | FSU | DC |
| 39 | Rest FSU | blr xee kgz tjk xsu arm aze geo | FSU | DC |
| 40 | Turkey | tur | Europe | DC |
| 41 | Egypt | egy | MENA | DC |
| 42 | Israel | isr | MENA | DC |
| 43 | Rest Middle East | bhr irn irq jor kwt lbn omn pse qat sau syr are xws | MENA | DC |
| 44 | Morocco | mar | MENA | DC |
| 45 | Tunisia | tun | MENA | DC |
| 46 | Ghana | gha | SSA | DC |
| 47 | Nigeria | nga | SSA | DC |
| 48 | Senegal | sen | SSA | DC |
| 49 | Kenya | ken | SSA | DC |
| 50 | Mozambique | moz | SSA | DC |
| 51 | South Africa | zaf | SSA | DC |
| 52 | Burkina Faso | bfa | SSA | DC |
| 53 | Benin | ben | SSA | DC |
| 54 | Rest Cotton SSA | civ cmr tgo xwf xcf | SSA | DC |
| 55 | Rest Africa | xnf gin xac eth mdg mwi mus rwa sdn tza uga zmb zwe xec bwa nam xsc | SSA | DC |
| 56 | Rest of World | xna xtw | North America | DC |

[a] *See https://www.gtap.agecon.purdue.edu/databases/regions.aspx?version=10.211 for full details of the GTAP countries and regions.*

*Table A2 Sectors modelled*

| No. | Sectors modelled | Original GTAP sectors[a] | Aggregated sectors for reporting |
|---|---|---|---|
| 1 | Paddy | pdr | Primary agriculture |
| 2 | ProcRice | pcr | Processed foods |
| 3 | Wheat | wht | Primary agriculture |
| 4 | CoarseGrains | gro | Primary agriculture |
| 5 | Oilseeds | osd | Primary agriculture |
| 6 | VegOilsFat | vol | Processed foods |
| 7 | SugarRaw | c_b | Primary agriculture |
| 8 | Sugar | sgr | Processed foods |
| 9 | Cotton | pfb | Primary agriculture |
| 10 | CattleSheep | ctl | Primary agriculture |
| 11 | Beeflamb | cmt | Processed foods |
| 12 | OtherAnimal | oap | Primary agriculture |
| 13 | PorkPoultry | omt | Processed foods |
| 14 | RawMilk | rmk | Primary agriculture |
| 15 | Dairy | mil | Processed foods |
| 16 | VegFruit | v_f | Primary agriculture |
| 17 | OtherCrops | ocr | Primary agriculture |
| 18 | Wool | wol | Primary agriculture |
| 19 | OtherFood | ofd | Processed foods |
| 20 | BevTob | b_t | Other manufactured |
| 21 | Forestry | frs | Other primary |
| 22 | Fishing | fsh | Other primary |
| 23 | FuelPPrMinPr, Non-ferrous metals | coa oil gas oxt p_c nmm nfm | Other primary |
| 24 | Iron & steel | i_s | Other manufactured |
| 25 | TexLeaWap | tex wap lea | Other manufactured |
| 26 | WoodPapProds | lum ppp | Other manufactured |
| 27 | Chems, pharms, rubber & plastics | chm bph rpp | Other manufactured |
| 28 | Electronics | ele eeq | Other manufactured |
| 29 | OtherManuf | fmp ome mvh otn omf | Other manufactured |
| 30 | Util_Svces | ely gdt wtr cns trd afs otp wtp atp whs cmn ofi ins rsa obs ros osg edu hht dwe | Services |

[a] *See https://www.gtap.agecon.purdue.edu/databases/contribute/detailedsector.asp#Sector65 for full details of the 65 GTAP sectors.*

*Table A3 Aggregate value of consumer tax equivalent, by product and country, 2019 (current US$m per year)*

| | Wheat | Maize | Barley | Rice | Sugar | Soybeans | Other oilseeds | Milk | Beef/Veal | Sheep meat | Wool | Pig meat | Poultry meat | Cotton |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | -117 | -149 | | | | -3,974 | -56 | 1-26 | -1,695 | | | 49 | -750 | |
| Australia | 0 | | 0 | 0 | 0 | | | 0 | | | 0 | 0 | 0 | 0 |
| Brazil | 105 | 0 | | 0 | 0 | 0 | | 0 | 0 | | | 0 | 0 | 0 |
| Canada | 0 | 0 | 0 | | | 0 | 0 | 1,598 | | | | | 132 | |
| Chile | 0 | 0 | | | 14 | | | 0 | 0 | | | 0 | 0 | |
| China | 6,975 | 7,509 | | 7,620 | 5,406 | 8,913 | 5,181 | 8,797 | 9,088 | 6,278 | | 23,367 | 13,751 | 3,781 |
| Colombia | | 603 | | 530 | 0 | | 169 | 450 | 26 | | | 269 | 653 | |
| Costa Rica | | | | 103 | 43 | | | 0 | 0 | | | 59 | 138 | |
| EU27 | 671 | 0 | 49 | 519 | 368 | 0 | 0 | -1 | 7,055 | 0 | | 0 | 4,339 | |
| India | 224 | 1,048 | | -7,353 | 2,312 | 0 | -65 | -28,080 | -269 | 0 | | | 3,730 | 519 |
| Indonesia | | 1,495 | | 9,369 | 1,930 | 0 | -399 | 66 | 339 | | | 85 | 1,701 | |
| Japan | 0 | | 275 | 11,157 | 1,469 | 0 | | 5,575 | 4,908 | | | 5,274 | 429 | |
| Kazakhstan | 41 | -6 | 1 | -100 | | | -64 | 0 | 205 | 0 | | 0 | 0 | -20 |
| Korea | | | 96 | 5,809 | | 312 | | 1,911 | 2,862 | | | 2,302 | 511 | |
| Mexico | 0 | 0 | 0 | 1 | 573 | 0 | | -65 | 0 | | | 35 | 559 | |
| New Zealand | 0 | 0 | 0 | | | | | 0 | 0 | 0 | 0 | 0 | 46 | |
| Norway | 57 | | 45 | | | | | 316 | 234 | 0 | 0 | 124 | 132 | |
| Philippines | 89 | | | 3,490 | 616 | | | | 104 | | | 1,671 | 1,050 | |
| Russian Federation | -45 | 79 | 4 | | 292 | | -395 | 643 | 1,471 | | | 1,693 | 518 | |
| South Africa | 67 | 0 | | | 139 | | 0 | 0 | 0 | 0 | | 0 | 0 | |
| Switzerland | 57 | 9 | 10 | | 0 | | 136 | 113 | 591 | 27 | | 540 | 320 | |
| Turkey | 126 | 0 | 8 | | 0 | | 540 | 0 | 2,474 | 0 | | | 0 | |
| UK | 90 | 0 | 18 | | 5 | | 0 | 0 | 942 | 0 | | 0 | 615 | |
| Ukraine | 0 | 0 | 0 | | 182 | | -138 | -51 | 0 | | | 164 | 0 | |
| US | 0 | 0 | 0 | 0 | 2,852 | 0 | | 6,857 | 253 | 124 | 0 | 0 | 0 | 41 |
| Viet Nam | | 1,495 | | -1,168 | 259 | | | | 379 | | | 0 | -1,027 | |

*Source: OECD (2021)*

*Table A4 Percentage consumer tax equivalent, by product and country, 2019 (%)*

| | Wheat | Maize | Barley | Rice | Sugar | Soybeans | Other oilseeds | Milk | Beef/Veal | Sheep meat | Wool | Pig meat | Poultry meat | Cotton |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | -11 | -17 | | | | -35 | -18 | -24 | -23 | | | 10 | -27 | |
| Australia | 0 | | 0 | 0 | 0 | | | 0 | | | 0 | 0 | 0 | 0 |
| Brazil | 5 | 0 | | 0 | 0 | 0 | | 0 | 0 | | | 0 | 0 | 0 |
| Canada | 0 | 0 | 0 | | | | | 41 | | | | | 6 | |
| Chile | 0 | 0 | | | 4 | | | 0 | 0 | | | 0 | 0 | |
| China | 21 | 23 | | 11 | 156 | 20 | 77 | 46 | 16 | 17 | | 16 | 19 | 29 |
| Colombia | | 52 | | 83 | 0 | | 30 | 23 | 1 | | | 30 | 24 | |
| Costa Rica | | | | 127 | 49 | | | 0 | 0 | | | 46 | 60 | |
| EU27 | 4 | 0 | 2 | 47 | 11 | 0 | 0 | 0 | 31 | 0 | | 0 | 27 | |
| India | 1 | 36 | | -16 | 33 | 0 | -4 | -28 | -13 | 0 | | | 53 | 6 |
| Indonesia | | 97 | | 57 | 461 | 0 | -10 | 11 | 14 | | | 22 | 57 | |
| Japan | 0 | | 37 | 220 | na | 0 | | 100 | 39 | | | 101 | 12 | |
| Kazakhstan | 5 | -5 | -3 | -54 | | | -40 | 0 | 14 | 0 | | 0 | 0 | -14 |
| Korea | | | 84 | 152 | | 48 | | 98 | 42 | | | 65 | 46 | |
| Mexico | 0 | 0 | 0 | 0 | 65 | 0 | | 0 | 0 | | | 1 | 9 | |
| New Zealand | 0 | 0 | 0 | | | | | 0 | 0 | 0 | 0 | 0 | 14 | |
| Norway | 75 | | 72 | | | | | 62 | 73 | 0 | 0 | 45 | 106 | |
| Philippines | 14 | | | 154 | 99 | | | | 10 | | | 40 | 33 | |
| Russian Federation | -1 | 19 | 0.4 | | 30 | | -8 | 5 | 27 | | | 24 | 7 | |
| South Africa | 8 | 0 | | | 47 | | 0 | 0 | 0 | 0 | | 0 | 0 | |
| Switzerland | 18 | 22 | 31 | | 0 | | 82 | 7 | 71 | 38 | | 111 | 418 | |
| Turkey | 3 | 0 | 2 | | 0 | | 47 | 0 | 71 | 0 | | | 0 | |
| UK | 5 | 0 | 2 | | 1 | | 0 | 0 | 29 | 0 | | 0 | 20 | |
| Ukraine | 0 | 0 | 0 | | 307 | | -3 | -2 | 0 | | | 11 | 0 | |
| US | 0 | 0 | 0 | 0 | 197 | 0 | | 21 | 0.4 | 10 | 1 | 0 | 0 | 0 |
| Viet Nam | | 80 | | -13 | 49 | | | | 27 | | | 0 | -27 | |

*Source: OECD (2021)*

*Table A5 Aggregate value of assistance to producers by product and country, 2019 (current US$m per year)*

| | Wheat | Maize | Barley | Rice | Sugar | Soybeans | Other oilseeds | Milk | Beef/Veal | Sheep meat | Wool | Pig meat | Poultry meat | Cotton |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | -363 | -1,143 | | | | -4,858 | -65 | -884 | -2,189 | | | 134 | -686 | |
| Australia | 0 | | 0 | 0 | | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Brazil | 61 | 65 | | 10 | 12 | 166 | | 1 | 99 | | | 4 | 5 | 7 |
| Canada | 121 | 76 | 27 | | | 66 | 99 | 1,626 | 44 | | | 57 | 133 | |
| Chile | 0 | 0 | | | 4 | | | 0 | 0 | | | 0 | 0 | |
| China | 7,583 | 18,283 | | 7,633 | 5,192 | 4,200 | 4,364 | 5,436 | 6,882 | 5,546 | | 18,965 | 12,415 | 5,412 |
| Colombia | | 144 | | 456 | 0 | | | 447 | 25 | | | 210 | 618 | |
| Costa Rica | | | | 44 | 74 | | | 0 | 0 | | | 50 | 133 | |
| EU27 | 1,564 | 1 | 244 | 451 | 665 | 0 | 0 | 1,245 | 9,102 | 611 | | -229 | 4,448 | |
| India | 209 | 1,922 | | -8,748 | 3,648 | 0 | -183 | -32,087 | -585 | -23 | | | 3,541 | 629 |
| Indonesia | | 4,135 | | 7,717 | 1,495 | 6 | | 15 | 194 | | | 56 | 3,594 | |
| Japan | 319 | | 125 | 11,699 | 396 | 221 | | 3,696 | 1,869 | | | 2,477 | 106 | |
| Kazakhstan | 85 | -8 | -13 | -112 | | | -141 | 46 | 326 | 28 | | 6 | 45 | -14 |
| Korea | | | 93 | 4,840 | | 253 | | 916 | 1,516 | | | 2,336 | 426 | |
| Mexico | 141 | 76 | 0 | 5 | 943 | 19 | | 30 | 0 | | | 35 | 559 | |
| New Zealand | 0 | 0 | 0 | | | | | 0 | 0 | 0 | 0 | 0 | 46 | |
| Norway | 80 | | 86 | | | | | 570 | 281 | 65 | 13 | 100 | 126 | |
| Philippines | | 265 | | 3,674 | 613 | | | | 57 | | | 1,076 | 912 | |
| Russian Federation | -123 | 353 | 13 | | 374 | | -393 | 1,068 | 972 | | | 1,427 | 475 | |
| South Africa | 31 | 0 | | | 194 | | 0 | 0 | 0 | 0 | | 0 | 0 | |
| Switzerland | 37 | 12 | 16 | | 37 | | 24 | 480 | 527 | 14 | | 497 | 267 | |
| Turkey | 225 | 26 | 56 | | 33 | | 448 | -11 | 2,462 | -3 | | | -1 | 388 |
| UK | 159 | 0 | 31 | | 3 | | 0 | -6 | 808 | -1 | | -9 | 527 | |
| Ukraine | 0 | 0 | 0 | | 224 | | -141 | -27 | 24 | | | 146 | 0 | |
| US | 707 | 2,367 | 25 | 63 | 1,294 | 1,190 | | 7,584 | 242 | 44 | 0 | 462 | 0 | 1,190 |
| Viet Nam | | 567 | | -1,308 | 243 | | | | 193 | | | -268 | -924 | |

*Source: OECD (2021).*

*Table A6 NRA to producers by sector and country, 2019 (%)*

| | Wheat | Maize | Barley | Rice | Sugar | Soybeans | Other oilseeds | Milk | Beef/Veal | Sheep meat | Wool | Pig meat | Poultry meat | Cotton |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | -11 | -17 | | | | -35 | -9 | -24 | -23 | | | 10 | -27 | |
| Australia | 0 | | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Brazil | 5 | 0 | | 0 | 0 | 0 | | 0 | 0 | | | 0 | 0 | 0 |
| Canada | 0 | 0 | 0 | | | 0 | 0 | 41 | 0 | | | 0 | 6 | |
| Chile | 0 | 0 | | | 4 | | | 0 | 0 | | | 0 | 0 | |
| China | 21 | 23 | | 11 | 156 | 20 | 77 | 46 | 16 | 17 | | 16 | 19 | 55 |
| Colombia | | 52 | | 83 | 0 | | | 23 | 1 | | | 30 | 24 | |
| Costa Rica | | | | 127 | 49 | | | 0 | 0 | | | 46 | 60 | |
| EU27 | 5 | 0 | 2 | 47 | 12 | 0 | 0 | 0 | 31 | 0 | | 0 | 27 | |
| India | 1 | 36 | | -16 | 36 | 0 | -4 | -28 | -13 | 0 | | | 53 | 6 |
| Indonesia | | 97 | | 57 | 461 | 0 | | 11 | 14 | | | 22 | 57 | |
| Japan | 59 | | 138 | 220 | 128 | 86 | | 111 | 41 | | | 101 | 12 | |
| Kazakhstan | 5 | -5 | -3 | -54 | | | -40 | 2 | 14 | 0 | | 0 | 12 | -14 |
| Korea | | | 160 | 152 | | 503 | | 98 | 42 | | | 65 | 46 | |
| Mexico | 21 | 1 | 0 | 9 | 65 | 23 | | 1 | 0 | | | 1 | 11 | |
| New Zealand | 0 | 0 | 0 | | | | | 0 | 0 | 0 | 0 | 0 | 14 | |
| Norway | 87 | | 81 | | | | | 73 | 98 | 69 | 93 | 38 | 103 | |
| Philippines | | 14 | | 154 | 99 | | | | 10 | | | 40 | 33 | |
| Russian Fed. | -1 | 19 | 0 | | 30 | | -8 | 6 | 27 | | | 24 | 7 | |
| South Africa | 8 | 0 | | | 47 | | 0 | 0 | 0 | 0 | | 0 | 0 | |
| Switzerland | 18 | 22 | 31 | | 0 | | 82 | 29 | 71 | 38 | | 111 | 418 | |
| Turkey | 6 | 2 | 4 | | 0 | | 60 | 0 | 71 | 0 | | | 0 | 37 |
| UK | 5 | 0 | 2 | | 1 | | 0 | 0 | 29 | 0 | | 0 | 20 | |
| Ukraine | 0 | 0 | 0 | | 307 | | -3 | -2 | 0 | | | 11 | 0 | |
| US | 0 | 0 | 0 | 0 | 118 | 0 | | 21 | 0 | 10 | 1 | 0 | 0 | 9 |
| Viet Nam | | 80 | | -13 | 49 | | | | 27 | | | 0 | -27 | |

*Source: OECD (2021)*

*Table A7 Regional contributions to global output by product,[a] 2019 updated GTAP Data Base (%)*

| | Oceania | NE Asia | SE Asia | South Asia | North Amer. | Europe | Latin Amer. | FSU | MENA | SSA | All HICs | All DCs | % total agric. & food production |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rice[b] | 0 | 44 | 21 | 25 | 1 | 1 | 5 | 0 | 2 | 2 | **6** | **94** | **7** |
| Wheat | 4 | 25 | 0 | 20 | 9 | 21 | 2 | 8 | 10 | 2 | **30** | **70** | **2** |
| Coarse grains | 1 | 33 | 4 | 4 | 17 | 12 | 11 | 5 | 3 | 11 | **29** | **71** | **3** |
| Veg oils & fats[b] | 1 | 30 | 14 | 7 | 10 | 12 | 16 | 3 | 1 | 4 | **22** | **78** | **8** |
| Sugar[b] | 2 | 24 | 11 | 9 | 8 | 10 | 20 | 4 | 3 | 9 | **20** | **80** | **3** |
| Cotton | 5 | 35 | 1 | 26 | 12 | 6 | 6 | 2 | 2 | 6 | **19** | **81** | **1** |
| Beef & sheep[b] | 4 | 22 | 2 | 3 | 20 | 14 | 12 | 8 | 4 | 10 | **37** | **63** | **11** |
| Pork & poultry[b] | 1 | 31 | 7 | 1 | 15 | 21 | 13 | 3 | 3 | 3 | **39** | **61** | **12** |
| Dairy[b] | 4 | 9 | 2 | 14 | 16 | 31 | 9 | 7 | 4 | 4 | **49** | **51** | **11** |
| Other crops | 1 | 34 | 8 | 11 | 5 | 14 | 8 | 3 | 5 | 10 | **20** | **80** | **15** |
| Wool | 9 | 61 | 1 | 5 | 0 | 10 | 5 | 4 | 3 | 2 | **19** | **81** | **0** |
| Other processed food | 1 | 28 | 6 | 4 | 17 | 25 | 8 | 3 | 4 | 4 | **47** | **53** | **26** |
| **All primary agriculture** | **2** | **30** | **8** | **12** | **10** | **13** | **10** | **4** | **4** | **7** | **24** | **76** | **44** |
| **All processed food** | **2** | **27** | **7** | **6** | **15** | **22** | **10** | **4** | **3** | **5** | **41** | **59** | **56** |
| **All agric. & proc. food** | **2** | **28** | **7** | **8** | **13** | **18** | **10** | **4** | **4** | **6** | **34** | **66** | **100** |

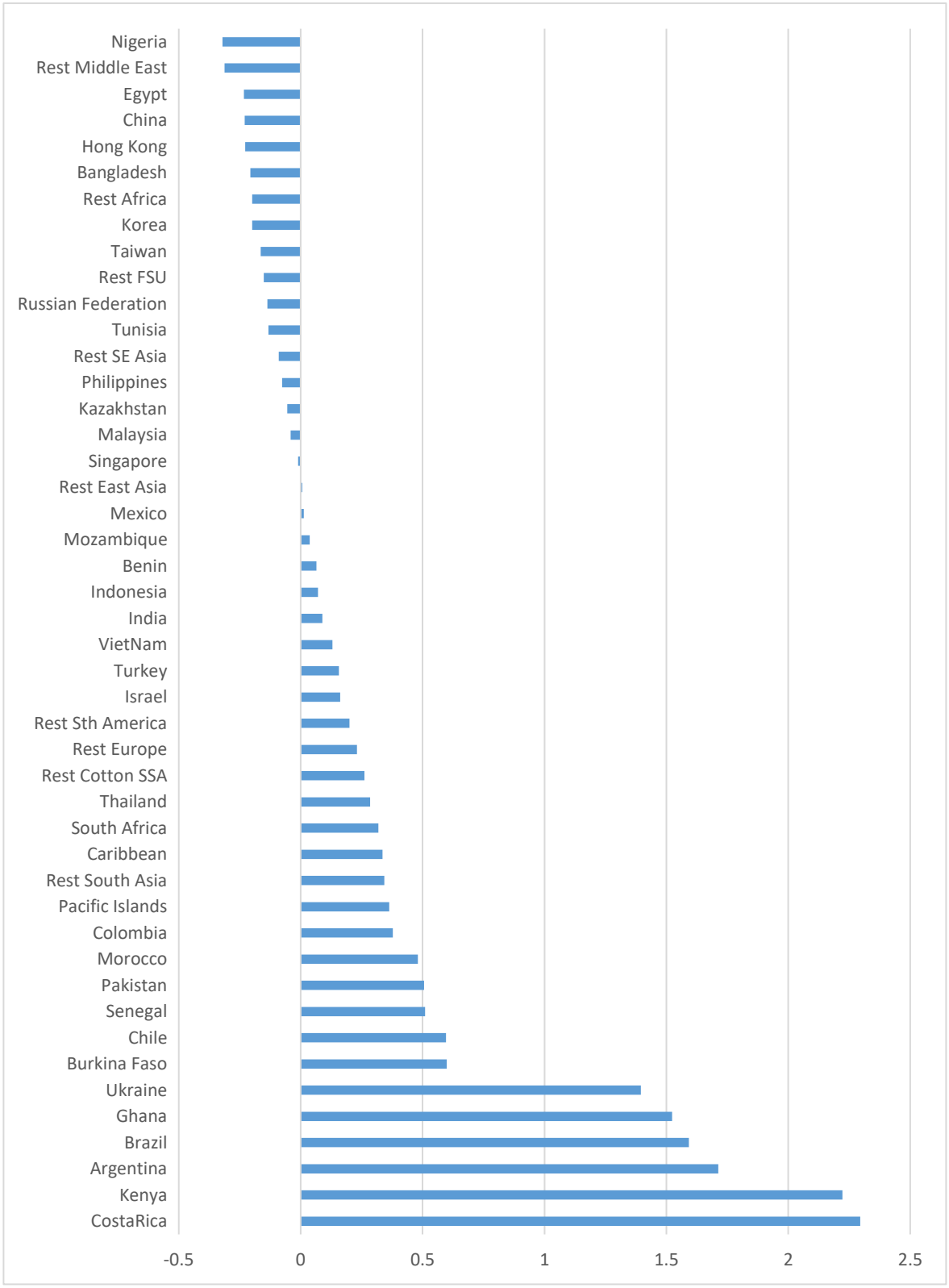
[a] *Production value excluding output taxes.*
[b] *Primary and processed sectors.*
*Source: GTAP v10 Data Base, updated to 2019.*

*Table A8 Regional contributions to global household consumption,[a] by product, updated 2019 GTAP Data Base (%)*

| | Oceania | NE Asia | SE Asia | South Asia | North Amer. | Europe | Latin Amer. | FSU | MENA | SSA | All HICs | All DCs | % total agric. & food consumption |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rice[b] | 0 | 43 | 15 | 26 | 1 | 1 | 6 | 0 | 3 | 5 | **5** | **95** | **7** |
| Wheat | 0 | 17 | 0 | 10 | 1 | 26 | 1 | 8 | 25 | 10 | **23** | **77** | **1** |
| Coarse grains | 0 | 26 | 6 | 10 | 2 | 6 | 7 | 3 | 10 | 31 | **7** | **93** | **2** |
| Veg oils & fats[b] | 1 | 33 | 9 | 18 | 3 | 11 | 9 | 3 | 4 | 10 | **13** | **87** | **5** |
| Sugar[b] | 2 | 5 | 10 | 16 | 8 | 16 | 17 | 7 | 8 | 11 | **24** | **76** | **2** |
| Cotton | 6 | 3 | 10 | 11 | 4 | 30 | 11 | 10 | 8 | 6 | **19** | **81** | **0** |
| Beef & sheep[b] | 1 | 19 | 2 | 2 | 16 | 16 | 12 | 10 | 4 | 18 | **33** | **67** | **11** |
| Pork & poultry[b] | 1 | 27 | 8 | 2 | 14 | 22 | 13 | 4 | 5 | 5 | **37** | **63** | **13** |
| Dairy[b] | 1 | 12 | 3 | 20 | 12 | 24 | 10 | 8 | 5 | 6 | **36** | **64** | **13** |
| Other crops | 1 | 22 | 7 | 14 | 6 | 16 | 8 | 4 | 7 | 15 | **22** | **78** | **16** |
| Wool | 0 | 73 | 2 | 9 | 0 | 10 | 1 | 4 | 1 | 1 | **10** | **90** | **0** |
| Other processed food | 2 | 23 | 6 | 5 | 19 | 23 | 9 | 3 | 5 | 5 | **50** | **50** | **30** |
| **All primary agriculture** | **0** | **26** | **7** | **16** | **5** | **13** | **7** | **5** | **8** | **14** | **17** | **83** | **31** |
| **All processed food** | **1** | **22** | **6** | **8** | **15** | **21** | **11** | **5** | **4** | **7** | **40** | **60** | **69** |
| **All agric. & proc. food** | **1** | **23** | **6** | **10** | **12** | **18** | **10** | **5** | **5** | **9** | **33** | **67** | **100** |

[a] *Including private household spending on domestic and imported products.*
[b] *Primary and processed sectors.*
*Source: GTAP v10 Data Base, updated to 2019.*

*Table A9 Terms of trade change from removal of domestic supports, developing countries and regions, 2019 (%)*




*Source: Authors' simulation results.*

*Table A10 Changes in exports by aggregate region and sector, importing regions in columns (%)*

| | Oceania | NE Asia | SE Asia | South Asia | Nth Amer | Latin Amer | Europe | FSU | MENA | SSA | World |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Oceania** | | | | | | | | | | | |
| Primary agric. | 5 | 5 | 6 | -3 | 5 | 8 | 18 | 11 | 3 | 14 | **6** |
| Proc foods | 2 | 2 | 0 | -4 | 6 | -1 | 20 | 0 | 2 | 1 | **4** |
| All exports | -1 | -1 | -1 | -1 | 0 | -1 | 1 | -1 | 0 | 1 | **-1** |
| **NE Asia** | | | | | | | | | | | |
| Primary agric. | 4 | 2 | 0 | 1 | 2 | 7 | 22 | 9 | 2 | 3 | **5** |
| Proc foods | 1 | 4 | 2 | 7 | 0 | 2 | 9 | 4 | 3 | 2 | **3** |
| All exports | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | **0** |
| **SE Asia** | | | | | | | | | | | |
| Primary agric. | 5 | 3 | 2 | 4 | 6 | 4 | 27 | 7 | 1 | -3 | **7** |
| Proc foods | 1 | 1 | 2 | 2 | 1 | 2 | 8 | 2 | 4 | 3 | **3** |
| All exports | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | **0** |
| **South Asia** | | | | | | | | | | | |
| Primary agric. | 0 | 9 | -1 | -1 | 3 | 4 | 24 | 8 | -2 | -4 | **4** |
| Proc foods | -15 | -12 | -5 | -5 | -24 | -14 | -13 | -9 | -6 | -13 | **-10** |
| All exports | 2 | 1 | 1 | 0 | 0 | 3 | 0 | 1 | 1 | 0 | **1** |
| **Nth Amer** | | | | | | | | | | | |
| Primary agric. | 0 | -7 | -13 | -5 | -2 | -4 | 17 | -2 | -4 | 3 | **-3** |
| Proc foods | 4 | 4 | 0 | 4 | 2 | -1 | 4 | 3 | 2 | 5 | **2** |
| All exports | 1 | -1 | -1 | -1 | -1 | 0 | 0 | 0 | 0 | 0 | **-1** |
| **Europe** | | | | | | | | | | | |
| Primary agric. | -28 | -22 | -23 | -22 | -20 | -25 | -10 | -14 | -24 | -24 | **-13** |
| Proc foods | -10 | -15 | -11 | -5 | -9 | -8 | -4 | -9 | -7 | -9 | **-5** |
| All exports | 1 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | **0** |
| **Latin America** | | | | | | | | | | | |
| Primary agric. | 4 | 4 | 4 | 4 | 3 | 7 | 26 | 6 | 2 | -2 | **8** |
| Proc foods | -1 | 1 | 1 | -1 | -1 | 1 | 8 | -1 | -1 | 0 | **2** |
| All exports | -1 | -1 | -1 | -1 | -1 | -1 | 1 | 0 | -1 | -2 | **-1** |
| **FSU** | | | | | | | | | | | |
| Primary agric. | 11 | 6 | 10 | -4 | 0 | 28 | 14 | 2 | 6 | 13 | **8** |
| Proc foods | 1 | -1 | 0 | -1 | 0 | 2 | 5 | 2 | 0 | 0 | **1** |
| All exports | 0 | 0 | 0 | -1 | 0 | 1 | 0 | -1 | 0 | 2 | **0** |
| **MENA** | | | | | | | | | | | |
| Primary agric. | 12 | 13 | 6 | 10 | 11 | 10 | 50 | 11 | 7 | 9 | **22** |
| Proc foods | 1 | 1 | 4 | 5 | 1 | 2 | 6 | 2 | 5 | 3 | **4** |
| All exports | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | **0** |
| **SSA** | | | | | | | | | | | |
| Primary agric. | 14 | 15 | 11 | 8 | 17 | 13 | 40 | 11 | 7 | 9 | **20** |
| Proc foods | 2 | 1 | 3 | 7 | 0 | 2 | 4 | 1 | 2 | 3 | **3** |
| All exports | -1 | -1 | 1 | 0 | 0 | 0 | 1 | 1 | -1 | -1 | **0** |
| **World** | | | | | | | | | | | |
| Primary agric. | 1 | -1 | -1 | -1 | 1 | -1 | 3 | -3 | -4 | -4 | **0** |
| Proc foods | -1 | -1 | -1 | 0 | -1 | -1 | -2 | -2 | -1 | -2 | **-1** |
| All exports | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | **0** |

*Source: Authors' simulation results.*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