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WHAT IMPACT ARE SUBSIDIES AND TRADE BARRIERS ABROAD HAVING ON AUSTRALASIAN AND BRAZILIAN AGRICULTURE?

Kym Anderson and Ernesto Valenzuela

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Centre for Economic Policy Research
33 Great Sutton Street, London EC1V 0DX, UK
Tel: +44 (0)20 7183 8801
www.cepr.org

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Abstract

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JEL Classification: N/A

Keywords: Agricultural trade distortions, domestic supports, farm subsidies, market access, Trade Negotiations

Kym Anderson - kym.anderson@adelaide.edu.au
Adelaide University and CEPR

Ernesto Valenzuela - ernesto.valenzuela@federation.edu.au
Federation University

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What impact are subsidies and trade barriers abroad having on Australasian and Brazilian agriculture?

Kym Anderson
University of Adelaide and Australian National University
kym.anderson@adelaide.edu.au

and

Ernesto Valenzuela
Federation University
ernesto.valenzuela@federation.edu.au

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Corresponding author:
Professor Kym Anderson
School of Economics,
University of Adelaide
Adelaide SA 5005, Australia
Phone +61 8 8313 4712
kym.anderson@adelaide.edu.au

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Data availability:

The GTAP modelling results are available on request to ernesto.valenzuela@federation.edu.au

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This paper provides new estimates of the extent and economic effects of agricultural policies that provide domestic support or import protection to farmers in countries that compete in the global marketplace with unsubsidized farmers. Analyses earlier this century found that import market access barriers accounted for more than 90% of the global welfare cost of all assistance to farmers, with domestic support measures providing as little as 5%. Since then the share contributed by domestic support has grown greatly in some high-income and emerging economies, thanks to policy re-instrumentation. Using the latest version of the GTAP model and database of the global economy, this paper estimates the economic effects of direct farmer subsidies, and of the producer subsidy and consumer tax equivalents of farm trade policies, on farmers in three lightly assisting countries. The estimates adjusted for country size suggest the effects on agricultural exports, net farm income, and national economic welfare of such policies are far more adverse for Australia, Brazil and especially New Zealand than for the rest of the world, and that domestic supports abroad are much more important contributors to those losses now than they were at the start of this century.

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1. Introduction

Agricultural subsidies and import restrictions have been a feature of the sectoral policies of most high-income countries since the 1950s. Both of these policy measures encourage domestic production, and import restrictions also discourage domestic consumption of the products of protected industries. That reduces opportunities for producers in other countries to sell into such protected markets. Some of those protective countries also have provided export subsidies in addition to various forms of domestic farm support. If those producer subsidies are sufficient to cause these countries to have an export surplus, that also curtails the opportunities for producers in non- or lightly-subsidizing countries, such as Australia, Brazil and New Zealand, to sell into third-country markets.

This issue came to a head in the mid-1980s when a farm export subsidy ‘war’ broke out between North America and Western Europe. It triggered the formation of the Cairns Group of 14 lightly subsidizing agricultural exporting countries, whose express purpose was to ensure agricultural policy reform was placed and remained on top of the agenda of the imminent round of multilateral trade negotiations under the General Agreement on Tariffs and Trade (GATT), the so-called Uruguay Round. That Round was launched in Punta del Este in Uruguay in September 1986 and culminated at the end of 1994 with the GATT being absorbed into what became the World Trade Organisation (WTO) and with numerous reform agreements – including one on agriculture – being implemented over the following ten years.

By 2007, the distortions to agricultural incentives, which had gradually built up during 1955-85, had just as impressively been reduced (Anderson 2009).

During 2007-12, however, international prices of farm products rose dramatically. Together with a global financial crisis around 2008, this triggered farm and food policy reactions in many countries. As a result, the gap between domestic and border prices dropped in food-importing countries as international prices rose, temporarily lowering measured protection and subsidy rates in many countries. Then the reverse happened as international prices fell over the remainder of that decade, particularly following President Trump's election in the United States that led to various tariff 'wars'. This is evident in the huge increase in the number of trade impediments since 2015 (WTO 2019; Evenett and Fritz 2019), and in a US$28 billion boost to US farm subsidies during 2018-19 (Glauber 2019) plus an additional $33 billion in 2020 in response to the COVID-19 crisis (USDA 2020a,b).

The purpose of this study is to take stock of how much various agricultural policy instruments assist farmers in key countries, and what that means for the competitiveness of farmers in Australia and New Zealand (hereafter Australasia) and Brazil. These three countries' farmers receive close to zero rates of government assistance (Figure 1) and are major contributors, along with more-assisted farmers in the US and EU, to global exports of key farm products (Table 1). Brazil is included as a comparator for Australia and New Zealand because, as well as providing very little assistance to its farmers, it is the world's biggest exporter of farm products outside the EU and US (exporting more than twice as much as Australia and 3.5 times as much as New Zealand in 2016).

[Insert Figure 1 and Table 1 about here]

Now is an appropriate time for such a study, not least because the conclusion of various bilateral and regional free trade agreements (FTAs) with most of Australasia's major trade partners warrants a renewed focus on the trade barriers not addressed by those agreements, including agricultural support policies. The study also provides pertinent information on agricultural subsidies and import restrictions of 54 countries to inform negotiations between these three agricultural-exporting countries and their potential FTA partners (most notably the EU and the UK following Brexit).

Early this century, import market access restrictions were estimated to be responsible for 93% of the total global cost of trade-distorting farm policies, with direct production subsidies accounting for just 5% and export subsidies for 2% of that global cost (see Anderson, Martin and Valenzuela 2006 and references cited therein). Export subsidies have since been outlawed by the WTO membership (in 2015), and various forms of farmer support measures that are ostensibly decoupled from current production have been introduced in place of market price supports (Brink and Orden 2020). How much lower now is the extent of farmer support that is provided by price- and trade-distorting policy instruments as compared with potentially less-distortive domestic measures? What are the other forms of support to farmers that have replaced them, and how close do they get to WTO members' maximum entitlements as agreed in the Uruguay Round? How are Australasian and Brazilian farmers impacted by those policies? These and related questions are addressed in this study.

To answer these questions, careful estimates of the extent of price distortions and domestic farm supports are required as inputs into a multi-country, multi-product global economywide model of national markets and international trade. For current purposes we use the latest version of standard GTAP Model and its global database (which is calibrated to 2014). Our main methodological contribution is to show how to distinguish the trade etc. effects in that model of various forms of domestic subsidies (to farm outputs, purchased inputs and primary factors of production) versus trade measures, whereas Anderson, Martin and Valenzuela (2006) and Hertel and Keeney (2006) only compare domestic supports in aggregate with import restrictions and export subsidies. In terms of empirical results, the

paper not only updates those earlier analyses but also reveals effects for three individual exporting countries rather than for just two large groups of countries (OECD members and the rest of the world). It also updates the analysis by Urban, Jensen and Brockmeier (2016) which relates to 2007, looks only at EU domestic supports, and does not report effects on Australia or New Zealand.

The next section outlines the data and methodology to be used. Section 3 summarizes indicators of the extent of support to farmers in various countries up to 2020 so as to put in perspective the GTAP Model's estimates for 2014 (which fortuitously was a year when international food prices were mid-way between the spike of 2008 and the slump of 2018-20 as captured by the FAO's real food price index). Section 4 provides new estimates of the effects of those support measures as of 2014 on Australasian and Brazilian economic welfare, net farm incomes and agricultural exports. The final section draws out implications of the results for those countries and global farm trade.

2. Data and measurement methodology

We draw primarily on OECD (2019) to consolidate information on government budgetary transfers and other forms of support for farmers by policy instrument for 41 OECD and/or EU member countries and 13 major emerging economies of agricultural significance. Together these 54 countries account for all but one-sixth of the value of global agricultural production.[1] 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. That allows countries to be ranked 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.

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 (Hertel 1997; Aguiar et al. 2019) do make that distinction. They do so by carefully drawing on OECD assistance estimates plus detailed national databases for 2014 (Huang and Aguiar 2019), as for example by Boulanger, Philippidis and Jensen (2019) for the European Union. The latest version of that database (Version 10a), for 2014, was made available to subscribers in February 2020. As reported in Section 3, assistance rates rose considerably in some key countries over the next five years as international food prices fell, so the model's inputs should be considered lower-bound estimates of the effects of 2020 support levels. The latest year of OECD estimates at the time of this analysis was 2018, but to avoid seasonal factors we provide three-year averages for 2016-18. (Estimates for 2019 have since become available, but their average is almost the same as for 2016-18, the key exception being for the

[1] An earlier study at the World Bank (Anderson and Valenzuela 2008) provides annual estimates from 1955 for an additional 29 developing countries so as to account for more than 90% of the value of global agricultural production. See summaries in Anderson (2009, 2010). That source, which built on Anderson, Hayami and Others (1986), Krueger, Schiff and Valdes (1988, 1991), Tyers and Anderson (1992) in addition to the OECD's work, has been updated by Anderson and Nelgen (2013), but only to 2011. Further updates have been made available at www.ag-incentives.org for some of those developing countries but only for a subset of products and only in the form of a nominal rate of protection to producers. The broader percentage nominal rate of assistance (NRA) and consumer tax equivalent (CTE) indicators, first developed in the 1970s by Josling (1973) and Australia's Industry Assistance Commission (now the Productivity Commission), was adopted for the World Bank study, as detailed in Anderson et al. (2008). They are also calculated by the OECD in the form of a nominal assistance coefficient (where NAC = (1 + NRA/100)) and a consumer support estimate (CSE= -CTE).

US where the OECD Secretariat's producer support estimate for 2019 is 29% higher than the 2016-18 average for the US, and it will have been boosted further in 2020.)

To reveal the impact of these supports on Australasia's and Brazil's competitiveness, the study estimates the effects of budgetary transfers, and of the subsidy equivalents of farm trade policies, using the latest version of the GTAP Model (Version 7, see Corong et al. 2017). That model's database separately identifies the markets of 121 countries, including each member country of the EU, plus 20 residual regions, and each of those 141 economies is divided into 65 sectors (https://www.gtap.agecon.purdue.edu/databases/v10/index.aspx). However, to focus on the key sectors and countries of interest in this study, we aggregated the database into 52 countries/country groups and 18 sectors.[2] With its new 2014 database, this modelling framework is able to provide estimates of the impacts on Australasia and Brazil of each competitor country's policies as well as their own policies, and of their combined global market effects, so countries and country groups can be ranked according to their impacts on Australasia's and Brazil's farm incomes, 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, a producer support estimate (PSE) is provided for each country's entire 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 are general services support estimates (GSSE) to the sector.

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 higher than the PSE in that it reflects the percentage by which producer incentives have been raised, whereas the PSE reflects the percentage of the producers' actual gross earnings (including assistance) that are due to farm support measures.

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. The most common instruments of such distortions are import restrictions such as a tariff.

Nine sub-sectors are emphasized in this study. Together they cover the key industries in Australasia's and Brazil's agricultural sectors, defined here to include all farm products plus key processed foods (rice, sugar, oilseed products, meat and dairy products). The 14 individual products within the nine sub-sectors for which subsidy estimates are available in OECD (2019) are: wheat, barley, maize, rice, soybean, canola (or other oilseeds), cotton, sugar, beef, sheepmeat, pork, poultry, eggs and milk.

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[2] The GTAP model assumes perfect competition and constant returns to scale in production. The functional forms are nested constant elasticities of substitution production functions. Land is specific to agriculture in the GTAP database, and is mobile amongst alternative agricultural uses according to a Constant Elasticity of Transformation which, through a revenue function, transforms land from one use to another. Aggregate national employment of each productive factor is fixed. In the model closure adopted here, labour and produced capital are assumed to be mobile across all uses within a country, but immobile internationally. On the demand side there is a national representative household whose expenditure is governed by a Cobb-Douglas aggregate utility function which allocates net national expenditures across private, government and saving activities. That household distinguishes between domestic and imported versions of a product and between different countries of origin in the case of imported goods, via Armington elasticities of substitution (Armington 1969). We use the standard GTAP Model's default values of all these and other elasticities, making replication by other modelers easy.

Australia is more than 100% self-sufficient (exports exceed imports) in each of these products, and it and Brazil are among the world's biggest exporters of each of them (Table 1). Despite those high rankings, Australia has little monopoly power because its share of global production was no more than 3% in any of those commodity markets in 2014; and Brazil's share was above 4% for only three products: sugar (13%), oilseeds (9%) and beef and lamb (7%). New Zealand is an even smaller producer and exporter of these commodities apart from exports of milk products (25% of the value of world dairy exports).

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 competitors to Australasia's and Brazil's exporters in third countries. Assistance to their farmers obviously makes it more difficult for lightly subsidized farmers to compete there and elsewhere. But supports to farmers in self-sufficient or net-importing countries also reduce opportunities for Australasian and Brazilian 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.

3. The Extent of Support

The national aggregate NRAs are shown in Figure 1 for 2014, and also for 2016-18 to reveal the extent to which they (in most cases) increased after 2014. Sluggish domestic responses to the 15% fall in international prices for agricultural products between those two periods (see World Bank 2019) contributed to the average NRA for all OECD countries rising by one-tenth (from 21% to 23%) and that for the EU by slightly more (by one-sixth, from 21% to 25%).

3.1 Total farm support levels

The rate of assistance to farmers is highest in the coolest European and East Asian countries. However, apart from Japan, those countries contribute a very small share of global farm production. To get a fuller picture of where the assistance is greatest, the gross value of production also needs to be considered. Figure 2(a) shows the aggregate annual value of agricultural assistance in US$ terms. It reveals that assistance to farmers in 2016-18 amounted to almost as much in China (US$239 billion) as in all OECD member countries (US$ 260b), and more than twice as much as that received by farmers in the European Union's 28 member countries (US$107b).

[Insert Figure 2 about here]

The full extent of assistance in 2016-18 is captured in Figure 2(b). It reveals that Japan (US$39b) and Korea (US$22b) together provide barely half as much aggregate farmer assistance per year as the EU, and the US just one-third (US$36b). The farming powerhouse of Brazil is hardly noticeable in Figure 2(b); rather, it is Indonesia that is the other developing country with sizeable farmer support (US$35b in 2015, the latest available estimate).

This is a relatively new situation. Historically, once developing countries became independent from the 1950s, many effectively taxed their farmers rather than assisting 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 in populous China, Indonesia and the Philippines (Anderson 2010). Hence

the average NRA for developing countries is converging on that for high-income countries (Figure 3), which is why we examine current policies of both sets of countries in this study.

[Insert Figure 3 about here]

Table 2 shows the extent of these transitions in agricultural support/taxation since the mid-1980s for each of the countries monitored by the OECD. Only four countries in that 54-country sample still had negative agricultural NRAs in 2016-18: Argentina (-12%), India (-5%), Viet Nam (-5%) and Ukraine (-2%).

[Insert Table 2 about here]

A subset of that assistance is product-specific. Figure 2(c) reveals that in OECD countries, dairy (US$18 billion per year) and beef cattle (US$17b) were 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).

3.2 Types of farmer support

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. Figure 4 shows that for the OECD as a group, the extent of assistance coming directly from supports to outputs or to input use has declined substantially, although it is still 60%. For the EU it has plummeted from 95% to 30%, but it is still nearly 90% in Japan. For most other countries, the vast majority of support still comes from those two direct forms of support.

[Insert Figure 4 about here]

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 has averaged less than 3% 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. GSSE is mostly made up of expenditures on agricultural research, development and extension (R,D&E) and infrastructure, but inspection and control expenditure also is non-trivial. Marketing and promotion, and public stockholding, are relatively minor.

Those component shares of GSSE vary considerably across countries. One example of that cross-country variation is revealed in Figure 5: it shows that public R,D&E as a percentage of the gross value of farm production has varied from less than 0.5% for numerous developing countries to above 1% for most developed countries. It is a little below 1% for the United States and China, but in both those countries private sector agricultural R,D&E investment exceeds public investment, pushing their total to more than 2% (Pardey et al. 2016). These percentages are higher when the gross value of production excludes the assistance provided by government of course. Even so, for the 54-country sample this investment number is still only 1.52%, down from nearly 1.9% fifteen years ago (Figure 6). The share for Australia is just below that average, at 1.51%, with Brazil and New Zealand even lower at 1.3% and 1.0%, respectively.

[Insert Figures 5 and 6 about here]

Another example of the component shares of GSSE varying across countries has to do with payments to farmers for resource conservation and for providing environmental services. This category has become substantial in Switzerland and the EU, and shows up a little in the US and Norway, but it is very minor or non-existent in all other countries, including in

Australasia and Brazil. Given that there are sometimes positive externalities associated with environmental services, the levels of these expenditures in Australasia and Brazil may be less than what is optimal from a national welfare or willingness-to-pay viewpoint (a point taken up in the next section).

3.3 Consumer taxes by product and country

The total value of transfers from consumers are equally important as those to producers, because insofar as they discourage consumption of farm products they reduce net imports and hence export prospects for farmers elsewhere. In 2016-18 the tax on Chinese consumers (US$146b) was twice as large as that on all OECD consumers (US$78b) in aggregate, and in percentage terms it was above the OECD average at 12% and far above the EU's 5%. Despite the consumer tax equivalents being negative for the United States (US$33b or -12%) and India (US$81b or -18%),[3] for the full sample of 54 countries 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 direct food consumer subsidies (OECD 2019). Such implicit taxes diminish quantities consumed, reducing the global demand for farm products and hence lowering international food prices.

4. Market and Welfare Effects of Support in 2014: GTAP Model Results

The above information on the extent of various government interventions in the farm sector is useful in its own right, including for trade negotiators, but it is not easy to imagine what its net effects would be on Australasia's or Brazil's national economic welfare, net incomes from farming and first-stage food processing, or agricultural exports. To provide more insight, a model of the world's markets for these and other products is needed. The world's most commonly used model for such purposes is the well-documented economywide GTAP model, which was recently revised (Corong et.al. 2017). Its new database, Version 10a released in February 2020, replicates the world's economies as of 2014 (Aguiar et al. 2019). We use it to see how that baseline year's data would differ if all agricultural subsidies and market access barriers (as summarized for that year in Appendix Table 1 and detailed in the Online Table) were removed.[4] This provides lower-bound estimates of what those effects would have been later in the decade, given the rise in the extent of farmer assistance to 2020 as reported in Section 3.[5]

4.1 Country and product contributions

There are four trading partners whose farm policies have by far the largest influences on Australia. They are the EU, Japan, China and Korea. Together they accounted in 2014 for

[3] The US spends a lot on food stamps and the like for low-income families. 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 $92 billion in 2018. 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 $30 billion in 2018. Australasian, Brazilian and other food exporters benefit from direct consumer subsidies abroad insofar as they expand the global demand for farm products.

[4] They include the effects on Australia, Brazil and New Zealand of own-country policies, but they are almost zero: we estimated the economic welfare cost of own-country policies as a share of the cost of global policies amounted to just 0.8% for Australia and 0.2% for Brazil and New Zealand.

[5] Details of the simulations are available on request from the authors, thereby enabling others to replicate or run variants of the scenarios presented in this paper.

about three-quarters of the adverse effects of the world's farm policies in 2014 on all three indicators (national economic welfare, net farm and processor incomes, and agricultural exports).[6] For New Zealand, the EU alone accounts for more than three-quarters of those adverse effects; and for Brazil also the EU is dominant, accounting for more than half of the damage to its economy and farmers, with five other big countries (Mexico, India, Russia, the US and China) responsible for most of the rest (Figure 7).

[Insert Figure 7 about here]

Turning from countries to products, Figure 8 shows that it is Australasia's red meat and dairy industries that are most adversely affected by farm policies abroad. Wheat, rice and cotton exports also are hurt in Australia, especially in proportional terms given their relative smallness in Australia's exports. Red meat is hurt also in Brazil, as is sugar, but pork&poultry is Brazil's most-adversely affected sub-sector.

[Insert Figure 8 about here]

In aggregate, the national economic welfare cost of all agricultural trade measures and domestic supports globally amounted in 2014 to US$2.2 billion for Australia, US$3.0 billion for New Zealand, and US$7.0 billion for Brazil. When expressed on a per capita basis, those national welfare costs are $33 for Brazil but $87 for Australia and a huge $605 for New Zealand – among the highest in the world.[7]

4.2 Policy instrument contributions: revisiting the 'three pillars' issue

These GTAP modelling results also allow us to re-visit the question raised in Anderson, Martin and Valenzuela (2006) as to how important are the WTO's 'three pillars' of agricultural market access, export subsidies and domestic budgetary transfers. That 2006 study estimated that in 2001, budgetary transfers accounted for only 5% of the global economic welfare cost of agricultural policies. (Unfortunately that study did not report its contribution to the cost to individual national economies and farmers.) Since then there has been re-instrumentation of assistance away from trade-reducing market price supports for individual products to policy instruments that are more generic and in some cases de-coupled to some extent from current production (Figure 4). As well, there has been a slowdown in increases in the total dollar value of the PSE and large reductions in the overall agricultural NRAs this century (Figure 3). Together this has meant the share of budgetary transfers in overall assistance to farmers has been growing. The extent of that change, for 54 countries for which data are available in the GTAP database time series, is shown in Figure 9: the value of budgetary transfers globally rose 160% in current US dollars between 2001 and 2014, while the total PSE value for those 54 countries rose only 80%.

[Insert Figure 9 about here]

By 2014, according to Table 3, budgetary transfers accounted for 37% of the economic welfare cost to Australia of global farm assistance policies, 22% of the loss in net incomes of Australian farmers and processors,[8] and 26% of the loss in Australia's farm

[6] Since 2014 Australia has signed free trade agreements (FTAs) with those three East Asian countries, with barriers being phased down preferentially from 2015. For that reason these adverse effects of Northeast Asian policies on Australia may have been slightly less in 2020.

[7] The global cost of these policies in 2014 is estimated at $73 billion. The comparable estimate for 2001 is $56 billion in current US dollar terms (Anderson, Martin and Valenzuela 2006; Hertel and Keeney 2006). That is, these costs rose over that 14-year period by only 30% in nominal terms, when the aggregate value of the PSE for our 54-country sample rose 80%. This difference is an indication of the extent to which the more-recent mix of policy measures is less costly than the mix at the turn of the century, thanks to re-instrumentation away from trade measures which, unlike domestic support measures, hurt consumers.

[8] More precisely, the net income from primary agricultural production plus processing of rice, sugar, oilseeds, meat and milk.

exports. By contrast, for New Zealand, budgetary transfers accounted for just 10% of the economic welfare cost of global farm assistance policies, 10% of the loss in fnet incomes in the sector, and 9% of the loss in farm exports. The shares for Brazil are in between those for Australia and New Zealand: 20% of the economic welfare cost, 12% of the net income loss, and 12% of the loss in farm exports. In all three countries, about half of those impacts of budgetary transfers are from output and input measures, and the other half from supports to primary factors of production (the farmers' labour, land and other capital).

[Insert Table 3 about here]

The sizes of domestic budgetary transfers in major countries in 2014 are shown in Table 4, which also reveals the value and shares of those transfers during the preceding decade. Over that period OECD payments rose 40% in nominal US dollar terms, while payments to farmers in the 13 emerging economies shown there trebled. Meanwhile, annual domestic payments to Australasian farmers were virtually the same in 2004 as in 2014, when they accounted for just 0.8% of the total domestic support in those 54 countries.

[Insert Table 4 about here]

Finally, it is instructive to compare the actual transfers in 2014 with what WTO members are legally entitled to transfer according to their AMS commitments plus the amount allowed under the WTO's *de minimis* rules. Almost all countries in 2014 were well below their domestic support entitlements under WTO rules and commitments. The top ten are shown in Table 5. In the 52 countries for which data are available for 2014 (representing all but 14% of global entitlements), the actual transfers averaged just 34% of entitlements. That means there is plenty of scope for many countries to make substantially more budgetary transfers to their farmers in future if they so choose.[9]

[Insert Table 5 about here]

5. Implications

Several implications flow from the above findings. One is that while domestic subsidies to farmers have grown in importance this century in numerous countries, market price support provided by import barriers remains the dominant policy instrument abroad that continues to dampen Australasian and Brazilian farmers' competitiveness. It therefore continues to be in Australasia's and Brazil's interest to vigorously pursue agricultural trade liberalization abroad wherever possible multilaterally, plurilaterally, regionally and bilaterally.

Second, the very considerable growth abroad in farmer assistance via domestic budgetary transfers, and the huge scope for further increases under current WTO entitlements, justifies the increasing attention it is receiving in trade negotiator and commercial diplomatic circles. Many of those forms of budgetary transfers fall under the 'green' or 'blue' boxes in WTO parlance, and so are subject to no limitations under the WTO's Agreement on Agriculture. Yet not all of them are fully decoupled from production (Goodwin and Mishra 2006; Bhaskar and Beghin 2009; Urban, Jensen, and Brockmeier 2016), not least because they enhance farmers' funds and so allow them to continue farming if they so choose. As well, new subsidies need to be assessed, most notably those provided by the US President to (over-)compensate farmers for China's retaliatory tariffs on farm products imported from the US (Glauber 2019; Janzen and Hendricks 2020) and to assist farmers during the COVID-19 outbreak (USDA 2020a,b). Domestic subsidies are therefore worthy of more-intense scrutiny and possibly of including, in addition to trade barriers, on the

[9] For details of WTO disciplines on agricultural support, see Orden, Blandford and Josling (2011), Brink and Orden (2020) and Glauber et al. (2020).

agenda of future trade/economic partnership negotiations – notwithstanding the fact that a given rate of farmer assistance via a domestic support program is typically less trade-reducing than it would be if provided via a trade measure.

It needs to be kept in mind, though, that some of these domestic measures may be contributing positive externalities (e.g., ecosystem services) in the implementing country, and thereby may be economically justified from a national viewpoint – in contrast to such measures as subsidies to pollutive farm chemical use, which are under-estimated as supports because the optimal national policy in such cases is a tax on pollutive inputs – or better still, a tax on the damage they cause such as to waterways. More generally, if the domestic measure is not the first-best instrument for dealing with any externality, it may be more-costly than a trade measure even though it does not have the consumption by-product distortion cost of a protective trade restriction (Anderson 2000).

Third, the above results vindicate Australasia's and Brazil's efforts this past decade to sign FTAs with China, Japan and Korea and to pursue current negotiations aimed at FTAs with the EU, since it is those economies whose subsidies and trade barriers are the most damaging to Australasian and Brazilian agricultural and overall economic interests. When the UK leaves the EU, that will be Australasia's next-highest FTA priority, because around one-quarter of Australia's and even more of New Zealand's agricultural exports to the EU28 are currently destined to the UK.

Fourth, the comparative data in the previous section expose Australasia's and Brazil's positions in terms of subsidies to their own farmers. All three countries appear to be below average among OECD countries in terms of their R,D&E intensity (Figures 5 and 6). Given the high marginal social rates of return to such public investments (Rao, Hurley and Pardey 2019), that suggests there is scope for a win-win for farmers and society from boosting those investments. All three countries also are comparatively very low in their payments to farmers for environmental services provided by them. Whether that implies under-investment by them or over-investment by other countries is difficult to evaluate, because each society has a different degree of willingness to pay for such services.[10]

Finally, most countries in 2014 were well below their domestic support entitlements under WTO rules and commitments, suggesting there is scope for many countries to make substantially more budgetary transfers to their farmers in future if they so choose. The same is true of entitlements to raise applied tariffs on farm imports. Anderson et al. (2016) show that if emerging countries were to exploit that policy space by becoming more protectionist of their farmers over the next decade (following the earlier example of numerous high-income countries), the opportunity cost of not completing the Doha round of multilateral trade negotiations under WTO could be considerably higher than earlier estimates suggest.

[Insert Appendix Table 1 here]

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[10] Australia's National Farmers Federation is now calling for the development of a natural capital market in Australia (NFF and KPMG 2019), with an aspiration for ecosystem services to be 5% of net farmgate revenue by 2030 (NFF 2019). Garnaut (2019) points to the potential for farmers to generate one such service, in the form of carbon sequestration, but he notes that fully exploiting this potential income source for farmers would require a large boost in appropriately targeted R,D&E.

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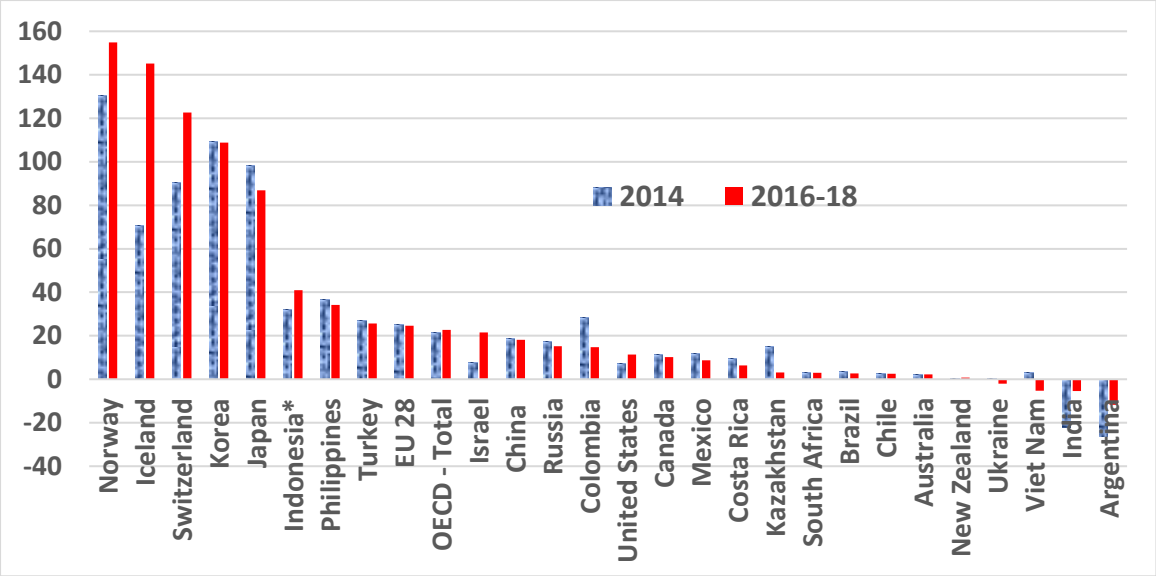
Figure 1: Aggregate agricultural nominal rate of assistance (NRA), by country, 2014 and 2016-18 (%, weighted average using value of production without assistance as weights)

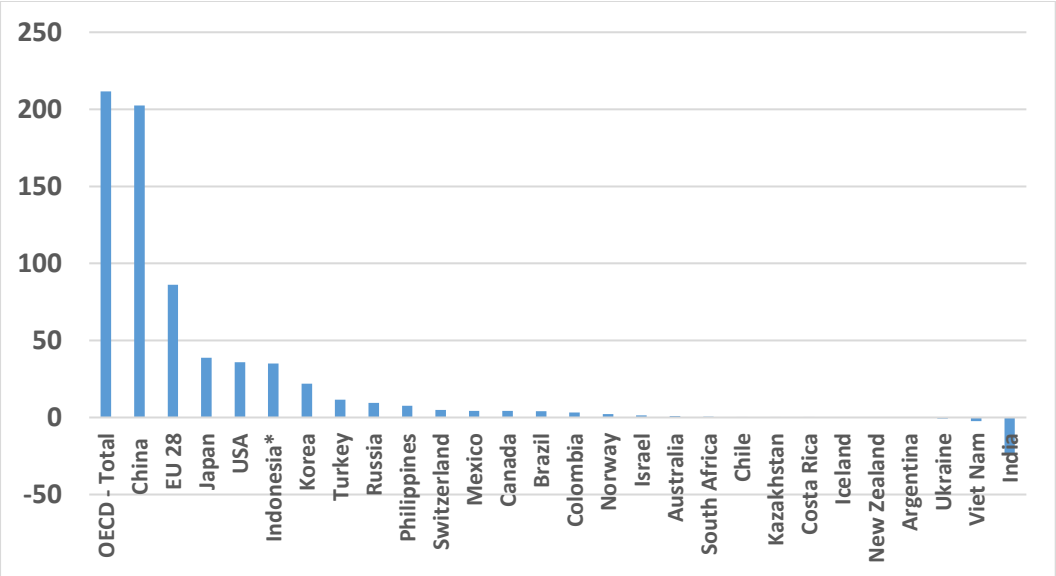


*Indonesia refers to 2015 in the absense of 2016-18 estimates.

Source: OECD (2019).

Figure 2: Aggregate value of agricultural assistance and percentage PSE, by country and product, 2016-18 (current US$ billion per year and %)

(a) By country, current US$ billion per year



(b) % PSE on vertical axis; current US$ billion per year is area of rectangle

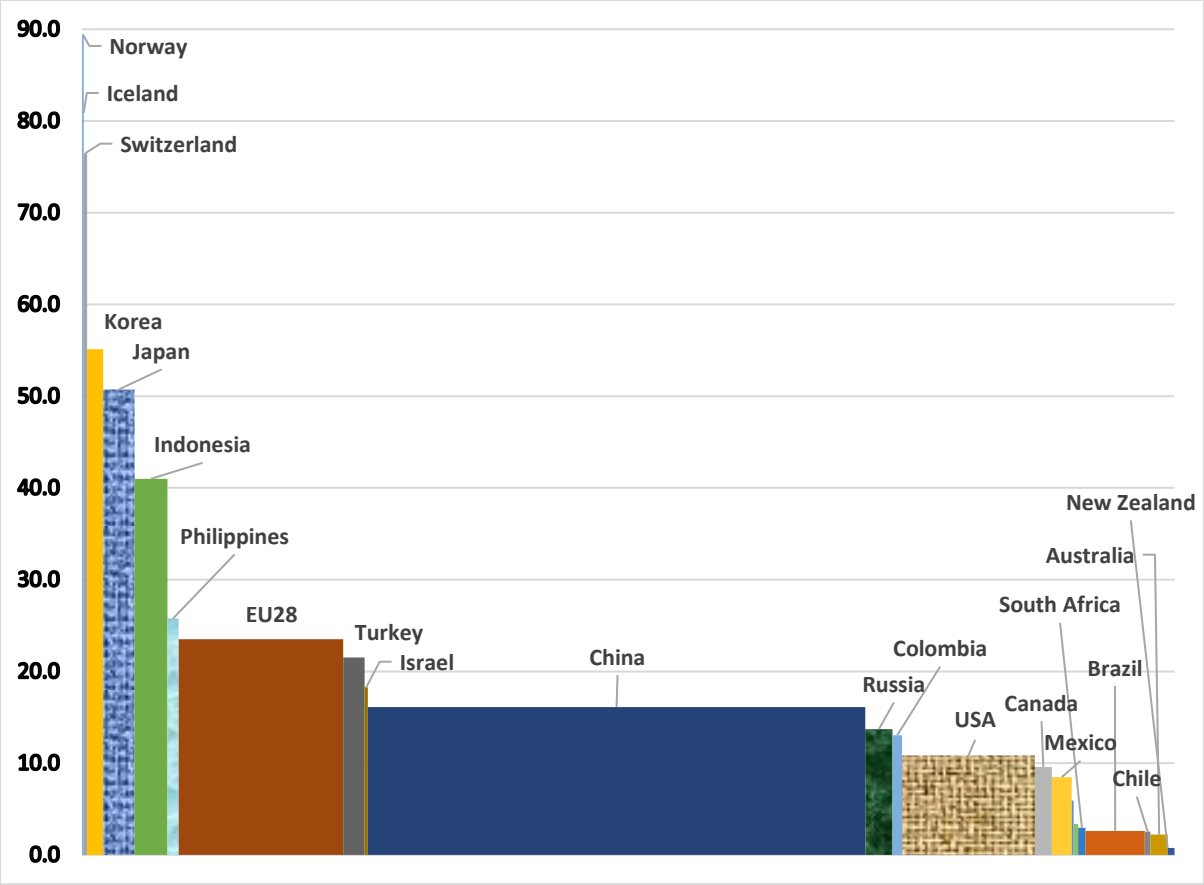
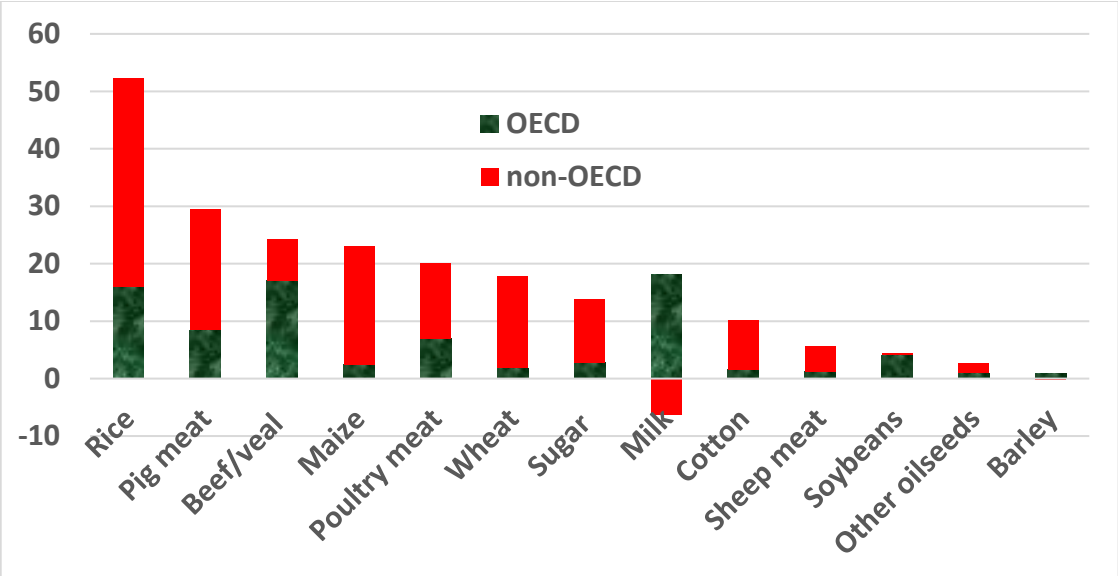


Figure 2 (continued): Aggregate value of agricultural assistance and percentage PSE, by country and product, 2016-18 (current US$ billion per year and %)

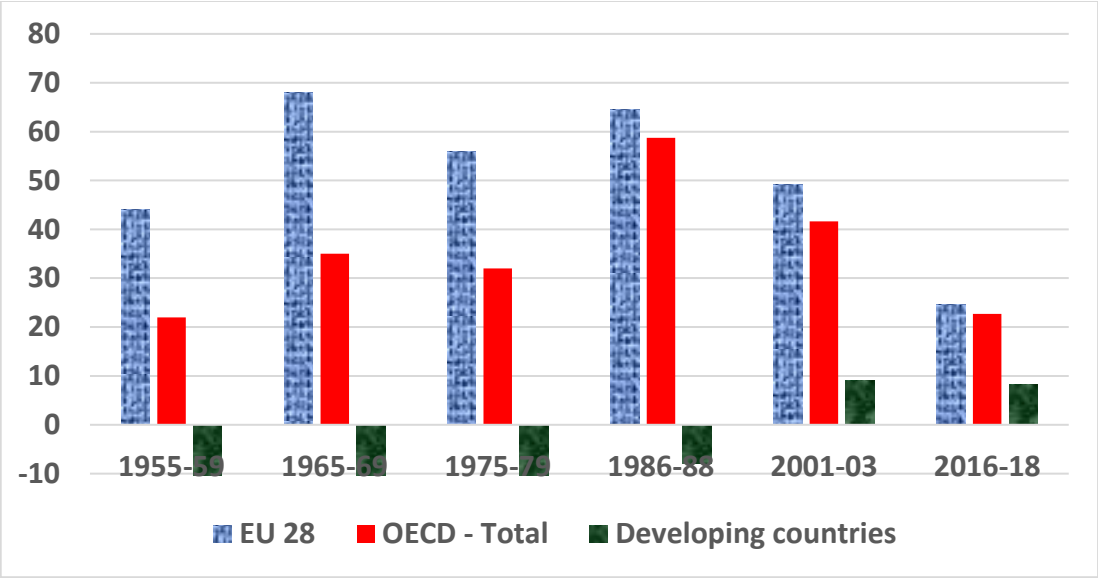
(c) By selected products, current US$ billion per year



*Indonesia refers to 2015

Source: OECD (2019).

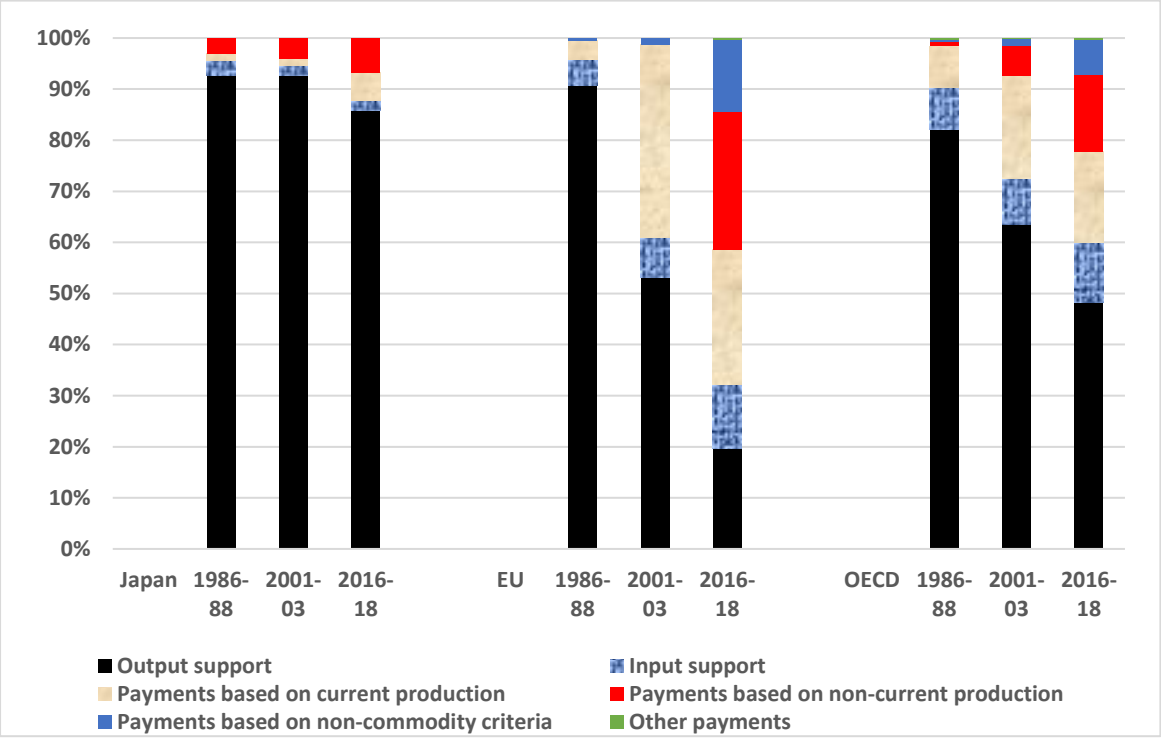
Figure 3: Agricultural NRAs for developing countries,[a] European Union and all OECD, 1955 to 2018 (%, weighted average using value of production without assistance as weights)



[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.

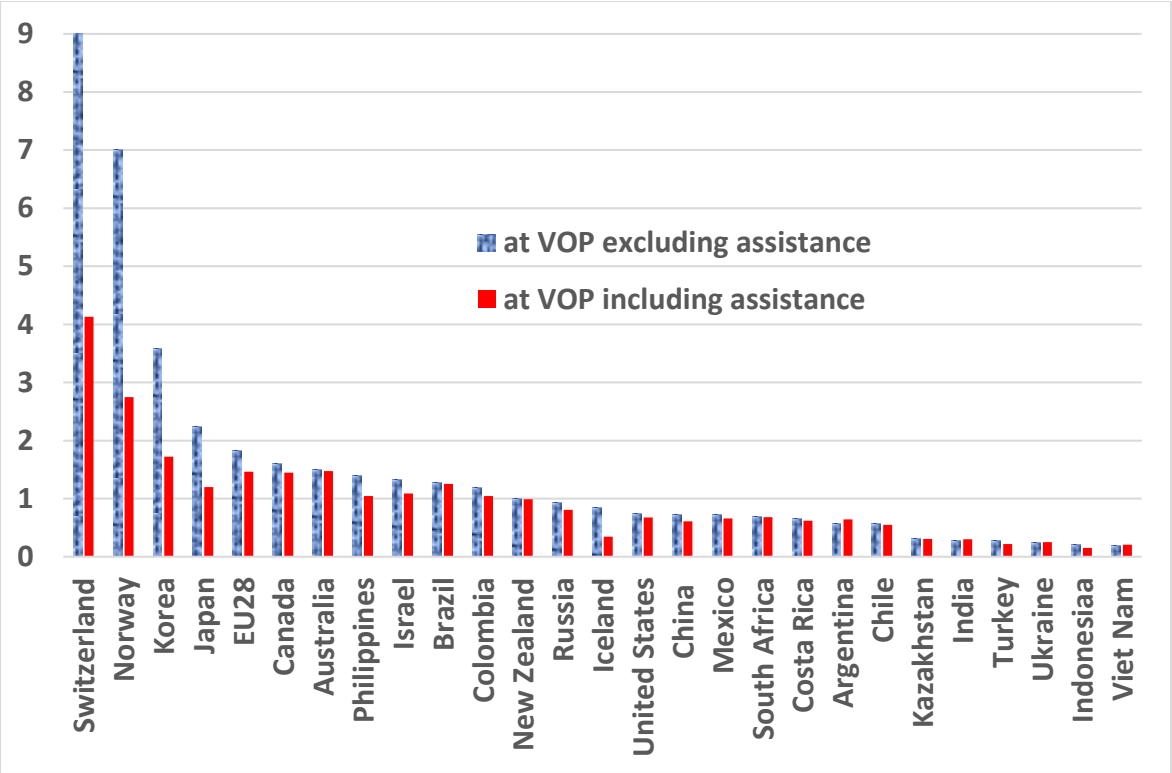
Source: OECD (2019), Anderson (2009), and www.ag-incentives.org.

Figure 4: Component shares of PSE, Japan, EU and all OECD, 1986-88, 2001-03 and 2016-18 (%)



Source: OECD (2019).

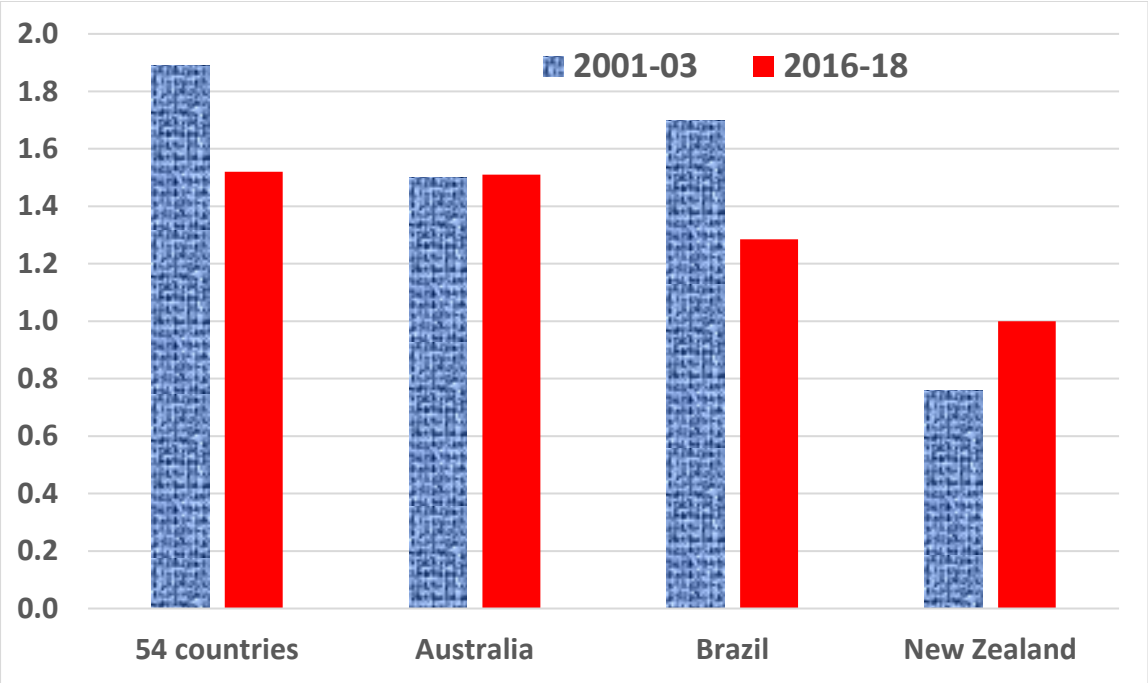
Figure 5: Public agricultural R,D&E as a % of gross value of farm production (VOP) excluding and including assistance, by country, 2016-18 (%)



*Indonesia refers to 2015.

Source: OECD (2019).

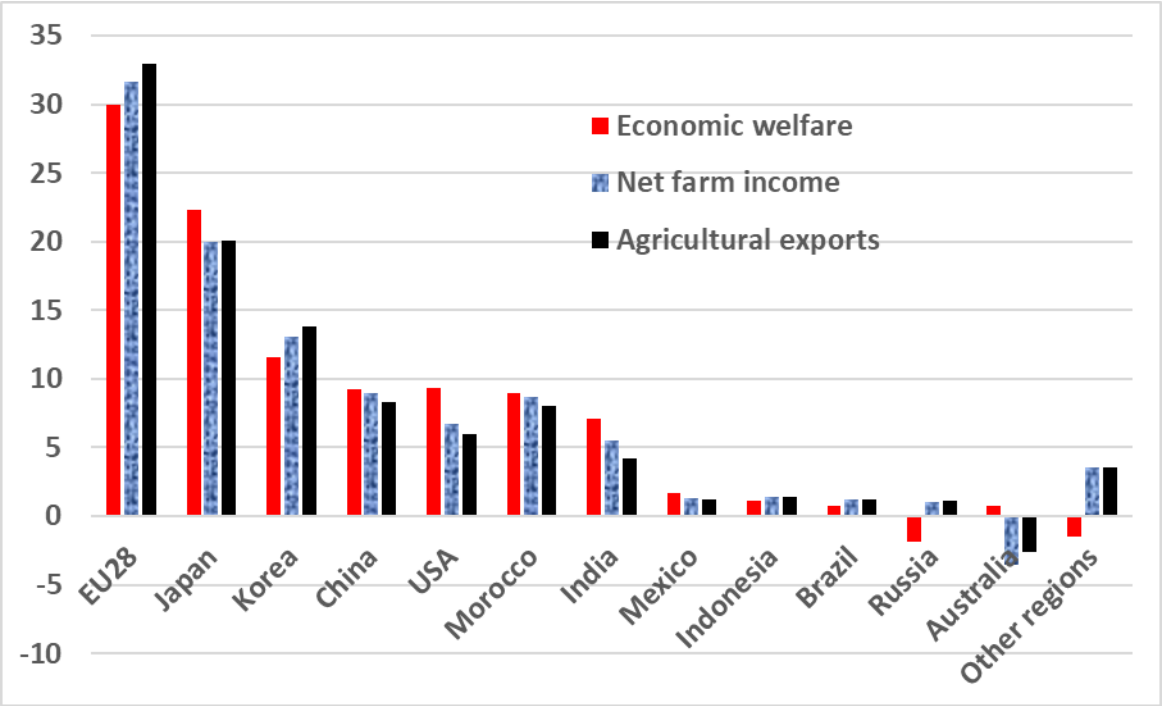
Figure 6: Public agricultural R,D&E as a % of gross value of farm production excluding assistance, 54-country average and Australasia and Brazil, 2001-03 and 2016-18 (%)



Source: OECD (2019).

Figure 7: Shares in the annual cost to Australasia's and Brazil's national economic welfare, net agricultural[a] incomes and agricultural exports of all agricultural trade measures and budgetary transfers globally, by country, 2014 (%)

(a) Shares in cost to Australia, by country



(b) Shares in cost to New Zealand, by country

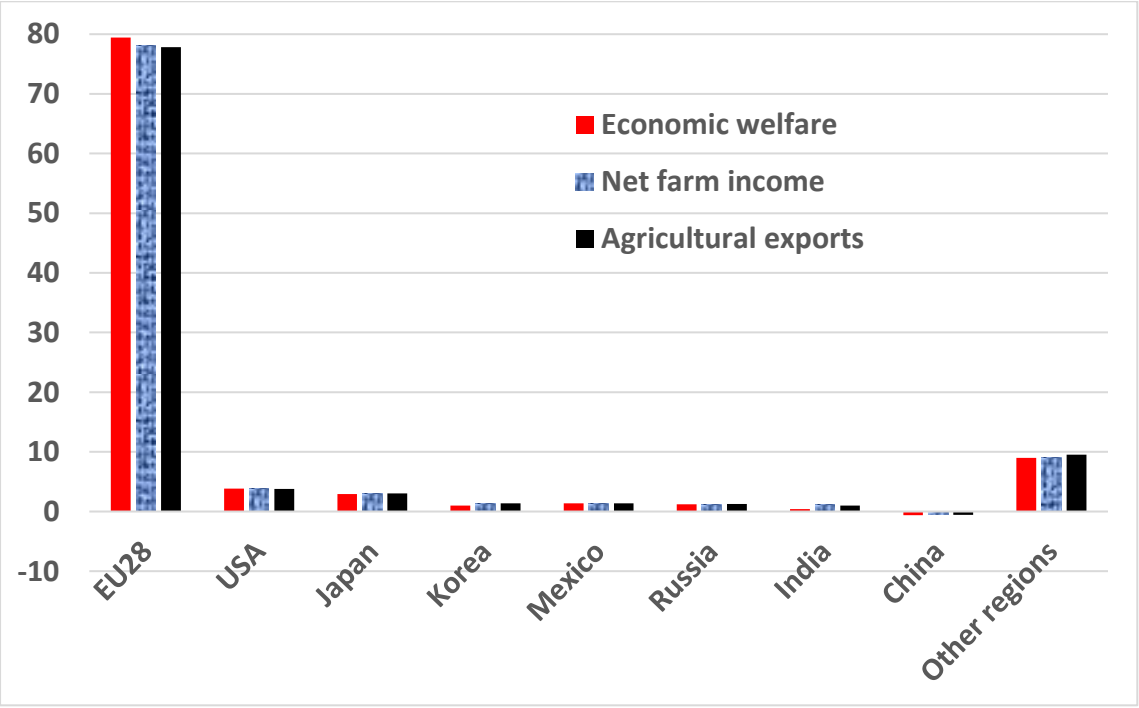
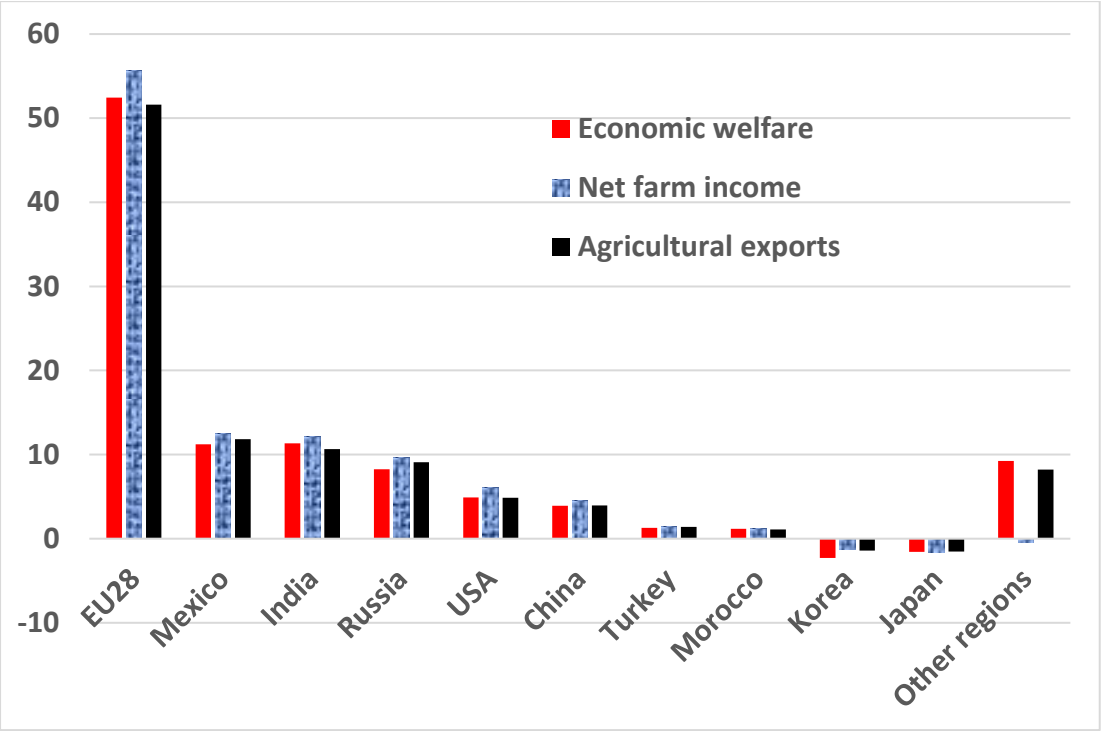


Figure 7 (continued): Shares in the annual cost to Australasia's and Brazil's national economic welfare, net agricultural[a] incomes and agricultural exports of all agricultural trade measures and budgetary transfers globally, by country, 2014 (%)

(c) Shares in cost to Brazil, by country

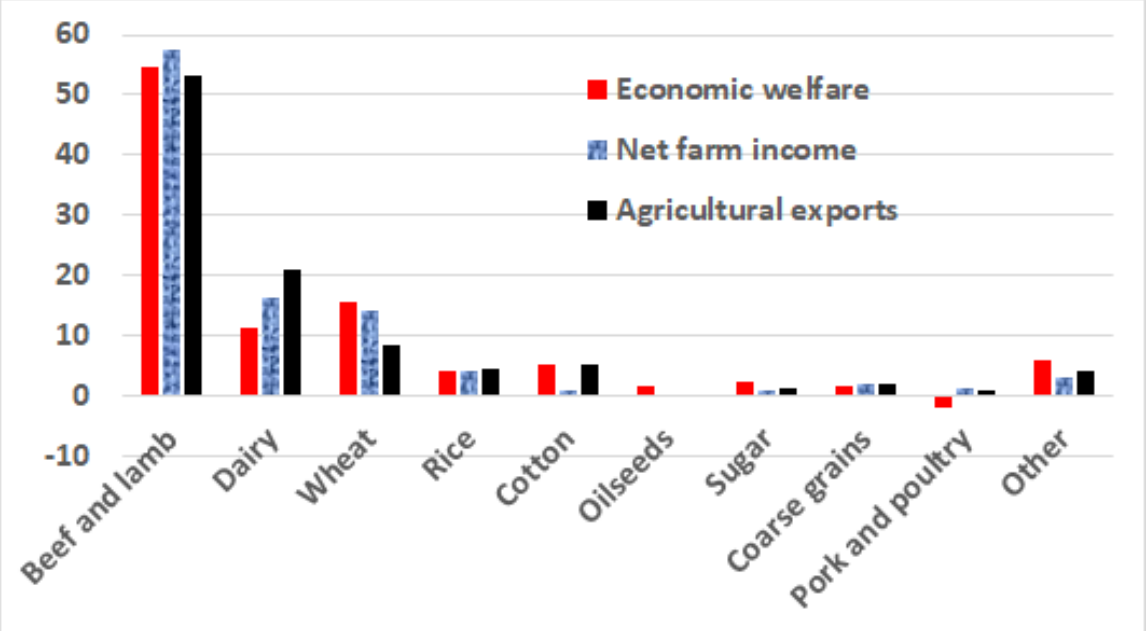


[a] Net income from primary agricultural production plus light processing of rice, sugar, oilseeds, meat and milk

Source: Authors' GTAP modelling results.

Figure 8: Shares in the annual cost to Australasia's and Brazil's national economic welfare, net agricultural[a] incomes and agricultural exports of all agricultural trade measures and budgetary transfers globally, by product, 2014 (%)

(a) Shares in cost to Australia, by product



(b) Shares in cost to New Zealand, by product

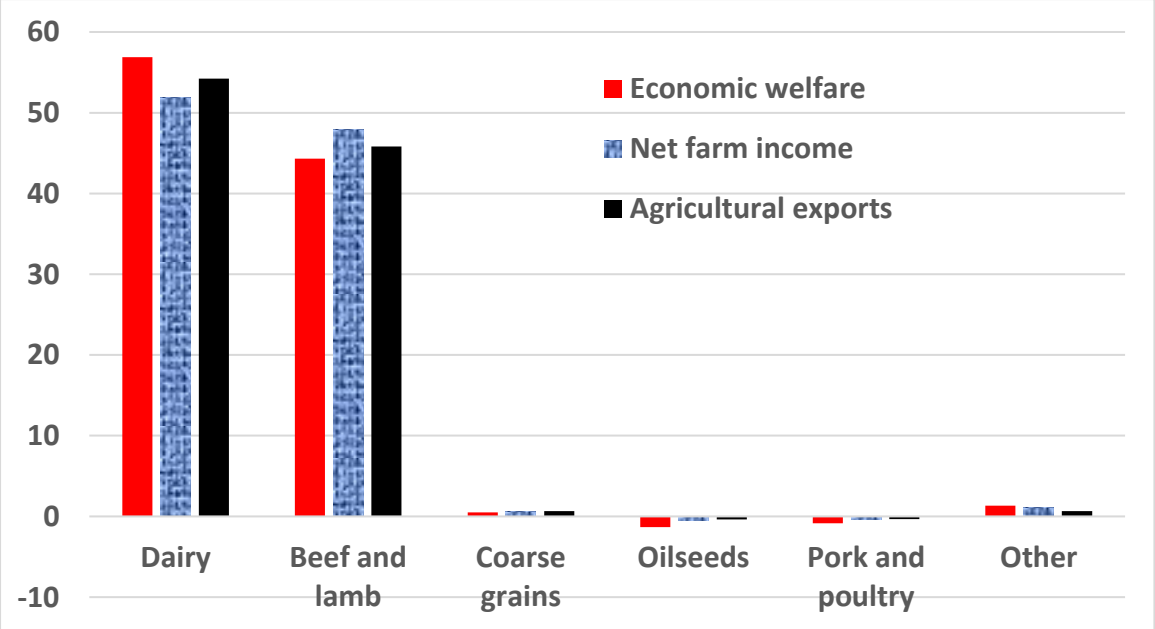
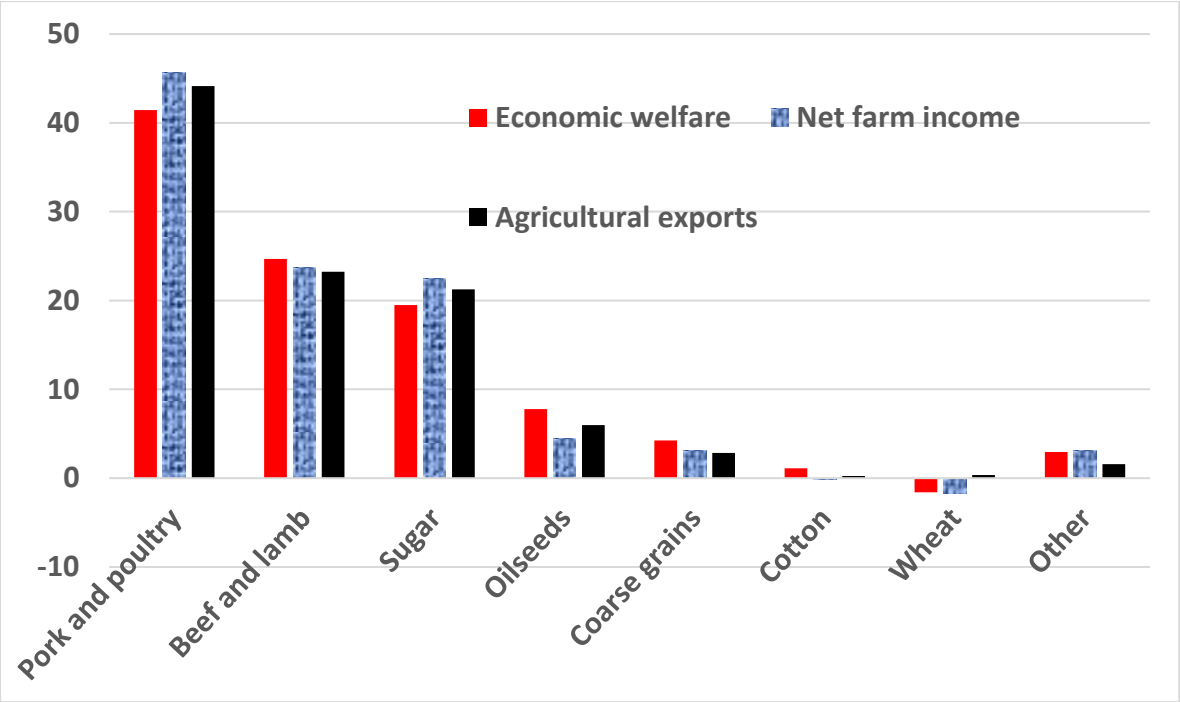


Figure 8 (continued): Shares in the annual cost to Australasia's and Brazil's national economic welfare, net agricultural[a] incomes and agricultural exports of all agricultural trade measures and budgetary transfers globally, by product, 2014 (%)

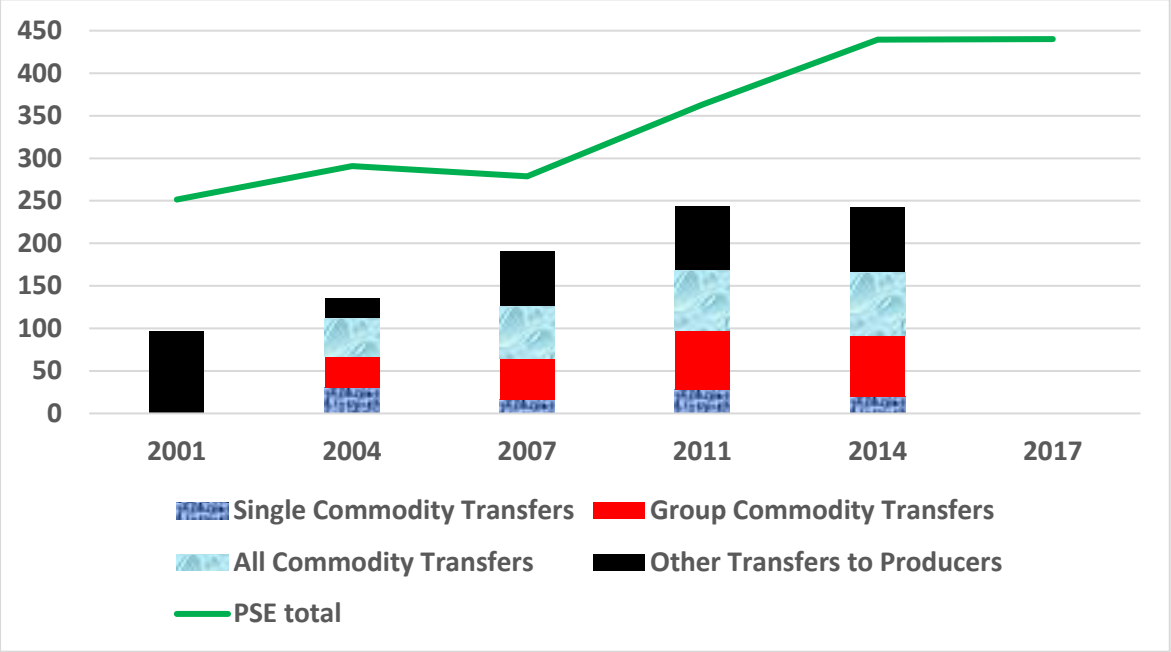
(c) Shares in cost to Brazil, by product



[a] Net income from primary agricultural production plus light processing of rice, sugar, oilseeds, meat and milk

Source: Authors' GTAP modelling results.

Figure 9: Components of budgetary transfers, and value of overall support (aggregate PSE including domestic market price support), 54 countries, 2000[a] to 2018 (current US$ billion, 3-year averages for PSEs around the year shown)



[a] The 2001 value is not just 'Other transfers' to producers but all transfers, from Anderson, Martin and Valenzuela (2006, page 364).

Sources: OECD (2019) for PSEs, and GTAP protection database for domestic support, accessed at https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=5946 on 13 December 2019.

Table 1: Shares of Australia, Brazil, New Zealand and others in the value of global exports of farm products, 2014 (%, with EU-28 treated as one country and intra-EU trade excluded from EU and world trade)

	Rice	Wheat	Coarse Grain	Oil-seeds	Sugar	Cotton	Beef &lamb	Pork& poultry	Milk	**All ag &food**
AU	1	14	5	1	5	11	20	2	4	5
BR	2	0	11	17	31	7	12	15	1	10
NZ	0	0	0	0	0	0	9	1	25	3
Subtotal	**3**	**14**	**16**	**18**	**36**	**18**	**41**	**18**	**30**	**18**
USA	8	19	33	19	6	26	13	24	12	16
EU28	1	21	6	4	7	6	6	21	29	10
ROW	88	46	45	59	51	50	40	37	29	56
TOTAL	100	100	100	100	100	100	100	100	100	100

Source: GTAP modelling database at www.gtap.org, accessed 6 January 2020.

Table 2: Agricultural NRA, by country, 1986-88, 2001-03 and 2016-18

(%, weighted average using value of production without assistance as weights)

	1986-88	**2001-03**	**2016-18**
Norway	238	237	155
Iceland	344	173	145
Switzerland	311	198	123
Korea	240	138	109
Japan	173	125	87
Indonesia[a,b]	-2	11	41
Philippines[b]	19	23	34
European Union	29	33	26
OECD Total	*65*	*49*	*25*
Turkey	59	42	23
Israel	na	19	22
China[b]	-36	7	18
Russia[b]	-8	13	15
Colombia[b]	0	28	15
USA	27	22	11
Canada	57	25	10
Mexico[b]	3	29	9
Costa Rica	na	10	6
Kazakhstan	na	6	3
South Africa[b]	12	7	3
Brazil[b]	-21	6	3
Chile[b]	13	7	3
Australia	12	4	2
New Zealand	12	1	1
Ukraine[b]	-21	0	-2
Viet Nam[b]	-14	9	-5
India[b]	25	-5	-5
Argentina[b]	-16	-13	-12

[a] In the 2016-18 column, Indonesia refers to 2015.

[b] In the 1986-88 column, the estimates for developing country are for 1985-89 and the estimates for Russia and Ukraine are for 1992-95, all from Anderson (2009).

Source: OECD (2019) and Anderson (2009).

Table 3: Estimated annual cost to national economic welfare, net farm income and agricultural exports of Australia, Brazil and New Zealand due to all agricultural trade measures and budgetary transfers (domestic support) globally, by policy instrument, 2014

(a) Australia (US$ million and %)

	National economic welfare		Net agric income (=value added)		Agricultural exports	
Global agric liberalization ↓	$m	*%*	$m	*%*	$m	*%*
Domestic support from:						
Output subsidies	107	*5*	188	*4*	376	*4*
Input subsidies	298	*14*	395	*7*	732	*8*
Primary factor subsidies	405	*18*	610	*11*	1250	*14*
All dom. support	**810**	***37***	**1193**	***22***	**2358**	***26***
Import mkt access	1386	*63*	4106	*77*	6765	*74*
Export subsidies	4	*0*	8	*0*	17	*0*
TOTAL, 3 pillars	**2200**	***100***	**5307**	***100***	**9140**	***100***
% of Aust. indicator	*0.17%*		*15%*		*29%*	

(b) New Zealand (US$ million and %)

	National economic welfare		Net agric income (=value added)		Agricultural exports	
Global agric liberalization ↓	$m	*%*	$m	*%*	$m	*%*
Domestic support from:						
Output subsidies	22	*1*	27	*1*	51	*1*
Input subsidies	136	*5*	177	*5*	337	*4*
Primary factor subsidies	136	*5*	159	*4*	308	*4*
All dom. support	**294**	***10***	**363**	***10***	**696**	***9***
Import mkt access	2663	*90*	3415	*90*	7029	*91*
Export subsidies	12	*0*	14	*0*	30	*0*
TOTAL, 3 pillars	**2969**	***100***	**3793**	***100***	**7756**	***100***
% of NZ indicator	*1.69%*		*30%*		*37%*	

(c) Brazil (US$ million and %)

	National economic welfare		Net agric income (=value added)		Agricultural exports	
Global agric liberalization ↓	$m	*%*	$m	*%*	$m	*%*
Domestic support from:						
Output subsidies	144	*2*	-44	*0*	207	*1*
Input subsidies	622	*9*	180	*1*	881	*4*
Factor subsidies	659	*9*	1528	*11*	1323	*6*
All dom. support	**1425**	***20***	**1665**	***12***	**2411**	***12***
Import mkt access	5489	*79*	12397	*87*	17793	*87*
Export subsidies	78	*1*	191	*1*	248	*1*
TOTAL, 3 pillars	**6992**	***100***	**14247**	***100***	**20452**	***100***
% of BR indicator	*0.34%*		*10%*		*29%*	

[a] Since agriculture contributes 3% of Australia's GDP, this 0.17% of total GDP is equivalent to 5% of agricultural GDP. Evidently the non-farm sector benefits from the rest of the world's policies that lower international agricultural prices, offsetting the farm sector's losses by (5.307 – 2.200 =) US$ 3.1 billion per year.

[b] Since agriculture contributes 7.5% of New Zealand's GDP, this 1.7% of total GDP is equivalent to 21% of agricultural GDP.

[c] Net income from primary agricultural production plus light processing of rice, sugar, oilseeds, meat and milk.

Source: Authors' GTAP modelling results.

Table 4: National budgetary transfers to farmers and share of total for 54 countries, 2004 to 2014 (US$ million and %)

	US$ million				% of total			
	2004	**2007**	**2011**	**2014**	**2004**	**2007**	**2011**	**2014**
EU	54667	82857	92510	85649	40.4	43.5	38.0	35.4
United States	30097	18185	25806	29012	22.2	9.6	10.6	12.0
Japan	5275	5178	12407	7352	3.9	2.7	5.1	3.0
Mexico	2875	4198	5309	5747	2.1	2.2	2.2	2.4
Switzerland	2617	2766	3929	3761	1.9	1.5	1.6	1.6
Turkey	2309	4285	4408	3186	1.7	2.3	1.8	1.3
Norway	1460	1764	2074	1987	1.1	0.9	0.9	0.8
Canada	3090	3579	2783	1490	2.3	1.9	1.1	0.6
Korea	1297	2482	2096	1476	1.0	1.3	0.9	0.6
Australia	930	1868	1616	950	0.7	1.0	0.7	0.4
Chile	144	253	338	395	0.1	0.1	0.1	0.2
Israel	150	161	202	226	0.1	0.1	0.1	0.1
Iceland	95	106	80	95	0.1	0.1	0.0	0.0
New Zealand	25	22	24	25	0.0	0.0	0.0	0.0
OECD - Total	***105031***	***127704***	***153582***	***141351***	***77.6***	***67.1***	***63.1***	***58.4***
China	13984	31949	41958	55330	10.3	16.8	17.2	22.9
India	9621	20069	30972	26288	7.1	10.5	12.7	10.9
Brazil	2049	3398	5105	5867	1.5	1.8	2.1	2.4
Russia	2644	3135	5608	5311	2.0	1.6	2.3	2.2
Indonesia	265	953	2316	2663	0.2	0.5	1.0	1.1
Ukraine	1131	1914	1693	1610	0.8	1.0	0.7	0.7
Kazakhstan	132	254	545	1309	0.1	0.1	0.2	0.5
Colombia	84	366	452	1234	0.1	0.2	0.2	0.5
Vietnam	129	262	416	446	0.1	0.1	0.2	0.2
Philippines	46	69	159	249	0.0	0.0	0.1	0.1
South Africa	129	203	278	219	0.1	0.1	0.1	0.1
Argentina	14	46	253	150	0.0	0.0	0.1	0.1
Costa Rica	15	7	33	14	0.0	0.0	0.0	0.0
Above 13	***30243***	***62625***	***89788***	***100690***	***22.4***	***32.9***	***36.9***	***41.6***
All above countries	**135274**	**190329**	**243370**	**242041**	**100.0**	**100.0**	**100.0**	**100.0**

Source: GTAP modelling database at www.gtap.org, accessed 6 January 2020.

Table 5: Budgetary transfers to farmers, actual 2014 and average AMS + de minimis entitlement, top ten countries,[a] 2014-16 (US$ million and % of total)

	Entitled, 2014-16 average	% of global entitlement, 2014-16	Actual, 2014	Actual 2014 as % of entitlement in 2014-16
China	205531	26.8	55330	27
European Union	120587	15.7	85649	71
India	70680	9.2	26288	37
United States	54599	7.1	29012	53
Japan	44571	5.8	7352	16
Brazil	38073	5.0	5867	15
Indonesia	26842	3.5	2663	10
Turkey	14271	1.9	3186	22
Russia	12417	1.6	5311	43
Mexico	11204	1.5	5747	51
Rest of world	169556	22.1	na	na
WORLD	768331	100.0	na	34[a]

[a] Average for 52 countries (covering all but 14% of global entitlements).
Sources: Actual 2014 from GTAP database; entitlement 2014-16 average from WTO database as assembled by DFAT. Both accessed 6 January 2020.

Appendix Table 1: Trade measures and domestic transfers supporting farmers (DS), 54 countries and rest of the world, all agriculture, 2014 (%)

	Import tariffs[a]	Export subsidies[a]	Domestic Support to primary agriculture (US$ million)				as % of value of production
	(%)	(%)	Output	Input	Factors	Subtotal	
Argentina	3.1		0	61	89	150	0.3
Australia	0.2		0	178	771	949	1.9
Brazil	4.5		526	2333	3010	5869	3.2
Canada	0.3		2	348	1140	1490	3.0
Chile	0.1		0	169	225	394	3.2
China	4.4		456	7392	47483	55331	7.5
Colombia	12.1		122	870	241	1233	6.3
Costa Rica	3.9		0	3	9	12	0.2
EU28	2.0		0	7173	78477	85650	29.3
Iceland	16.3		50	3	42	95	24.7
India	41.0	1.1	0	25924	364	26288	10.2
Indonesia	2.9		0	1991	672	2663	4.0
Israel	16.5		20	122	81	223	3.1
Japan	20.2		1395	306	5650	7351	15.1
Kazakhstan	5.8		137	310	863	1310	14.7
Korea	103.6		0	272	1208	1480	4.6
Mexico	1.5		80	1938	3730	5748	13.2
New Zealand	0.6		0	25	0	25	0.1
Norway	23.1	3.3	272	127	1582	1981	33.5
Philippines	9.4		0	121	127	248	0.8
Russia	9.2		567	960	3783	5310	7.9
South Africa	2.9		0	127	95	222	1.3
Switzerland	7.9		320	73	3365	3758	55.9
Turkey	9.8	0.1	1207	500	1478	3185	6.7
Ukraine	4.3		65	1178	366	1609	7.2
United States	0.9		430	6596	21987	29013	8.6
Viet Nam	5.4		0	344	101	445	1.2
Rest of World	7.0		0	0	0		0.0
WORLD	**7.7**	**0.0**	**5649**	**59444**	**176939**	**242032**	**6.7**

[a] Import tariffs and export subsidies correspond to primary and lightly processed products for: rice, sugar, oilseeds, meats and dairy products. The undistorted value of production is used to aggregate across countries.

Source: Compiled by the authors from the 2014 database described in Aguiar et al. (2019). The values for each commodity are reported in the Online Table.