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Food Policy in a More Volatile Climate and Trade Environment*

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Abstract

Providing affordable access to enough healthy and safe food for an ever-more-affluent and growing world population has become more challenging in the face of climate change, rising income inequality and a more uncertain global trade environment. Agriculture is expected to contribute more, but is under pressure in both high-income and developing countries to do so more sustainably and inclusively. This paper reviews the roles of food policy in this changing setting. It begins by revisiting the case for keeping food markets open to international trade, investment and technology transfer, and concludes that openness is even more important, especially for developing countries, as the climate becomes warmer and more volatile. It then summarizes trade-related food policy developments globally in the 50 years prior to the global financial crisis, and in the price-spike periods since then. The current situation is calling for more action – including from agriculture – to mitigate climate change and biodiversity loss. The scope for re-purposing food policies to better meet these demands is then assessed. It proposes some alternatives to current measures that could better achieve national societal objectives while simultaneously benefitting the rest of the world in terms of easing natural resource and environmental stresses and reducing national and global poverty, food and nutrition insecurity, and inequalities in income, wealth and health. The review concludes by noting areas where further research could facilitate such transformations in food policy.

Keywords: Uncertain international trade environment; Virtues of liberal food trade; Re-purposing food policies

JEP codes: F13, F18, Q17, Q18

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1. Introduction

Food policies over the past dozen or so years have come under numerous strains. After a steady rise in the first few years of this century, real international food prices spiked up in 2007-08 during the global financial crisis (GFC). They rose again in 2011-12, and then in 2021 rose once more and to a height not seen since 1974-75. Meanwhile, the United States unilaterally started a series of tariff ‘wars’ during the Donald Trump presidency (2017-20) triggering retaliation affecting the trade of numerous farm products. In 2020 the COVID-19 pandemic hit the world, causing border closures, lockdowns and thus major disruptions to international movement of most goods including food. Overlaying these short-term shocks have been long-term concerns with climate change and biodiversity loss, both of which adversely affect agriculture – and to which agriculture is itself a significant contributor. China’s rapid economic growth has brought opportunities for food-exporting countries, but its greater assertiveness under President Xi Jinping is adding new challenges. These developments, plus perceived rises in income and wealth inequality in numerous countries, are contributing to more market and policy uncertainty – and more populist political leaders with trade-protectionist inclinations to appease anti-globalization groups – than have been seen for several decades (see www.policyuncertainty.com and Funke, Schularick and Trebesch 2021).

This paper reviews the roles of food policy in this changing global environment. It begins by revisiting the case for keeping food markets open to international trade, investment and technology transfer. It then summarizes trade-related food policy developments globally

in the 50 years prior to the GFC (Section 3), and in the two price-spike periods since then (Section 4). COVID-19 has caused a considerable rise in the number of poor and malnourished people in the world (FAO et al. 2021), making it more difficult to meet the UN's Sustainable Development Goals of eradicating extreme poverty and hunger by 2030. The current situation is calling for renewed progress on that front, and for more action on climate change and biodiversity loss to help preserve the global commons, as well as less soil and water degradation and more space in intensive livestock facilities. Section 5 explores the scope for re-purposing food policies to better meet these demands. It suggests that some of the available measures for achieving national societal objectives can simultaneously benefit the rest of the world in terms of easing natural resource and environmental stresses while reducing national and global poverty, food and nutrition insecurity, and inequalities in income, wealth and health. The final section notes areas where further research could facilitate such transformations in food policy.

2. Why have open food markets?

When food markets are opened to international trade the gains from intra-national production specialization and market exchange are multiplied. Those gains from trade can come from exchange when domestic preferences differ from those in the rest of the world, but also from production specialization when relative factor endowments or technologies differ, from intra-industry trade when seasons differ, and from increased competition from abroad driving down monopolistic pricing domestically. The gains from production specialization are increasing as global value chains increase in importance. And since openness expands the scope for raising the variety of products available to consumers, it can contribute to diet diversity and food safety and quality, the demands for which rise with per capita income.

The smaller a country, the greater its gains from openness (Limao and Xu 2021). This is because without it there is less scope for specialization in production to exploit economies of scale, more scope for monopolistic pricing, and less likelihood that a weather shock to crops in one part of the country will be countered by an offsetting shock in the rest of the country. The latter also means that openness is becoming more important because of climate change: weather shocks are becoming greater and more frequent everywhere, and global warming is altering the comparative advantage of farmers, harming those in the tropics most.

These standard gains-from-trade arguments have been questioned at various times, but most such criticisms have been shown by welfare economists to be unfounded since there are superior domestic policy measures for dealing more efficiently and equitably with the concerns raised by those critics (Bhagwati 1971, Ch. 13 of Corden 1997). So long as complementary first-best domestic policies are in place for encouraging accumulation of various forms of capital (natural, human, knowledge, financial, physical), for providing public goods, and for offsetting local environmental and other externalities and risks, trade openness will be welfare-maximizing for any economy unable to influence its international terms of trade.

These arguments apply also to countries with an element of monopoly power in the international marketplace, because that power cannot easily be exploited by taxing the country's trade if other countries can retaliate (Johnson 1953-4). The General Agreement on Tariffs and Trade (GATT) and now the World Trade Organization (WTO) were designed at the outset to minimize such trade tax 'wars' via their most-favored-nation and reciprocity Articles, and by the WTO's dispute settlement mechanism that limits infringement retaliation to no more than a proportionate response. With these institutions in place, even large economies are incentivised to not exploit their market power, to the great benefit of smaller

economies and the world as a whole (Bagwell and Staiger 1999, 2002; Staiger 2021, Felbermayr et al. 2020).

In the past it has often been claimed that taxing trade is necessary for a late-developing country because that is its lowest-cost way of raising essential government revenue. As countries develop though, the capacity of the state to rely more on consumption and income taxes than on trade taxes gradually improves (Besley and Persson 2011, Besley, Dann and Persson 2021). Arezki, Dama and Rota-Graziosi (2021) find that liberalization alters the tax structure toward a greater reliance on indirect taxes relative to direct ones, and that economies with value added taxes in place prior to liberalization see less-negative effects on tax revenues from trade reform. Moreover, countries with the weakest tax-raising capacity can begin trade liberalization by replacing an import tariff with a consumption tax of the same magnitude which, even if collected only at the border, would raise the same revenue as a tariff. Any imposition of that new tax on domestically produced goods and services would then be a bonus to the treasury.

A further reason for openness this century is the vastly increased scope to separate in time and space the various productive tasks along each product's value chain, thanks to the information and communication technology (ICT) revolution. Firms are increasingly able to take advantage of factor cost differences across countries for specific tasks without having to sacrifice gains from product specialization or move the whole of their production operation offshore where the risks of intellectual property theft may be greater. This includes trade in services, which goes alongside and facilitates trade in most goods (Liu et al. 2021), including both unprocessed and processed farm products (OECD 2021c).

There is an important exception to the above gains-from-trade arguments, however. It has to do with environmental externalities and how they – and policy responses to them – can spill over to other countries and the global commons. International transport is one

contributor to global pollution: its direct damage is small, but it contributes also indirectly by facilitating the relocation of pollutive production and consumption (Cristea et al. 2013).

Whether the damage from greater transportation when importing food is more or less than the pollution from producing that food abroad instead of locally is an empirical question. In the comprehensive global study by Avetisyan, Hertel and Sampson (2014), transport costs are shown to be important in the case of dairy products but, overall, environmental benefits from differences in domestic emissions intensities of production outweigh transport costs in about 90% of the country/commodity cases they examine, undermining the ‘eat local’ rhetoric.

In some cases, removing current trade barriers and subsidies could itself improve the global environment (Anderson and McKibbin 2000, Shapiro 2021, Laborde et al. 2021), but in other cases expanding trade of products whose consumption or production is pollutive may cause environmental damage which costs more than the gains from expanding trade. An important influence on the environmental/resource outcome of opening is the extent to which property rights are attached to renewable resources and how well markets for them or their services operate in each jurisdiction, as for example with forests (Ferreira 2004), water (Debaere 2014, Ringer, Perez and Xie 2021) and fisheries (Erhardt 2018). Another influence is how heavily environmental pollution is taxed or otherwise regulated in each nation. Those policy measures alter the international competitiveness of domestic firms, the extent to which each nation’s environmental damage spills over to the rest of the world, and thereby global pollution.¹

¹ Going forward, trade measures such as carbon border tax adjustments may be imposed by the European Union and some other countries ostensibly to entice their trading partner countries to sign an international abatement agreement on greenhouse gas (GHG) emissions. Should that not alter the number of signatories, however, it would simply serve as an anti-trade protectionist measure benefitting local producers at the expense of producers abroad. Cattle and sheep producers in the rest of the world, and consumers of beef, sheepmeat and milk products in the protective countries, would be especially harmed if methane emissions were included in the scheme. Copeland, Shapiro and Taylor (2021) provide a thorough survey of these and related issues, including the effects of trade openness on national environmental policies and international environmental agreements and the latter’s possible linkages with international trade agreements.

In addition to the above comparative static arguments, openness to trade has the additional benefit of boosting innovation and an economy's growth rate (Estevadeordal and Taylor 2013, Akcigit and Melitz 2021, Melitz and Redding 2021, Aghion, Antonin and Brunel 2021). Greater openness to international financial markets adds further stimulus to investment. (By contrast, back-tracking on trade reform has a negative impact on foreign investment.) The latest surge of globalization has been spurred also by the technology 'lending' that is involved in off-shoring a rising proportion of production processes (Baldwin 2016).

More-open economies also tend to be more innovative insofar as that involves greater trade in intellectual capital. That is, international trade and investment liberalization can lead not just to a larger capital stock and a one-off increase in productivity but also to higher rates of capital accumulation and productivity growth in the reforming economy (Alcalá and Ciccone 2004), thanks to the way reform energizes entrepreneurs to be more innovative including through creative destruction of low-productivity firms by the most-productive firms (Feenstra 2018).

In the case of food markets, innovation can be accelerated by interactions between domestic and international R&D providers. New agricultural technologies and improved genes in seeds and breeding animals come from investments by both the private and public sectors.² Their uneven generation, adoption and international transfer across the world and across species have altered agricultural comparative advantages of countries and commodities non-trivially. Such investments have yielded extremely high estimated rates of return, even after great scrutiny of the methodologies used for measuring them (Rao, Hurley and Pardey 2020). Those high returns suggest agrifood R&D underinvestment by both high-income and

² Investments to improve agricultural productivity and thus general well-being have been called for almost since agriculture began and certainly well before Christ in India, China and the Roman Empire (Fuglie et al. 2020).

developing countries, especially as they do not include health benefits such as reduced infant mortality for poor rural households (which have been huge, see von der Goltz et al. 2020 and Bharadwaj et al. 2020).

Dynamic welfare gains from trade can occur even in countries that specialize in non-innovative, low-technology sectors, provided they are open to trade. They occur not from production but via consumption: innovation in high-tech sectors in the rest of the world lowers the price of those sectors' output and thus improves the international terms of trade of the less-innovative countries. This is a specific example of the more-general point that open economies benefit from the growth of other open economies with complementary trade specialization via the effect the latter has on the international terms of trade. Lewis (1979) made this point in arguing that developing countries, as exporters of primary products and importers of most manufactured goods, had gained from the post-war growth of advanced industrial economies up to 1973.

Whatever the degree of openness between national economies, an additional global dynamic gain can come from lowering uncertainty in the trade environment. One of the great benefits of the WTO has been that its member states agree to legally bind their import tariffs such that traders can be confident that they will pay no more than that ceiling rate, or otherwise have the right to be compensated (Francois and Martin 2004). China's accession to the WTO at the end of 2001 also reduced uncertainty in global trade for both China and its trading partners (Handley and Limão 2017) – something the current US-China tariff 'war' is undoing.

Econometric evidence regarding the impact of trade reform on economic growth were critiqued in a survey by Rodríguez and Rodrik (2001). In the two decades since then, researchers have tried to overcome the various methodological problems that plagued earlier

studies. A new survey by Irwin (2019) finds trade reforms to have had a consistent positive impact on economic growth on average, although the effect is not uniform across countries.

One reason for that unevenness of impact is that gains from opening an economy are greater if that opening is extended beyond goods to tradable services (Borchert et al. 2020, Liu et al. 2021), and if accompanied by a freeing up of domestic markets for land, water, labor, finance and non-tradable services, and of the market for foreign currency exchange (Atkin and Khandelwal 2020). If a country's currency is flexible such that its real exchange rate can move freely in response to international price or domestic market shocks (or a trade reform), producer and consumer incentives will adjust promptly to the new market conditions in a way that smooths the adjustments required and continues to maximize national economic welfare. And if a low-income country's trade reform is accompanied by (or preferably preceded by) the introduction of indirect taxes, the government's optimal level of tax revenue need not be compromised by reduced trade taxation.

Despite all the above benefits, critics of openness and globalization have raised various concerns (e.g., Stiglitz 2017, Helpman 2018, Rodrik 2020), and have pointed to the need to address them seriously if populist contenders are to be kept from reversing past trade liberalizations. The main criticisms have to do with income, wealth and health distributional consequences, plus environmental outcomes.

The current globalization wave has seen a massive decline in the incidence of global poverty (Ravallion 2016 and 2020, Atkinson 2019), and also ill-health (Deaton 2013). Another consequence is a great reduction in inequality of incomes across countries (Milanovic 2016). Yet much has been made of the rise of income and wealth inequality *within* countries during the current globalization wave (Goldberg and Pavcnik 2007, Stiglitz 2012, Bourguignon 2015, Zucman 2019, Case and Deaton 2021, Collier et al. 2021), and the lack of improvement in self-assessed well-being or happiness (Layard 2020),

notwithstanding the simultaneous massive declines in absolute poverty and ill-health nationally and globally. Empirical evidence vindicates the Corden (1997, pp. 72-76) notion of a conservative social welfare function in revealing that governments choose policies that help to avert losses for significant groups from exogenous shocks (Freund and Özden 2008, Tovar 2009), including food price shocks (Meyimdjui and Combes 2021).

Regarding poverty, evidence surveyed by Ravallion (2006, 2016) suggests aggregate economic growth differences have been largely responsible for the differences in poverty alleviation across regions. Initiatives that boost economic growth are therefore likely to be helpful in the fight against poverty, and trade liberalization is one such initiative. But cuts to trade barriers also alter relative product prices domestically and in international markets, which in turn affect factor prices. Hence their net effect on poverty and income inequality depends also on the way those price changes affect poor households' expenditure and their earnings net of remittances. If the consumer and producer price changes (whether due to own-country reforms and/or those of other countries) are pro-poor, then they will tend to reinforce any positive growth effects of trade reform on the poor. Simulation studies show that reforms to the food and agricultural policies of high-income countries could provide a major source of developing country gains from trade reform. Such reform would boost the demand for unskilled labor and for farm products produced in poor countries. Since more than two-thirds of the world's poor live in rural areas (World Bank 2021), and since many poor rural households are net sellers of farm labor and/or food, one would expect such reforms to reduce the number in absolute poverty.³

³ A set of analyses reported in Anderson, Cockburn, and Martin (2011), in which global and national CGE model results are carefully combined with household income and expenditure survey data for nearly a dozen developing countries, tests this hypothesis. It finds strong support for it in most of the country case studies considered, even though those estimates use comparative static models and so underestimate the gains because they do not include the poverty-reducing dynamic effects on economic growth of such reforms. A broader study of 163 countries since the 1960s finds market-oriented reforms were positively correlated with income shares of low-income citizens (Gründler, Potrafke and Wochner 2020); but it also shows that low-income citizens are less likely to support market-oriented reforms than high-income citizens, suggesting they misperceive the prospective benefits from such reforms.

In summary, openness to agricultural trade is likely to bring gains not just in efficiency terms but also in terms of reducing income inequality and especially poverty, malnutrition and ill-health, and contributing to diet diversity and food safety and quality. Whether it would reduce or add to national and global environmental damage and biodiversity loss is a separate empirical question. It was rudimentarily addressed three decades ago in a study that concluded the removal of food output and input price and trade distortions would likely reduce global environmental damage and chemical residues in food (Anderson 1992). A recent study focusing on the removal of agricultural subsidies and market price supports in 54 high- and middle-income countries found, however, that it would have only a minor impact on GHG emissions (Laborde et al. 2021). Another new study that focused on agricultural trade's impact on land systems found very heterogeneous environmental effects across regions and commodities (Kastner et al. 2021). Both came to a similar conclusion to that in the survey by Baylis, Heckeley and Hertel (2021), namely, that far more empirical research is needed by economists and ecologists to get a more comprehensive view of the effects of food and agricultural trade – and of trade reform – on various environmental indicators. This point is taken up in the final section of the present review.

3. How open were food markets pre-GFC?

During the globalization wave preceding World War I, international trade was hugely liberalized. It began for farm products with the repeal of Britain's Corn Laws in 1846, which benefitted the rest of the world as much as Britain due to its influence on their international terms of trade (Irwin and Chepeliev 2021). Then 1860 saw the signing of the Cobden-Chevalier Treaty that liberalized trade between Britain and France. That bilateral treaty's

most-favoured-nation (MFN) clause required any agreed cut in the tariff on each item in the bilateral trade to be applied also to their imports from other countries. It also meant that every European country that subsequently signed a bilateral trade treaty with either Britain or France (and most had done so by 1867) signed onto MFN. The systemic effect of that 1860 Anglo-French accord was thus of much greater significance than its importance to either country alone, as it led to a network of treaties that lowered hugely the average level of import tariff protection. During the years from 1860 to 1913 the world thereby enjoyed relative serenity in terms of international trade and monetary relations. Even though economic growth then was proceeding at less than half the post-World War II pace, it was very rapid by previous standards, as was international trade growth.

However, when many of the European trade treaties were reaching their expiry date (nearly fifty of them were to expire in the first half of the 1890s), economic difficulties were making their renegotiation contentious. Tariff wars ensued, so that the threat of retaliation – which had served as a deterrent to raising tariffs – was no longer a constraint on trade liberalization reversal. Even though MFN was retained, relations were strained by the absence of bindings on tariffs (to prevent backsliding), of constraints on non-tariff trade-distorting measures, and of legal means to resolve disputes. Furthermore, the unwillingness of America or others to adopt the unconditional MFN principle meant the sustainability of the European commercial policy achievements of that period was far from certain. Indeed, the bilateral treaty regime ended abruptly with the outbreak of World War I in 1914.

Following that war, efforts to restore liberal trade centred on international conferences. However, despite the rhetoric in support of open markets, those meetings did not lead to renewed trade treaties with binding commitments to openness based on MFN. With no country willing or able to replace Britain as the hegemon, there was trade policy anarchy (Kindleberger 1989). When economic recession and low agricultural prices hit in the late

1920s, and the US introduced the Smoot-Hawley tariff hikes of June 1930, governments elsewhere responded with beggar-thy-neighbour protectionist trade policies that together helped drive the world economy into depression (Hynes, [Jacks](#) and [O'Rourke](#) 2012, Jacks and Novy 2020). The volume of world trade shrunk by one-quarter between 1929 and 1932, and its value fell by two-fifths. Over the entire inter-war period both agricultural and other merchandise trade grew hardly at all. According to Federico (2005, page 22-29), world exports of both agricultural and non-agricultural goods declined by 0.8% per year between 1925 and 1938, and real prices of farm (and other primary) products in international markets slumped following their highs during World War I. That decline in international prices of primary products nudged Prebisch (1950) and Singer (1950) to advise developing country governments to encourage industrialization relative to primary production, the impact of which took decades to erode (Irwin 2021).

The first attempts to reverse the growth in protection were discriminatory, benefitting Europe's colonies at the expense of other trading partners. Thus between 1929 and 1938 the share of imports from colonies rose from 30 to 42% for Britain, from 12% to 27% for France, and from 20% to 41% for Japan (Anderson and Norheim 1993). By the end of the 1930s, protectionism was far more entrenched than in the late 19th century when only non-discriminatory tariffs had to be grappled with. Indeed nontariff trade barriers were so rife as to make tariffs redundant and hence a return to MFN irrelevant unless and until 'tariffication' of those barriers occurred. For agriculture that took until the World Trade Organization came into being in 1995.

Out of the interwar trade policy experience, many in Britain and the United States were convinced that liberal world trade required a set of multilaterally agreed rules and binding commitments based on non-discriminatory principles. After much negotiation, that led to the General Agreement on Tariffs and Trade (GATT). It was signed in 1947 by 23

trading countries – 12 high-income and 11 developing – who at the time accounted for nearly two-thirds of the world’s international trade (UNCTAD 2018). The GATT provided a forum to negotiate subsequent tariff reductions and changes in rules, plus a mechanism to help settle trade disputes. Eight so-called rounds of negotiations were completed in the subsequent 46 years, as a result of which many import tariffs on at least manufactured goods were progressively lowered in most high-income countries. Global merchandise trade grew faster in the half century following the coming into force of the GATT than in any other half century in history.

The last of those negotiations, the Uruguay Round (1986-94), culminated in numerous agreements to further reduce trade barriers over the subsequent decade. Two of those agreements involved, for the first time, a serious attempt to liberalize agricultural trade and discipline sanitary and phytosanitary (SPS) trade measures. Another agreement involved the GATT’s Secretariat in Geneva being replaced by the World Trade Organization (WTO) in January 1995, the membership of which now involves 164 countries/customs territories that account for more than 97% of world trade. By the end of the implementation of the Uruguay Round, the extent to which different farm products were imported or exported still varied enormously across countries and products (Table 1). Even though differential trade costs would explain part of that variance across products, it nonetheless suggests there may still be plenty more scope for further liberalization in the 21st century.

[insert Table 1 around here]

There were three reasons why agricultural trade grew much less rapidly than trade in other goods in the 20th century. Two reasons were structural, but a third has to do with policies. The first structural reason is the fall in agriculture’s share of global GDP (it is now only 3%, down from more than 50% not much earlier than 1900). The second structural reason is the recent fragmentation of industrial production into ever-more processes and the

associated rapid expansion in the number of international links in their global value chains (Antràs 2016, Baldwin 2016, Sposi 2019). Global value chains have grown for farm products too (Reardon and Minton 2021), but at a much slower pace than for manufactured goods. That shows up in the global shares of exports as a percentage of sectoral GDP, which rose during 1995-2010 from 66% to 105% for manufacturing while hardly changing (a rise from 53% to 58%) for agriculture.

The third contributor to relatively slow farm trade growth has to do with trade-restricting policies. The lack of strong GATT disciplines on agriculture's trade-related policies allowed two separate developments in farm policies between the 1950s and the 1980s: agricultural protection growth in high-income countries (especially Japan and the European Community), and agricultural export taxation in low-income countries. Nearly all of the assistance to Japanese and European farmers in that period was due to restrictions on imports of farm products. But assistance then rose markedly in the early 1980s, generating a surplus that was being disposed of with the help of export subsidies and which triggered a North Atlantic food export subsidy "war" (Bagwell and Staiger 2001).

Meanwhile, developing countries had been heavily discriminating against their farmers. A major World Bank study of 18 developing countries by Krueger, Schiff, and Valdés (1988) shows that the depression of incentives facing developing-country farmers from the 1960s to the mid-1980s had been due partly to various forms of agricultural price and trade policies, including subsidies to food imports as well as taxes on farm exports, and partly to developing countries' nonagricultural policies that hurt their farmers *indirectly*. The two key indirect measures were manufacturing protectionism (which attracts resources from agriculture to the industrial sector) and overvalued exchange rates (which attract resources to sectors producing nontradables, such as services).

A more-comprehensive World Bank study two decades later (Anderson 2009, 2010a) covers 45 developing countries but also 13 European transition economies as well as 24 high-income countries, and it covers all foods plus key raw materials such as fibres. Its results reveal that there have been substantial reductions in distortions to agricultural incentives in both high-income and developing countries over the past three decades (Figure 1). This is also clear from three decades of producer support estimates by the OECD (2021a):⁴ the nominal rate of agricultural protection for the 36 OECD member countries (mostly high-income economies) fell from 46% in 1986-88 to 26% in 2000-02 and 9% in 2018-20. However, for 12 (mostly large middle-income) emerging economies, the OECD estimates that their nominal rate of agricultural protection rose on average from 1% in 2000-02 to 4% in 2018-20.

[insert Figure 1 around here]

Those recent estimates also reveal that the reform process is far from complete. First, the average progress has not been uniform across countries and regions, particularly among developing countries: an average relative rate of assistance to farmers (RRA) for that group of close to zero hides the fact that some in that group of countries have RRAs well above zero and others less than zero. That is, some developing countries have “overshot” in the sense that they have transitioned from having an average RRA that was negative to one that is positive, rather than stopping at the welfare-maximizing rate for a small economy of zero. Second, even if a country has a zero RRA, that may be because the nominal rates of assistance (NRA) for its agricultural sector is the same as the weighted average of that for its other goods-producing (most notably manufacturing) sectors, both of which may be positive and thus attracting resources from non-tradable parts of the services sector. Third, many

⁴ The OECD’s NRA is defined as $PSE/(1-PSE/100)$ where its PSE is more comprehensive than that estimated by the World Bank study: the latter is based just on domestic to border price ratios and so is closer to the OECD’s NRP.

countries still have within their agricultural sector a wide dispersion in NRAs for different farm industries. In particular, all countries have a strong anti-trade bias in the structure of assistance within their agricultural sector. Global resource use is further distorted by the trade-restrictiveness of service sector policies, which are more severe than those for goods and which raise input costs in goods production (OECD 2020a).

More specifically, while the average NRA for exporters in developing countries has been negative throughout (but coming back from -50% in the 1960s and 1970s to almost 0% in 2000-10), the NRA for import-competing farmers in developing countries has fluctuated around a trend rate that has risen from 10% to 30% (and it even reached 40% in the years of low international prices in the mid-1980s). That anti-trade bias is further confirmed in Figure 2, which shows the while average import tariffs have come down over the past 25 years, they are still higher for agriculture than manufacturing and the agricultural average for DCs is well above that for HICs. And non-tariff measures restricting both exports and imports are far more prevalent for farm products than for those from mining or manufacturing (Figure 4 in WTO 2021b). Furthermore, there are still some African countries that directly discriminate against their farm sector (Pernechele, Balié and Ghins 2018). All this suggests that export-focused farmers in many developing countries are still discriminated against in two respects: (1) by the anti-trade structure of assistance within their own agricultural sectors, and (2) by the protection from imports that remains for farmers in other – especially developing – countries and thus limits both South-North and South-South trade.

[insert Figure 2 around here]

The RRA estimates shed light on something that had perplexed agricultural trade analysts for some time: why did self-sufficiency in farm products fall so little in China in the decades following its opening up despite the very strong growth in production and exports of manufactures in China? A non-trivial contributor has been the gradual removal of agricultural

disincentives, which encouraged farm output growth even as China's international competitiveness in manufacturing was strengthening (Huang et al. 2009). China transitioned from negative to positive assistance to farmers far faster than an average developing country, and almost as fast as its Northeast Asian neighbors did in earlier decades at similar levels of real per capita incomes. That helped to ensure China remained food self-sufficient during the first two decades of reform; but agricultural self-sufficiency is now declining and is projected to continue to do so over the next decade under current policies (Anderson 2018). Net imports of farm products declined until the early 1990s, but have been growing since then (Figure 3) – although more than half of those net imports are accounted for by just soybeans and now also maize for animal feed.

[insert Figure 3 around here]

Prior to this century, taxes on and quantitative barriers to trade were the dominant instruments of inter-sectoral distortions to producer incentives in most countries. Over the past two decades, however, budgetary transfers to farmers have paid an increasing role. Drawing on PSE estimates by the OECD (2021a), the GTAP modelling database suggests those US\$ outlays almost doubled between 2004 and 2014 in the 54 countries (including 13 large emerging economies) monitored by the OECD – as did the emerging economies' share in that total, which rose from 22% to 42% (Anderson and Valenzuela 2021).

The overall PSE in US dollars for OECD countries has changed little since the late 1980s, while their average PSE in percentage terms has halved thanks to growth in the value of farm output. With the contribution of trade barriers falling relative to that from domestic supports, the distortion to consumer prices has dropped even more, from a tax equivalent of 41% to just 7% (OECD 2021a). That compares with a 4% average for the 13 large emerging economies the OECD also monitors. It means there are still restrictions on imports into those countries' food markets provided by agrifood policies that make food more expensive for consumers than it would be under free trade.

As for public investments assisting the agricultural sector, an important component is agricultural R&D, which has had major influences on long-term trends in agricultural comparative advantages. Those investments fell between 2000-02 and 2018-20 from 1.1% to 0.8% of the gross unassisted value of production of the 54 countries monitored by the OECD (2021a), despite their very high rates of return (Rao, Hurley and Pardey 2020). Pardey et al. (2016) point to two important caveats though. One is that private investments in agricultural R&D have grown dramatically and now exceeds the rate of public investment (if food processing is included); the other is that developing countries, particularly Brazil, China and India, are rapidly increasing their share of global investment in agricultural R&D (Pardey et al. 2015, Fuglie 2016).

Payments to farmers for resource conservation and providing environmental services have grown to become a significant contribution in Switzerland and the EU, but it shows up only a little in the US and Norway and is very minor or non-existent in all other countries For

the OECD as a whole, it amounts to well under 2% of the gross value of agricultural production (OECD 2021a). Given that there are sometimes positive externalities associated with environmental services, these expenditures may be less than what is optimal from a national welfare or willingness-to-pay viewpoint.

Other forms of non-product-specific assistance to the farm sector included in the OECD's General Services Support Estimate (GSSE) are investments in rural infrastructure, in quarantine services, in public stockholding, and in marketing and promotion of farm products. For the 54 countries monitored by the OECD (2021a), the GSSE has added nearly one-quarter to the US\$ value of the PSE over the first two decades of this century. That annual sum (PSE+GSSE) averaged \$533 billion during 2018-20. If the import protection policies of all other developing economies were added, this sum would be 20% or so higher, according to the World Bank and IFPRI (2021). How that might be re-purposed to better meet current social objectives is taken up following the next section, which examines the volatility of food policies when prices spike.

4. How did food policies change during recent international price spikes?

The growth in agricultural protection to the mid-1980s added to a R&D-induced downward trend in real international farm product prices following the Korean War in the early 1950s, with the developing countries' export taxes only partly offsetting that effect (Tyers and Anderson 1992). Those prices flat-lined for the last 15 years of the 20th century, before rising dramatically for a combination of demand, supply, and policy reasons. One of the policy contributors was the emergence of biofuel subsidies and mandates in both the United States and the EU, just at a time when fossil fuel prices were rising for a decade from the early 2000s (Figure 4).

[insert Figure 4 around here]

But policy responses to food price rises have exacerbated the situation, as Johnson (1975) pointed out with respect to the 1973-74 food price spike. Although agricultural trade policies were officially all converted to tariffs following the Uruguay Round, many of the legal bindings on tariffs were set well above actual applied rates, allowing considerable flexibility to adjust protection rates down or up without breaching the limits imposed by these ceiling commitments to the WTO membership. That allows many countries' policymakers to seek to stabilize their domestic prices relative to world market prices by varying the

protection or taxation rates applied to agricultural trade in the short run. This insulating behavior may make sense for a small individual country if no other countries reacted, but such thinking involves a fallacy of composition. This is most easily seen by considering a case where each country's price is linked to the world price and each country responds in the same way to an increase in world prices. If a tightening of world market conditions raises world prices by \$10, and all exporters offset this by applying a \$10 export tax while all importing countries lower their import duties by \$10 for the same reason, the combined impact is a rise in world prices of \$20 instead of \$10. Thus domestic prices rise by the same \$10 they would have risen in the absence of this collectively ineffective intervention. This is similar to all people in a stadium standing up in the forlorn hope of getting a better view of the playing field.

The extent to which that type of impact occurred during the global financial crisis is shown by Martin and Anderson (2012) and Jensen and Anderson (2017) using annual data and by Giordani, Rocha and Ruta (2016) using monthly data. It also occurred following the food price spike in the early 1970s and the price slump in the mid-1980s (Anderson and Nelgen 2012). In those environments, only countries that insulate by more than the average have any hope of stabilizing their domestic prices using this strategy (Anderson, Martin, and Ivanic 2017). In practice, by becoming less integrated into the international grain market it is possible that domestic markets become *more* unstable in the medium term – as found for wheat in Russia and Ukraine (Götz, Glauben and Brümmer 2012) and for maize in Africa where imperfect implementation diverted trade into the informal sector (Porteous 2017).

Slumps in international prices can trigger the opposite government reaction, to protect domestic farmers from a drop in the price of their output. For food-importing countries that can be in the form of a higher tariff or quantitative import restriction, and for food-exporting countries in the form of export subsidies. The use of such measures in the mid-1980s by the

EU and North America was one of the reasons the Cairns Group (made up of 15 non-subsidizing agricultural-exporting countries) insisted the Uruguay Round Agreement on Agriculture involve binding and phasing down both import tariffs and export subsidies.

Another important form of agricultural trade policy response for staple foods—frequently observed in Africa—focuses on actual or perceived shocks to agricultural supply. When domestic outputs of maize or other key staples are expected to be below normal levels, export restrictions are often imposed or state-traded imports are brought in. Such sporadic policy responses tend to destabilize many domestic and international markets, and frequently reduce food security by focusing on the availability of food rather than on the more economically relevant ability of vulnerable groups to access food (Sen 1981). A recent example is for maize in Zambia, which added to poverty because the poorest households were net sellers of maize (Koo, Mamun and Martin 2021).

These two reasons for governments to alter border restrictions (to insulate the domestic market from international price volatility, or to ensure enough supplies in the wake of a domestic production shortfall) are likely to be invoked more in future insofar as climate change adds to market instability.⁵ That suggests there will be a greater need to extend WTO disciplines on import restrictions and export subsidies to cover also export restrictions in future, to avoid the futile ‘standing-up-in-the-stadium’ practice seen in 2008-11 or the export subsidy ‘war’ of the mid-1980s. Yet some developing countries continue to call for special safeguard measures that would allow them to use temporary import price- or quantity-triggered restrictions at their discretion, in spite of numerous analyses that suggest they will be ineffective ((Hertel, Martin and Leister 2010, Grant and Meilke 2011, Ivanic and Martin 2014, Thennakoon and Anderson 2015). More encouraging is the fact that the 30% upward

⁵ COVID-19 provided another example of governments altering border restrictions during a crisis, namely for vaccines and *personal protective equipment* for health care workers: import tariffs were suspended, and export restrictions including bans were put in place in 2020/21 (WTO 2021b).

spike in international food prices in 2021 (see Figure 4) triggered relatively few and shorter-lived food export restrictions compared with the 2008-12 period (Ch. 2 in IFPRI 2021).

5. How best to re-purpose food policies?

The hyper-globalization of the first two decades of this millennium, plus the global financial crash of 2008, China's re-emergence on the world stage, and the increases in income and wealth inequality in numerous nations have contributed to a swell of anti-globalization sentiment. Adding to these concerns are the digital revolution, climate change, biodiversity loss, and biosecurity/food safety and animal welfare issues. On top of that, the COVID-19 pandemic in 2020-21 has led to a considerable rise in the number of poor and malnourished people in the world (FAO et al. 2021), making it more difficult to meet the Millennium Development Goals of eradicating extreme poverty and hunger by 2030. One consequence has been a rise in the number of populist national political leaders, some of whom have withdrawn from multilateralism and imposed 'temporary' protectionist import tariffs and other trade sanctions, adding substantially to global market and policy uncertainty.

Even though globalization and trade opening are often blamed for increased disruption to and uncertainty in markets, much is due to on-going structural changes that accompany economic growth and to which new technologies and innovations are major contributors. Yet key societal concerns are based on assumed impacts of trade on such things as inequality of income, wealth and health, unemployment, poverty, and damage to the natural environment and its resources. The COVID-19 pandemic has added to inequalities and reduced interest in cross-border activities.

If trade *per se* is not the main reason for these disliked social outcomes, then a trade policy instrument is unlikely to be the first-best response and might even worsen the situation (Bhagwati 1971, Corden 1997). Even so, the task for governments challenged with demands to meet multiple policy objectives is becoming more complex as the voices of ever-more single-focused interest groups become louder via the megaphone of social media, and as concerns for the global commons grow.

It is in this environment that there have been calls for transforming the world's food systems to make production more sustainable, consumption safer and healthier, and both more resilient and inclusive and less damaging to natural resources and the environment (see, e.g., Fan et al. 2021). That would require major re-purposing of food policies in both high-income and developing countries. It would help if WTO members could resolve multilaterally to lower

trade barriers first. Since one of the thorniest sectors to deal with at the WTO has been agriculture, Cahill et al. (2021) have suggested new pathways for agricultural negotiations that, if taken up, could re-invigorate other parts of the WTO's long-inactive Doha Development Agenda. But should that prove elusive, and should bilateral or regional preferential trade agreements (PTAs) continue to deliver few cuts to agricultural subsidies and tariffs (Bureau, Houssein and Jean, 2019), reliance in the meantime will need to be on unilateral actions.

As argued in Section 2 above, unilaterally lowering food trade barriers could bring gains not just in efficiency terms but also in terms of reducing inequality and especially poverty, food insecurity, malnutrition and ill-health. Openness is not only the backbone to long-term human progress (Norberg 2020), it is also the best national insurance against unexpected shocks to markets. That applies not just to goods and services trade but also to migration, finance, foreign currency exchange, foreign direct and portfolio investments, technologies and ideas. The long-term decline in costs of trading internationally, and the consequent strengthening of global value chains, add to that potential for openness to increase the trend rate of economic growth and to reduce its fluctuations, and to boost affordable access to healthy food as populations and incomes grow.

Since global warming and extreme weather events are becoming more damaging to food production in many regions, climate change is a further reason for nations to be open to international food markets so trade can buffer seasonal fluctuations in domestic production. The more countries that do so, the less volatile will be international food prices.

As for dealing with natural resource and environmental issues, the best option for national governments is to directly target local market frictions and market failures that currently lead to inefficiency, inequality and environmental damage, including via better education for the next generation of leaders and for those likely to be otherwise left behind by forthcoming technologies (Acemoglu 2021, Colantone, Ottaviano and Stanig 2021).

Specifically, to reduce the risk of back-tracking on the trade reforms of recent decades and increase the prospect of continuing down the reform path, attention should turn to strengthening the measures that will make firms and households more resilient in the face of

uncertainties, and more assured that optimal domestic policies and institutions are in place to deal with externalities and to supply needed public goods – including meeting expectations and agreed obligations to contribute to global public goods such as mitigating climate change and biodiversity loss. For example, taxing greenhouse gas emissions would add to costs of production, and more in agriculture than many other sectors, but it would also potentially stimulate new environmentally friendlier technologies. That could provide other income streams for some landholders in the form of carbon sequestration options or the provision of priced ecosystem services.

The national economic welfare gains from trade opening are greater, the more there are complementary first-best domestic policies and institutions in place for encouraging optimal accumulation of various forms of capital (natural, human, knowledge, financial, physical), for providing national public goods and for offsetting local environmental and other externalities and risks. A key set of institutions that can boost optimal investments in primary production are well established and enforced land, water, forest and fishery property rights, in addition to those for minerals and energy raw materials. And social costs associated with households and firms being more exposed to uncertain international markets and new innovations can be lowered with better-functioning financial and insurance markets (Jensen and Barrett 2017, Robles 2021), income tax systems, and generic social safety nets/trampolines. The latter also facilitate the adjustments by firms and households to reductions in trade barriers and subsidies, especially if those reforms are pre-announced and phased in over time.

As noted above at the end of Section 4, there is currently more than US\$500 billion worth of support being provided annually to farmers in the 54 countries monitored by the OECD (2021a), the majority via import restrictions which also raise the consumer price and reduce the availability of food in protectionist countries. Opening up those food markets and

removing subsidies to pollutive farm inputs would be strongly opposed by farmers if they were not compensated. More than that, in the 1990s in some high-income countries it was argued that agricultural protection and subsidies were warranted because farmers contributed to ‘non-economic’ objectives of society. The claim was that agricultural production was ‘multifunctional’ in that it provided positive externalities and public goods for which farmers were not being paid directly. Examples pointed to included food security, environmental protection, and the economic viability of rural areas. Such claims did not stand up well to scrutiny, however, as they ignored negative externalities from farming (and farm input subsidies) and there were more-efficient and more WTO-consistent instruments for achieving those social objectives than measures that support farm prices and reduce trade (Anderson 2000). For example, for those countries becoming more food import-dependent as their comparative advantages move away from agriculture, slowing that process by raising food import barriers worsens rather than improves their national food security and nutrition, since it raises food consumer prices and thus reduces economic access to food for the vast majority of households who are net buyers of food. And protecting net sellers of farm products from import competition is a very inequitable way of assisting farmers, in that it helps such farmers in proportion to their marketed output and thus boosts the incomes of the biggest/least-needy farmers most. It also boosts landowners’ wealth in proportion to the size of their holding (Ciaian et al. 2021).

A far more efficient way to assist today’s farmers to compensate for reducing their import protection would be to boost the current underinvestment in rural infrastructure (to lower transport and communication costs involved in getting to market farm products, especially nutritious but perishable fresh fruits and vegetables) and in agricultural R&D (to lower farmers’ costs of production or raise the quality and thus price of their product) – both of which benefit consumers as well as producers. Rural education and health services often

are inferior to those in urban areas, so they could be improved. That would provide the human capital needed for farm families to become more resilient as farmers, or to more-easily take up more lucrative non-farm activities. If that were not enough support for the poorest farm households, a generic social safety net e-payment such as conditional targeted income supplements could be provided, especially when prices spike or crops fail, thereby lowering the number falling below the poverty line. The widespread use of e-banking now makes fiscal transfers to individuals possible at little administrative cost, even to poor households in low-income countries (Demirgüç-Kunt et al. 2018).

More recently, much of the environmental protection component of those earlier ‘multifunctionality’ claims by farmers has been rebadged as payments for ‘ecosystem services’. These are deemed necessary to ensure society gets closer to the optimal use of its natural capital. Where a market can be developed such that the community can express its willingness to pay for such services, it would then be up to farmers to demonstrate that they are competitive suppliers of those services. That may well boost demand for targeted research on how best to design and implement institutions and policies in this space. One example has to do with carbon sequestration in soils, demand for which will be greater the higher the taxation of carbon emissions and the more developed the market for tradable emission permits nationally and abroad (Simone et al. 2017). For individual farmers the first task is to estimate whether the up-front cost of changes in land management practices is more than offset by the subsequent flow of benefits from selling carbon credits (White, Davidson and Eckard 2021). Some scientists have cautioned that the scientific basis for such payments is often not sound, so they have proposed a set of guidelines and principles to assist this process (Naeem et al. 2015). As well, much remains to be learned about the effectiveness of various schemes that have been tried (Börner et al. 2017), with their inadequate design and implementation hampering their success to date (Wunder et al. 2020).

How might lowering restrictions on international technology transfers impact malnutrition and hunger, and diet diversity and quality? Hunger and undernutrition in particular could be eased greatly, if slowly, by trade in agricultural technologies, in particular newly bred varieties of staple crops. The introduction of high-yielding dwarf wheat and rice varieties during the Green Revolution that began in Asia in the 1960s is a previous case in point, whereby producers and consumers shared the huge benefits in terms of higher farm profits and lower consumer prices for cereals (Gollin, Hansen and Wingender 2021). Now there is the possibility of breeding crop varieties that are not only less costly to grow sustainably (Qaim 2020) but are also biofortified in the sense they contain vitamin and mineral supplements. One of the most promising is so-called golden rice. Consumers in many poor countries suffer from chronic vitamin A deficiency that can lead to blindness, weakened immune systems, and increased morbidity and mortality for children as well as for pregnant and lactating women. Golden rice has been genetically engineered to contain a higher level of beta-carotene in the endosperm of the grain and thereby provide a vitamin A supplement. However, there continues to be a reluctance in many countries to import both genetically modified (GM) seeds for local production and GM foods for local consumption (Anderson, Jackson and Nielsen 2005). While that reluctance persists, conventionally bred biofortified crops can and do offer an alternative pathway (see www.harvestplus.org), although it is necessarily slower at producing novel varieties than is possible using GM or gene editing biotechnologies.

Unfortunately, trade in technologies to national agricultural researchers via the CGIAR (Consultative Group on International Agricultural Research) has been slowed by a decline in investments of more than one-fifth between 2015 and 2019 – despite a benefit-cost ratio from past investments in CGIAR research of more than 10:1 for developing countries as a group (Alston, Pardey and Rao 2021), and despite new opportunities also for public-

private partnerships in such research as food supply chains become more sophisticated with the continuing growth of supermarkets and spread of digital technologies (Fuglie et al. 2020). Hopefully the recent reorganization to create a more-integrated ‘One CGIAR’ will reverse that decline in its funding.

What about food policy changes to boost consumers’ nutrition and health? The dietary transitions that occur with economic growth and urbanization are substantial (Masters, Finaret and Block 2022). They are influenced also from the supply side by transport and infrastructure improvements that lower cost of trading fresh food, and by productivity growth along the food value chain right through to retail supermarkets. Yet despite the rapid penetration of fresh fruit and vegetable consumption in both rural and urban areas of low- and middle-income countries, undernutrition and obesity continue to coexist as major health concerns in those countries (Reardon et al. 2021a). Both types of malnutrition, as well as micronutrient deficiencies, can be influenced by government policies. Specific taxes on ingredients such as sugar and low-quality oils are being introduced in numerous countries (Calcott 2021). Other interventions include labelling regulations, restrictions on advertising and marketing of unhealthy products such as sugar-sweetened beverages, and nutritional education programs, e.g. for mothers and school children. Interventions that simultaneously target both undernutrition and obesity could be expanded, because of the common drivers of these often coexistent forms of malnutrition (Hawkes et al. 2020).

6. Some areas for further research

Whether or not global public good efforts lead to new multilateral agreements that require changes to national policies, the task of national governments to satisfy many objectives simultaneously when reviewing their food policies have become more complex. For

developing countries this is on top of their attempts to reach the United Nations' Sustainable Development Goals (SDGs) by 2030. The conventional wisdom is that a similar number of policy instruments is needed if those multiple objectives are to be met efficiently (Tinbergen 1952). The complexity of finding optimal levels of intervention for numerous policy instruments multiplies greatly as the number of objectives and hence instruments rises; and the welfare cost of deviating from the most appropriate instruments or their optimal intervention levels is becoming ever-more difficult to assess.

All this suggests the need for more-sophisticated analyses of policy options for governments to consider. It is thus encouraging that methodologies for solving this multiple objectives problem are being developed and appear to be tractable (see, e.g., Martin, Ivanic and Mamun 2021, Bellanger et al. 2021). Those new methodologies can be and now are beginning to be used also to encourage governments to re-purpose farmer assistance policies away from welfare-reducing and environmentally damaging agricultural price supports and towards natural environment- and human health-enhancing measures. Such measures, like those demanded of livestock producers by animal welfare groups, add to producer costs. In so far as trading partners do not impose similarly costly new measures, this will raise competitiveness issues and potentially demands for compensating border tax adjustments. Already the EU is planning to introduce a carbon border adjustment tax on imports from countries with a lower tax equivalent on GHG emissions (EC 2021). This could have the positive environmental effect of encouraging other countries to impose such taxes, but the downside risks of such measures are considerable, especially for GHG-emitting foreign producers of exportables, and for developing countries with lower environmental standards (Ch. 13 of Corden 1997, Mattoo et al. 2012, Martin 2021).

A new study suggests that while removing current farm policies would reduce standard distortionary costs, that alone would not make a big improvement in the global

environment, assuming none of the benefits from such liberalization are invested in initiatives to improve the natural environment (Laborde et al. 2021). Policies therefore will need also to tilt towards environment- and health-enhancing measures. Thus further research is needed to assist the search for politically, administratively and fiscally feasible solutions. New efforts to that end include analyses of incentives to encourage the adoption of more-sustainable agricultural practices (Piñeiro et al. 2020), of enhanced investments in more-sustainable, climate-sensitive and nutrition-sensitive agricultural technologies, of more direct re-distributions of purchasing power to the poorest households as and when needed, and of boosts to consumer information that will nudge households towards a healthier diet⁶ based on food ingredients that are also less damaging to the environment (World Bank and IFPRI 2021, Huang and Zhang 2021, Mamun, Martin and Tokgoz 2021, Searchinger et al. 2021).

A mundane but necessary step in improving on these modelling efforts is to have sound representations of current policies in the various models. The annual PSE and CSE monitoring and evaluation by the OECD (2021a) continues to be the main resource for high-income and key emerging countries, but it is being supplemented for other developing countries at www.ag-incentives.org only with nominal rates of import protection. More resources need to be found in international organizations to deepen that effort among developing (especially low-income) countries, and to broaden it to include a fuller range of non-tariff measures such as regulatory policies behind national borders. The latter are among the biggest trade barriers today. Certainly it is challenging to estimate their extent and effects,

⁶ The Lancet Commission (Willett et al. 2019) sought to provide an ideal diet capable of sustaining health and protecting the environment, but it did not assess its affordability. A first attempt to do the latter found its cost exceeded the household per capita income for at least 1.6 billion of the world's poorest people, and is 60% above the minimum cost of nutrient adequacy (Hirvonen et al. 2020). Apart from affordability, the ideal diet differs by age group (for example, Headey, Hirvonen and Hodinott (2018) suggest animal-sourced foods may be very beneficial in early childhood), and the demographics of high-income countries are very different from those of developing countries.

but more progress is possible (Beghin, Maertens and Swinnen 2015, Francois and Hoekman 2019).

Such policy-focused research and empirical open-economy analysis by economists can assist governments more, and have more-lasting impacts, the better analysts understand from the outset the political economy forces at work both domestically and abroad (Swinnen 2018, Grossman and Helpman 2021). After all, long-standing agricultural and other policies that distort markets persist not because of the economic illiteracy of policymakers but as a consequence of asymmetries in political power and costs of collective action between those groups gaining and those losing from a measure (Anderson 1995, Zingales 2020). It is a recognition of those political forces that is driving analysts, including at the World Bank and IFPRI (2021) and the FAO, UNDP and UNEP (2021), to look for ways to re-purpose farm-support measures such that the well-being of a broader range of groups in the rest of the society is improved without reducing greatly the welfare of currently supported farmers.

The key topics/questions that cry out to be addressed better by analysts are complicated and overlapping. That is, they involve trade-offs that require interactions between different groups in society, different professions, and various bureaucracies all with different priorities. For example, economists projecting the effects of climate change on agriculture using a global multi-sector economywide model that has a baseline in which climate change is assumed not to happen, need to compare that projection with one in which climate change does occur to some specified degree, without and then with various greenhouse gases being taxed in some countries from specified periods, then with GHG emission permits being traded internationally, then with the European Union and perhaps other countries imposing a carbon border tax adjustment on certain imported products, and then with other countries imposing GHG emission taxes in lieu of paying the EU etc. carbon border taxes.

Much more research is needed also to improve on schemes involving payments for ecosystem services. Börner et al. (2017) find that positive incentives (rather than disincentives such as taxes, sanctions and legal regulations) work only if very well designed, and that their environmental impacts so far have tended to be small at best and usually just local or sub-national, as are their social impacts. Sustainability standards also have had only a modest impact so far (Meemken et al. 2021).

Another example of a future complex research area involves empirical analysis of the effects of trade reforms on poverty, nutrition, food security, health and gender.⁷ What the analyst assumes about whether/how fiscal policies are to be adjusted as part of the reform will matter in such analyses. So too will any re-instrumentation of the measures to be removed (e.g., introducing a producer subsidy or an income supplement in place of an import tariff), and any efforts to nudge consumers away from products that add directly to obesity (e.g., sugar-rich beverages) or indirectly to greenhouse gas emissions (e.g. methane and nitrous oxide from cattle) via the production of beef.

The capacity of economists to project global production, consumption and international trade in agricultural and other products has improved enormously since 1990, particularly with the set of global economywide computable general equilibrium (CGE) models. Examples using GTAP-type models include Chateau et al. (2015) and Bekkers et al. (2021). As well, the OECD and FAO join forces each year to project the world's agricultural commodity markets one decade hence (OECD/FAO 2021), while IFPRI has now linked its very detailed IMPACT model of global agricultural product markets and associated input and factor markets (Robinson et al. 2015), to a global CGE model (Willenbockel et al. 2018). The more extensive of these types of models are capable of estimating income inequality and poverty consequences of projections and shocks, by region and by type of household, and also basic resource and environmental consequences including GHG emissions. Other social consequences also are now able to come into focus, helped by regulatory impact assessments becoming standard in advanced economies (OECD 2020b, Kauffmann and Saffirio 2021).⁸ Since the degrees of market and policy uncertainty around trend projections have grown considerably in recent

⁷ Only recently has attention begun to focus on its unequal impact of trade on gender (Boler, Javorcik and Ulltveit-Moc 2015 and 2018, Shepherd and Stone 2017, Brussevich 2018, OECD 2018, Gurevich, Riker and Tsigas 2020, World Bank and WTO 2020, and Korinek, Moise and Tange 2021).

⁸ A few countries are going beyond standard GDP/GNI measurement to capture a broader concept of well-being based on the science of psychology. See, e.g., Durand (2018, 2019), Stiglitz, Fitoussi and Durand (2018a,b), Layard (2006, 2020) and OECD (2020c). National life satisfaction scores are more closely correlated with the national Pillars of Prosperity Indexes generated by Besley, Dann and Persson (2021) than with GNIs.

years, systematic sensitivity analysis will need to be far more common in future modelling efforts.

The natural resource and environmental impacts of modelled projections and shocks continue to improve, but much scope remains for analyses becoming more comprehensive. This is especially important when numerous sectors are involved. Bellanger et al. (2021) point out that when the focus is on a single sector and user group, remedies can include Pigouvian restraints, or small group controls following Ostrom (1990, 2009), or bargaining across users (Coase 1960). However, more-difficult natural resource management problems involve competing uses of a resource or of multiple resources across numerous sectors. Such cross-sectoral externalities impede equal attainment of each conservation objective, especially if they fall under several jurisdictions. Bellanger et al. (2021) provide a four-level institutional analysis following Williamson (1996, 2000): social embeddedness, institutional environment, governance and resource allocation. That is able to illustrate the sources of potential conflict, the costs of addressing them, and the potential for resolutions via exchanges. It includes transaction costs associated with property rights, the costs of lobbying, implementing and enforcing government regulation, and the costs of scaling up from small-group controls when resource problems involve multiple sectors and heterogeneous populations.

To operationalize such complexities in analyses using national and global multi-sector economywide models, a prior step is to better value capital beyond physical capital, and to include investment in a recursive way in projections. McKibbin and Wilcoxon (1999) have included financial capital and investment in their G-Cubed Model, which informs their modelling of climate change (see, e.g., McKibbin et al. 2020 and Fernando, Liu and McKibbin 2021) and allows them also to assess monetary policy (McKibbin et al. 2020). But better specifications also of human, natural and social capital are needed to capture environmental and social outcomes more comprehensively. The OECD (2020c) is gradually contributing in that direction in its national accounting, for example by subtracting net depreciation of the total capital stock from GDP each year, while UNEP (2019) is improving global estimates of natural capital. Lange, Wodon and Carey (2018) have conveniently assembled a time series of those various capital stocks up to 2014.⁹

Another issue that could be better incorporated into national and global sectoral and economywide models involves the impacts of modelled projections and shocks, and of policy changes, on nutrition and health. Specific taxes on unhealthy ingredients such as sugar and

⁹ Incidentally, UNEP (2019) found that between 1992 and 2014 the global natural capital stock per capita declined by nearly 40% while the per capita stock of physical capital doubled and that of human capital rose by one-eighth.

low-quality oils can be included in and analysed using economic models (Calcott 2021). More difficult to model are such things as labelling regulations, restrictions on advertising and marketing of sugar-sweetened beverages, and nutritional education programs. Even in OECD countries though, better data are needed to help improve policy analyses of and responses to these interventions (Placzek 2021, Deconinck et al. 2021).

With less than a decade to the target date, projecting the costs involved to achieve the UN's SDGs is needed to focus the attention of government and international agencies. A beginning has been made regarding the innovations required for sustainable agricultural intensification to meet several SDGs (Laborde, Parent and Smaller 2020, Baldos, Fuglie and Hertel 2020, Rosegrant 2021), but more such studies will be needed as the decade progresses.

Finally, some progress has been made in endogenizing political economy realities in simulation models (building on the work surveyed in Anderson 2010b and Anderson, Rausser and Swinnen 2013), but much more could be done to ensure policy options being analysed for developing countries with limited state capacity include ones that are realistic politically, administratively and fiscally (Birner 2021). Even with sound and shared multi-disciplinary evidence-based policy analyses to hand that expose the winners and losers of major policy options, and even if no vested interests captured the political process, remaining frictions may need to be resolved because of differences in values held by different groups within each society (Besley, Dann and Persson 2021, OECD 2021d).¹⁰ Transparency and inclusiveness in policy debates, and possibly compensation for losers (adjustment assistance) and long transition periods will need to be among the strategies adopted by politicians and international negotiators as they seek to resolve remaining differences within countries and in fora such as the WTO. While no amount of compensation would satisfy some groups with

¹⁰ Differences in values affect a large array of food issues, over and above the factual gap between perception and reality (Paalberg 2020).

extreme values, these processes may be able to reduce at least some opposition to policy reforms that improve economic welfare, human health and the natural environment. That will require more-savvy use of communication channels though: in their survey of the political economy of populism, Guriev and Papaioannou (2021) find the impact of the internet and social media appear to favor populists far more than mainstream political leaders. More research is thus needed on how to more-persuasively communicate the virtues of welfare-improving policies, including the proposed re-purposing of food policies to better meet multiple objectives – not just economic but also social, environmental and cultural and not just nationally but hopefully also globally.

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Table 1: Shares of domestic consumption imported and of domestic production exported, 27 major agricultural products,^a 2000-03 (%)

	Africa	Asia	Latin America	European transition economies	High-income countries
% of consumption imported					
Grains ^b	17	9	22	11	27
Oilseeds ^c	2	51	27	6	62
Tropical crops ^d	13	18	12	42	42
Livestock products ^e	8	6	5	9	14
All products	27	13	14	11	19
% of production exported					
Grains ^b	2	7	11	13	29
Oilseeds ^c	4	32	35	25	30
Tropical crops ^d	52 ^f	38	45	32	47
Livestock products ^e	1	4	10	7	20
All products	27	16	22	11	24

^a Weighted averages across 82 countries, using consumption or production measured at undistorted prices as weights.

^b Barley, cassava, maize, millet, oats, rice, sorghum, wheat

^c Groundnuts, palm oil, sesame seed, soybean, sunflower seed

^d Cocoa, coconut, coffee, cotton, rubber, sugar, tea

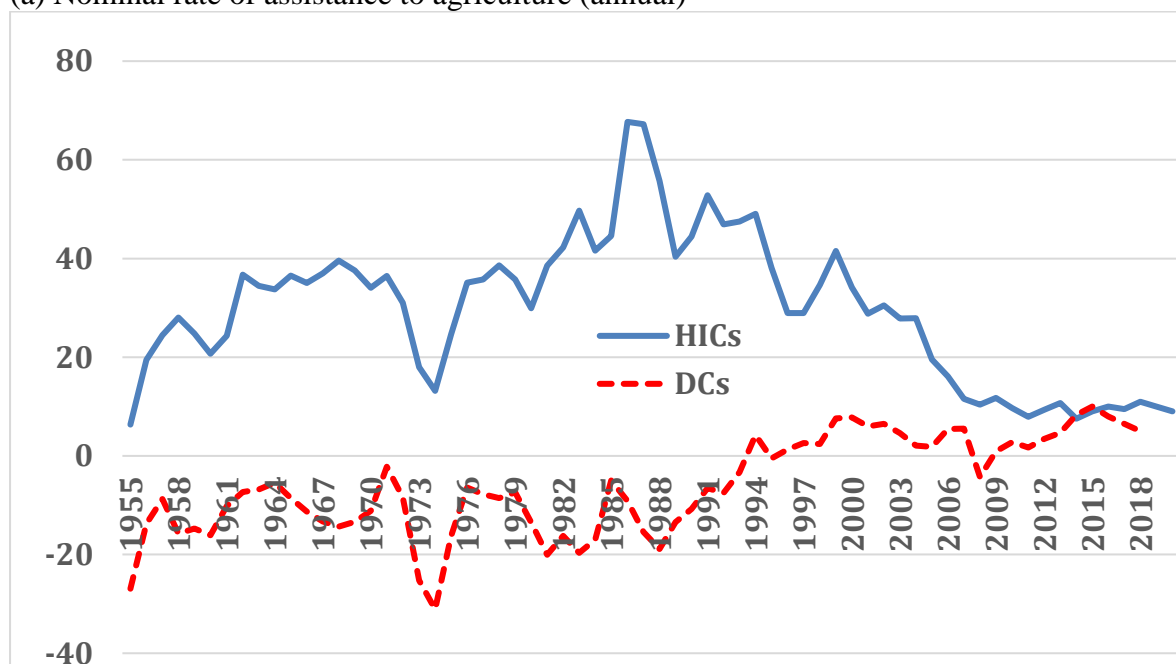
^e Beef, eggs, milk, pig meat, poultry, sheep meat, wool

^f Not including the cotton-exporting countries of Benin, Burkina Faso, Chad, Mali and Togo, most of whose cotton was exported.

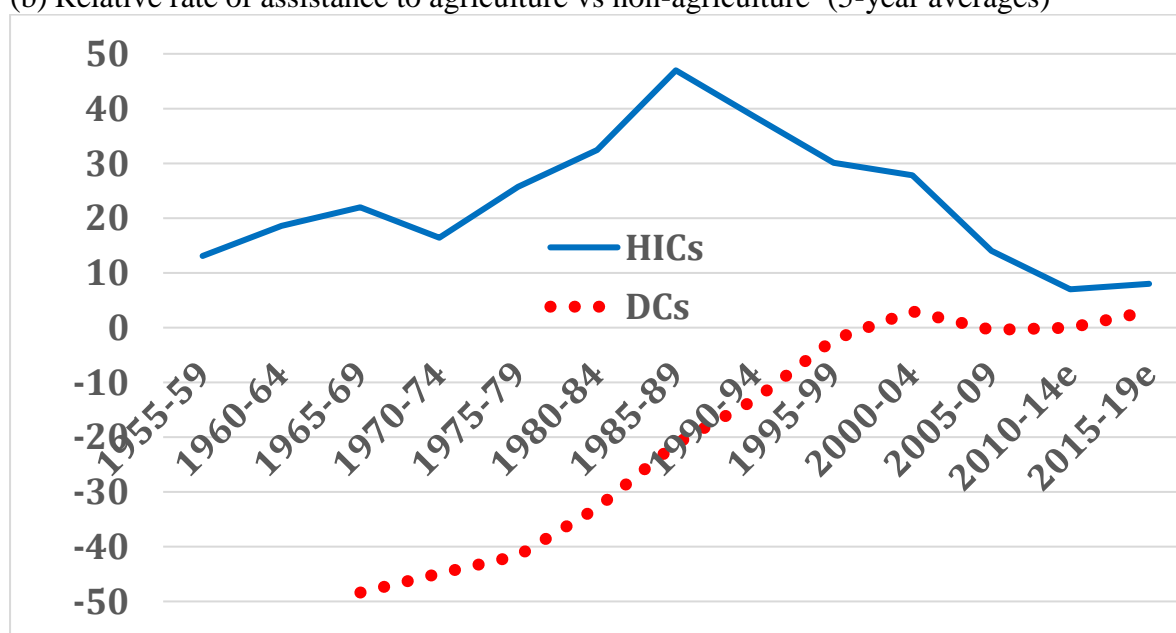
Source: Anderson (2009, Table B.8), based on FAO commodity balance sheets.

Figure 1: Nominal and relative rates of assistance to agriculture,^a high-income (dotted line) and developing countries (solid line), 1955–2020 (%)

(a) Nominal rate of assistance to agriculture (annual)



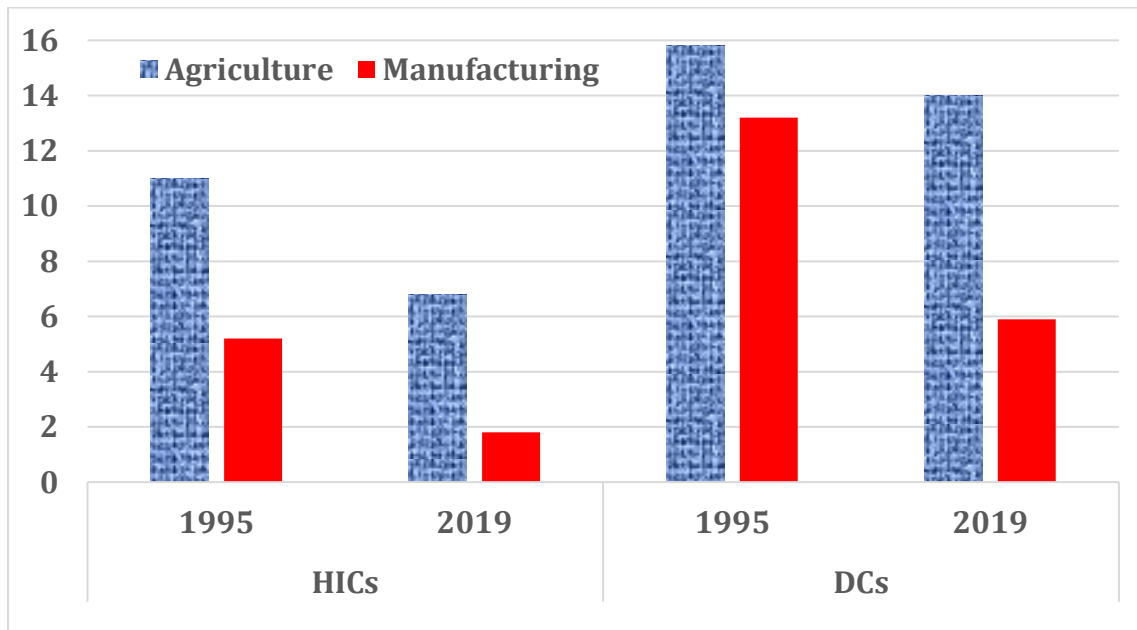
(b) Relative rate of assistance to agriculture vs non-agriculture^a (5-year averages)



^a RRA is defined as $100 * \left[\frac{(100 + \text{NRA}_{\text{ag}}^t)}{(100 + \text{NRA}_{\text{nonag}}^t)} - 1 \right]$, where NRA_{ag}^t and $\text{NRA}_{\text{nonag}}^t$, respectively, are the nominal rates of assistance (NRAs) for the tradable segments of the agricultural and non-agricultural goods sectors. The NRA is the percentage by which gross returns to producers in a sector are raised because of government sectoral or trade policies.

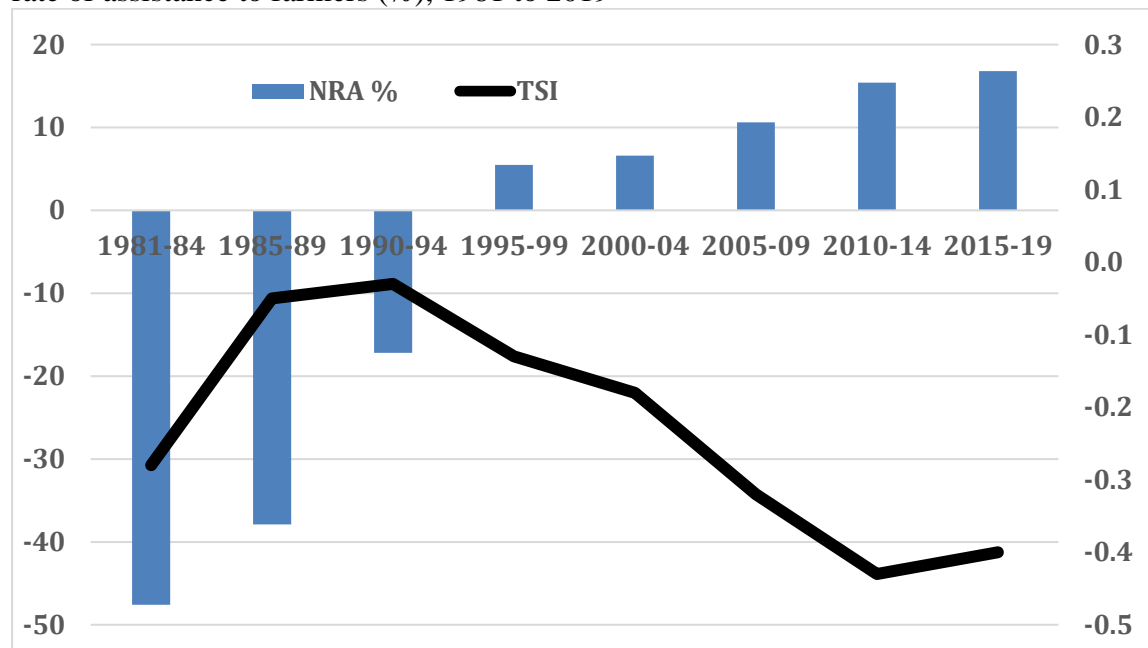
Source: Anderson and Nelgen (2013) to 2011 updated using nominal rates of protection from www.ag-incentives.org (accessed 9 November 2021) plus (for HICs in 2019 and 2020) OECD (2021a).

Figure 2: Average import tariffs protecting agriculture and manufacturing in high-income and developing countries, 1995 and 2019 (%)



Source: WTO (2021b).

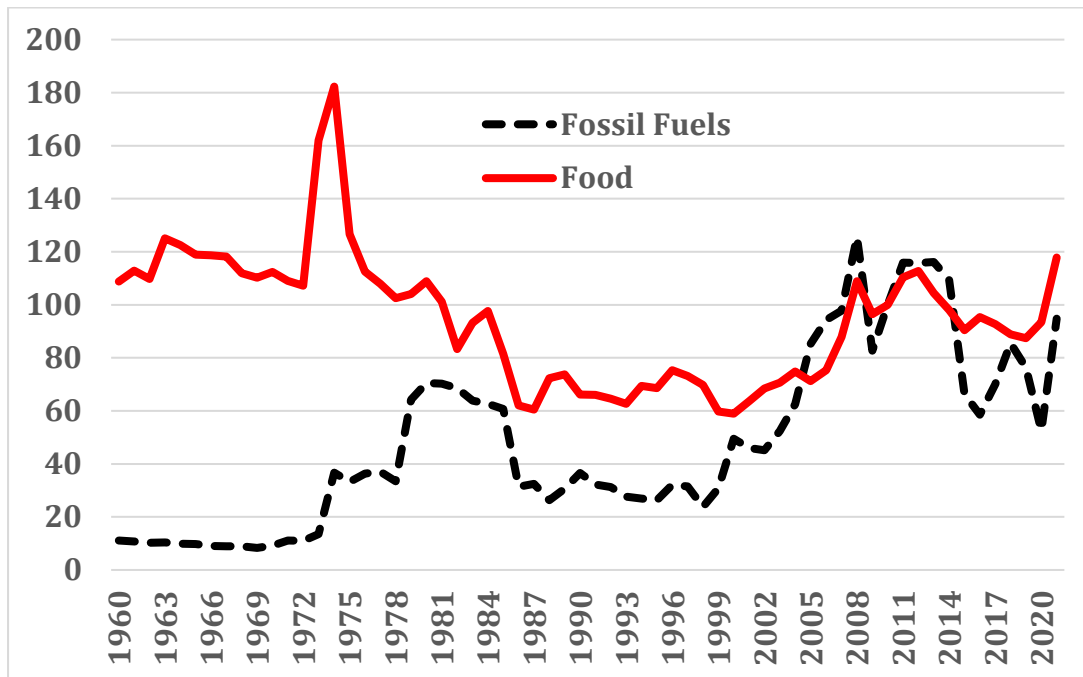
Figure 3: China's index of trade specialization in agricultural and food products^a and nominal rate of assistance to farmers (%), 1981 to 2019



^a The TSI is net exports as a ratio of exports+imports.

Source: Trade data from FAO (2021a), NRAs from Huang et al. (2009) to 1994 and OECD (2021a) thereafter.

Figure 4: Real international prices of food and fossil fuel (energy raw materials) for developing countries, 1960 to 2021^a (2010 = 100, based on real 2005 \$US)



^a 2021 data refer to the projection as of 21 October 2021.

Source: World Bank, *Pink Sheets* (accessed 29 October 2021).