Australian National University

Working Papers in
Trade and Development

National and global price- and trade-distorting policies

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April 2016
Working Paper No. 2016/07

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ANU College of Asia and the Pacific

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National and global price- and trade-distorting policies

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Abstract

This paper surveys significant contributions made **by** Australian and New Zealand agricultural and trade economists to our understanding of the extent to which price- and trade-distorting policies affect domestic and international prices and markets for agricultural products and economic welfare. It begins with the theory of policy impacts on producer and consumer prices and value added by farmers. It then surveys efforts to measure the extent of distortions due to such policies, first in Australia and New Zealand and then in other regions of the world. ANZ economists' efforts to use models to estimate the market and welfare effects of policies nationally and globally are then assessed, before attention turns to their ex ante estimates of the effects of trade agreements. The paper's online supporting material includes a brief survey of attempts to understand the political economy forces behind those various policies and their recent reforms.

Keywords: Distortions to agricultural and food markets, nominal and relative rates of assistance, economywide modelling of trade-related policies

*The author is grateful for very helpful comments from many workshop participants and AJARE reviewers, while remaining solely responsible for the views expressed. Forthcoming in a Special Issue of the *Australian Journal of Agricultural and Resource Economics* 60(4), October 2016, on 60 years of Antipodean contributions to agricultural and resource economics.

National and global price- and trade-distorting policies

1. Introduction

During the first century of European settlement, the remote and lightly populated colonies of Australia and New Zealand faced higher trade costs, both domestic and international, than any other high-income country. They were therefore less able to benefit from international trade than North Atlantic economies. Yet on independence in 1901 both the new Australian Federal Government and New Zealand chose to adopt highly protectionist manufacturing policies, and retained them for more than seven decades (Anderson and Garnaut 1987; Rayner and Lattimore 1991). Australia also adopted many market-distorting agricultural policies shortly after Federation, and many of them survived to the 1970s as well (Sieper 1982; Edwards 1987; Mauldon 1990). In both countries those policies had a strong anti-trade bias, thereby harming the interests of their exporters, the vast majority of whom were farmers and associated agribusinesses.

Australian and New Zealand (ANZ) agricultural export interests also have been harmed by agricultural protectionist policies of other high-income countries. Some of those policies were liberalized in the mid-19th century, but many were reinstated around the turn of that century and again in the 1930s. Then from the 1950s they became gradually more protectionist, limiting the growth in farm imports and depressing both international food prices (Johnson 1991) and the terms of trade for agricultural-exporting Australia and New Zealand.

It is therefore not surprising that antipodean policy economists focused on analysing the extent, effects, and political economy underpinnings of price- and trade-distorting policies not only locally but also abroad, especially those thwarting growth in their nations' exports.[1]

This paper surveys significant contributions made by ANZ economists to our understanding of the extent to which price- and trade-distorting policies affect domestic and international prices and markets for agricultural products and why they

[1] For a review of the past one hundred years of contributions by agricultural economists globally to this field of research and analysis, see Josling et al. (2010).

were adopted and changed over time. While **i**t is impossible to provide a comprehensive survey of the literature in the space available, the paper seeks to be a pointer to the most-significant contributions by ANZ agricultural and trade economists to either trade-related policy outcomes in ANZ and elsewhere or to the history of thought within the global profession of agricultural trade economists.

The paper begins with the theory of policy impacts on producer and consumer prices and value added by farmers. It then surveys efforts to measure the extent of distortions due to such policies, first in ANZ and then in other regions of the world. ANZ economists' efforts to use models to estimate the market and welfare effects of those policies nationally and globally are then assessed, before attention turns to their ex ante estimates of the effects of trade agreements. The online supporting material includes a brief survey of attempts to understand the political economy forces behind those various policies and their recent reforms.

2. Price- and trade-distorting policies and economic welfare: theory

Own-country policies were the initial focus of ANZ economists examining trade-related policies. The most-significant early analysis was the report by Brigden et al. (1929), which examined qualitatively the effects of the Australian tariff on protected and other industries, and on national income and its distribution. But it was not until 1957, when agricultural economists gathered for their inaugural annual conference in Australia, that the first formal partial and general equilibrium analysis of the economics of the Australian tariff appeared in print (Corden 1957). Corden made very clear to other ANZ economists the importance of the insight in Lerner (1936): that an import tariff in a two-sector economy lowers the relative prices of other tradable products and so is equivalent to a tax on the country's exportables. That is, unassisted ANZ farmers are harmed not only by having to pay tariff-inflated prices for imported farm inputs, but also higher prices for mobile factors of production. The latter include labour, which is being attracted to tariff-protected manufacturing industries, and also farm land insofar as some less-competitive agricultural industries also receive government assistance.

This insight was picked up again a decade later in a famously unpublished paper by Fred Gruen,[2] who coupled it with the theory of the second best. Gruen (1968) pointed out that lowering assistance to agriculture in the presence of high assistance to manufacturing could decrease rather than increase national economic welfare. A policy debate followed over the next decade, with some arguing for tariff-compensating farm assistance to continue until manufacturing tariffs were brought down (e.g. Harris *et al*. 1974; Harris 1975) whereas others (e.g. Lloyd 1975; Warr 1978, 1979) pointed out the political economy dilemmas and informational and other problems this could raise. The latter gave weight to the first-best argument for lowering the rate of protection to manufacturing down to the rate of assistance to agriculture (and other tradable sectors), or at least lowering both rates in tandem.

Corden (1963, 1966) made a subsequent crucial contribution to trade-related policy analysis by developing, along with Balassa (1965), the concept of effective tariff protection. The concept underlines two facts: (i) that a nominal tariff on an imported product would provide less protection to an industry if there was also a tariff on some of that industry's imported inputs, and (ii) that an industry's value added would be raised proportionately more by a particular nominal tariff on competing imports the smaller is the value-added share of the industry's gross output. A report to the Australian government by Vernon et al. (1965) was the first official report in any country to embrace the effective rate of tariff protection (ERP) concept.

Australia's Tariff Board was expanded to the Industries Assistance Commission in 1974 (later renamed the Industry Commission and then the Productivity Commission), following a report to the Prime Minister by Crawford (1973-S).[3] In the process its mandate was expanded to include all of agriculture and other sectors, and the ERP concept was broadened to the effective rate of assistance (ERA) so as to capture also non-tariff forms of government support to each industry. That opened up the possibility of bringing evidence to bear on Gruen's concern that policymakers need to be aware of assistance differences across industries and sectors.

[2] Unpublished because the author was unsatisfied with the extent to which he understood the economics involved when there are more than two sectors in the economy (Gruen 1998, pp. 185-87).
[3] References, Figures and Tables marked with an S appear as supplementary material in the Appendices to this paper.

Generating annual ERA estimates for every industry and thus averages for the key sectors producing tradables is computationally demanding, however, and it requires an up-to-date input-output table for the entire economy. Such estimates are thus difficult to generate for developing countries, and even for advanced economies if one wishes to go back to earlier decades.

To retain the essence of the inter-sectoral insight from Lerner's Symmetry Theorem but avoid the computational complexity of ERAs, a team at the World Bank (Anderson et al. 2008) suggested generating a relative rate of assistance (RRA). This is defined in percentage terms as:

$$RRA = 100[(1+NRAag^t/100)/(1+NRAnonag^t/100) - 1]$$

where $NRAag^t$ and $NRAnonag^t$ are the weighted average percentage nominal rates of assistance on outputs (NRAs) for the tradable parts of the agricultural and non-agricultural sectors, respectively. If agriculture is assisted to the same extent as other sectors, the RRA is zero; and if it is below (above) zero, the RRA provides an indication of the extent to which a country's policy regime has an anti- (pro-) agricultural bias.[4]

Also important, as Gruen (1968) noted, is the dispersion of NRAs and ERAs across industries within each sector. This is because the welfare cost of distortions is greater the more mobile are productive factors, and factors tend to be more mobile within than between broad sectors such as agriculture and manufacturing.

To take account of NRA dispersion, Anderson and Neary (2005) specified an elegant methodology to provide a family of measures under the catch-all name of trade restrictiveness indexes to supplement sectoral NRAs and CTEs (parallel consumer tax equivalents of border measures). Lloyd, Croser and Anderson (2010) showed how that methodology can be applied using no more information than that used to generate product NRAs and CTEs if it is assumed that domestic price elasticities of supply are equal across farm commodities within a country, and likewise for price elasticities of demand. The resulting measures thus can be readily generated as supplements to current policy monitoring indicators. Croser, Lloyd and Anderson (2010) do so by defining a Welfare Reduction Index (WRI) and a Trade Reduction Index (TRI). The TRI (or WRI) is that ad valorem trade tax rate which, if

[4] The RRA is an alternative way of capturing Lerner's insight to the 'omega' concept developed by Clements and Sjaastad (1984-S).

applied uniformly to all tradeable farm commodities in a country that year, would generate the same reduction in trade (or economic welfare) as the actual cross-commodity structure of agricultural NRAs and CTEs for that country, other things equal. An implication is that the more dispersed the industry NRAs (and CTEs) within a sector, the more the WRI will be above the NRA for that sector.

Since NRAs and CTEs are relatively easy to calculate, especially if the only distortions are to output prices, so too are estimates of RRAs, and of TRIs and WRIs, for comparing over time and among countries.[5]

3. Measures of the extent of ANZ distortions to farmer incentives

Following the Brigden Report (1929), the first attempt to provide quantitative indices of the extent of Australia's import tariff protection was by Crawford (1934). Piecemeal efforts were made as part of various tariff inquiries in the following decades, but it was only once the relatively independent Industries Assistance Commission was established in 1974 that systematic regular estimates of Australia's NRAs and ERAs were calculated and published. Rates have since been estimated annually for not only all 4-digit manufacturing industries but also all agricultural industries, allowing the two sectors' average ERAs to be compared. They reveal that agriculture's ERA was below that for manufacturing throughout the 1970s and 1980s, but since then the two sectors' ERAs have been very similar and have fallen steadily to less than 5% (Figure S-1).

Earlier NRA estimates for Australian agriculture were made available for selected products and years by Harris (1964) and Lloyd (1973). A more-comprehensive set have since been reported in Anderson et al. (2009) and updated by Anderson and Nelgen (2013-S). Summarized for the period 1946 to 2011 in Table S-1, they reveal the considerable extent of the anti-trade bias in assistance to various farm industries, especially in New Zealand. They also reveal the wide dispersion across industries even within the two sub-groups of exportables and import-competing farm industries. They also show that farmer assistance in both countries initially rose in the post-World War II period before declining after 1970 in Australia and after the

[5] Indeed even semi-general equilibrium measures of assistance can be generated using TRIs, see Lloyd and MacLaren (2010).

mid-1980s in New Zealand. Most remarkably from the perspective of other high-income countries, they show government assistance to most farmers in both countries has been close to zero since the start of this century.

NRAs for manufacturing have now been compiled back to 1903 by Lloyd (2008). Building on those, a first attempt to calculate a long time series of RRAs for Australia and New Zealand is reported in Anderson et al. (2009). They show New Zealand began lowering its NRAs to both farm and non-farm sectors a little after Australia, but both countries have had NRAs and hence the RRA close to zero since 2000. The Australian numbers (summarized in Anderson, Lloyd and MacLaren 2007-S), that have since been extended back to 1904 by Lloyd and MacLaren (2015), are shown in Figure S-2. They reveal that Australia's anti-agricultural policy bias was even greater in each of the seven decades prior to 1970 than suggested by the Productivity Commission's ERA estimates for the period since then.

In their World Bank dataset, Anderson and Nelgen (2013-S) provide WRI and TRI estimates for 82 countries including Australia and New Zealand. As expected from theory, the WRI is well above the NRA. In the case of Australia, the WRI was as much as three times the farm sector's average NRA before the country's policy reforms dealt with the last of the politically difficult industries. Now, however, both indicators are below 5%, indicating a large reduction in not only the mean but also the variance of industry NRAs (Figure S-3).

4. Distortions to agricultural incentives in the rest of the world

When agricultural economists gathered for their first annual conference in Australia in 1957, there were already clear signs that agricultural price and trade policies were again causing disarray in world food markets (Haberler 1958). The extent of that disarray escalated over the 1960s in two ways: (i) farm protection growth following the creation of the European Economic Community's Common Agricultural Policy and the rapid industrialization of Japan plus domestic and export subsidy growth in the United States (BAE 1981, 1985; ABARE 1989; Harris 1990), and (ii) the imposition of high rates of agricultural export taxation and manufacturing import protection plus overvalued exchange rates in newly independent developing countries. Those policy settings continued through to the 1980s, before both country groups

began to undertake major policy reforms. When placed in historical perspective, the reforms in other advanced economies since the late 1980s are as dramatic as their agricultural protection growth in the previous three decades.

Measurement of the economic impacts of those policies has improved enormously over the past half-century. The most commonly cited indicators of government interventions in agricultural markets of high-income countries and a few large middle-income countries are the producer and consumer support estimates (PSEs and CSEs, which are closely correlated with NRAs and CTEs) and related measures that have been computed annually by the OECD (2015). Those estimates only begin in 1986 though.

An earlier study by Anderson, Hayami and Others (1986) estimated NRAs for key high-income countries for the period 1955-82. It also estimated them for Japan, Korea and Taiwan from 1903. Both datasets were used to test the hypothesis that countries switch from taxing to subsidizing agriculture relative to other sectors in the course of their industrialization – an hypothesis that is supported strongly by that evidence.

For the OECD as a whole (whose country membership was expanding gradually), producer support rose only slightly between 1986-88 and 2012-14 in US dollar terms (from $238 to $251 billion) and, when expressed as a share of support-inclusive returns to farmers, it came down from 37% to 18%. When the PSE payment is expressed as a percentage of undistorted prices to make it like an NRA, the fall is from 58% to 22%. This, together with the fact that much support was re-instrumented so as to be somewhat de-coupled from production, suggests high-income country policies have become considerably less trade-distorting.

As for developing countries, the main comprehensive set of pertinent estimates over time was, until recently, for the period just prior to when reforms became widespread. They were generated as part of a study of 18 developing countries by Krueger, Schiff, and Valdés (1988). That study was followed up by a global study that began in the mid-2000s at the World Bank and covered the years from 1955 for a total of 82 countries that together account for all but one-tenth of global agriculture. The initial results to 2004 were summarized in Anderson (2009). They were updated to 2011 by Anderson and Nelgen (2013-S), and from 2016 will

continue to be updated by a consortium of international agencies led by IFPRI and the OECD.

The results from that study (which are compared with the earlier estimates by Krueger, Schiff and Valdés ones in Anderson 2010-S) reveal that there have been substantial reductions in distortions to agricultural incentives in both high-income and developing countries over the past two to three decades. They also reveal, however, that progress has not been uniform across countries and products, and that the reform process is far from complete. More specifically, many countries still have a wide dispersion in NRAs for different farm industries (and hence a large gap between their WRI and NRA – see Figure S-4), and all continue to have a strong anti-trade bias in the structure of assistance within their agricultural sector.

Those new results reveal that the NRA to farmers in high-income countries rose steadily over the post-World War II period through to the end of the 1980s, apart from a dip when international food prices spiked around 1973-74. After peaking at more than 50% in the mid-1980s, when international food prices were at a near-record low, the average agricultural NRA for high-income countries has fallen substantially (Figure S-5(b)). This is so even when the new farm programs that are 'decoupled' from directly influencing production decisions are included. For developing countries, too, the average NRA for agriculture has been moving towards zero, but from a level of around -25% between the mid-1950s and early 1980s (Figure S-5(a)). Indeed that indicator 'overshot' in the 1990s by becoming positive, but by 2010 was still less than half the average NRA for high-income countries.

The improvement in farmers' incentives in developing countries is understated by the above NRA estimates, because those countries also have reduced their assistance to producers of non-agricultural tradable goods, most notably manufactures. The RRA for developing countries as a group went from minus 46% in the second half of the 1970s to just above zero in the first decade of the present century (Figure S-5(a)). This increase (from a coefficient of 0.54 to 1.01) is equivalent to an almost doubling in the relative price of farm products domestically compared with that ratio in international markets. This is a huge change in the fortunes of developing country farmers in just one generation. The removal of such disincentives has contributed to expanding developing countries' net exports of agricultural goods. It was thus an offset to the positive impact on international prices of ANZ farm exports due to reduced assistance to farmers in high-income countries.

5. Modelling effects of distortionary policies on markets and economic welfare

Formal modelling by ANZ economists of the economic effects of market-distorting policies goes back more than five decades. Many academic agricultural economists provided partial equilibrium analyses of policies affecting individual farm products. Some of those studies are reprinted in Throsby (1972), and many more are reviewed in the survey papers by Edwards and Watson (1978) and Griffith and Watson (2016). While those studies themselves did not lead to the immediate reform of the policies being analysed, they became the foundation on which policy economists built in State Departments of Agriculture, the federal Bureau of Agricultural Economics and (from its formation in 1974) the Industries Assistance Commission to make the case for reforms.

The earliest empirical analyses of global market distortions also were based on single commodity partial equilibrium models, such as those developed for sugar policy analysis by Snape (1963, 1969). Around the same time, Takayama and Judge (1963) championed spatial price equilibrium models when Takayama was at the University of New England. These were followed by a multi-commodity stochastic dynamic (but still partial equilibrium) model of world food markets developed by Tyers (1985).

Then economy-wide, computable general equilibrium (CGE) models came into being. The first one developed for Australia was by Evans (1972), and over the next decade it was greatly enhanced for practical policy analysis by Dixon et al. (1982).[6] Known as ORANI, the latter model was used to estimate impacts on sectoral production, employment and trade, and on economic welfare, of a wide range of national policies. Those results had a major impact through adding to transparency in

[6] The agricultural part of the ORANI model drew on earlier innovations in modelling farm supply by Powell and Gruen (1967, 1968), and enhanced by Vincent, Dixon and Powell (1980).

the policy debate in Australia during the acceleration of microeconomic reforms in the 1980s (Powell and Snape 1993).

Since the 1980s CGE models have become even more sophisticated. Australia has again been at the frontier of those developments, as manifested in the transforming of the Australian ORANI model into the dynamic MONASH model with its regional, occupational and household disaggregations (Dixon and Rimmer 1998).

Global CGE models necessarily took longer to develop than national models such as ORANI because they require so much more data. In Australia one emerged as the SALTER model, developed in the late 1980s by the Industry Commission (Jomini et al. 1991).

While on sabbatical as a Fulbright Fellow at the University of Melbourne in 1990, Tom Hertel was granted permission to take the SALTER model back with him to Purdue University. There, from the early 1990s, he and myriad colleagues have been improving it as the publicly available so-called GTAP model and database (Hertel 1997). That openness, which has been characteristic of some other CGE modelling groups including ORANI and MONASH, has been a great spur to model innovation. It has also led to numerous variants of the GTAP model being developed, and to many others drawing on the GTAP database (including the World Bank's global Linkage model the family of dynamic models built from McKibbin and Wilcoxen 1995).

Valenzuela, van der Mensbrugghe and Anderson (2009) used the Linkage model (a) to estimate the net economic effects of (non-farm as well as farm) price and trade policy changes around the world between the early 1980s and 2004, and (b) to see how the estimated effects of those reforms on farm incomes and economic welfare compare with the estimated effects of removing price distortions that were still in place as of 2004. Their results suggest the world had come three-fifths of the way toward free trade in goods over those two decades.

6. Effects of altered trade restrictions in response to international food price spikes

The pattern of government distortions to agricultural incentives has made international markets for these weather-dependent products thinner and thus more volatile. The consequent price volatility is exacerbated, however, by the tendency for both rich and poor countries also to alter their border (and domestic) measures from year to year in an attempt to stabilize prices and quantities in domestic food markets – a tendency that has faded in ANZ (Griffith and Watson 2016) but has not diminished elsewhere as part of the trade-related policy reforms that began in the mid-1980s.

Such border actions amplify the price volatility faced by other countries, prompting their governments to follow suit. The irony is, however, that when both food-exporting and food-importing countries so respond, each country group undermines the other's attempts to stabilize its domestic markets. That is to say, what seems like a solution to each importing (or exporting) country's concern *if it were acting alone* turns out to be less effective, the more exporting (or importing) countries – presumably for the same political economy reasons – respond in a similar way. Back-of-the-envelope (BOTE) estimates by Martin and Anderson (2012) and Anderson and Nelgen (2012-S) suggest that the combined responses by governments of all countries contributed between one-tenth and one-third to the 2006-08 international grain price rise. But they also suggest that the importing countries' actions were sufficiently offsetting of the exporting countries' actions as to do very little to insulate either country group's domestic markets from that spike. Jensen and Anderson (2016) fine-tuned these BOTE estimates by using the global economy-wide GTAP model, but drew similar conclusions. Moreover, a related study has shown that those policy responses did not even reduce global poverty when account is taken of the combined effect of all countries' actions in exacerbating the international price spike (Anderson, Ivanic and Martin 2014).

7. Ex ante analysis of economic effects of partial reforms via trade agreements

Australia has long hoped to enjoy growth in farm (and mineral) exports to neighbouring East Asia as that region's densely populated economies industrialize, just as it did as Europe industrialized. Given the growth and spread of agricultural protectionism in both regions' advanced economies over most of the past century, however, it is not surprising that Australian economists saw value in revealing to consumers and non-farm businesses the extent of distortions in ANZ export markets

and analysing opportunities to open up those protected markets (BAE 1981, 1985; Stoeckel 1985; ABARE 1987). The greatest prospects for doing so have always been seen to be via multilateral agreements under the GATT and its successor from 1995, the World Trade Organization (WTO), with regional free-trade agreements viewed as next best but far less helpful (Harris 1990; Snape, Adams and Morgan 1993).

Providing detailed estimates of the prospective benefits from such multi-country reforms to trade-related policies was still in its infancy in the 1980s as efforts were being made to launch the GATT's Uruguay Round of multilateral and multi-sectoral trade negotiations. Following their contribution to the World Bank's *World Development Report 1986* on this issue (Tyers and Anderson 1986-S, later expanded to their 1992 book), Anderson and Tyers (1992-S) provided ex ante results using their partial equilibrium model of world food markets for a hypothetical set of partial reforms.

The emergence of global economywide computable general equilibrium (CGE) models offered new opportunities to assess the Uruguay Round agreements once they were reached at the end of 1994 (Martin and Winters 1996). Some years later, those CGE studies were criticized in retrospect for overstating the benefits of agreed reforms. The problem arose because analysts did not recognize the extent to which key high-income countries bound their tariffs at well above applied rates such that the agreed subsequent reductions in bound rates led to few cuts in applied tariffs.

In the light of that criticism, Will Martin of the World Bank launched a research project focused on providing more-precise estimates of possible gains from the next multilateral round (WTO's Doha Round). The results from that project (Anderson and Martin 2006), which were released in time for the WTO Ministerial Meeting in Hong Kong in late 2005, were widely used by agricultural trade negotiators and commentators at the height of those negotiations. So too was a follow-up paper that explained why farm export subsidies and domestic farm support programs accounted for only 7% of the global cost of the distortions to agricultural incentives that were under negotiation, with the other 93% due to import restrictions (Anderson, Martin and Valenzuela 2006-S).

Unfortunately the global financial crisis of 2008 took the wind out of the sails of the Doha Round. In an attempt to contribute to re-starting it, the World Bank

commissioned a further set of empirical studies to highlight not only prospective gains from completing the round but also opportunity costs of not doing so (Martin and Mattoo 2011). One of the studies in that volume showed that the estimated benefits of partially liberalizing farm trade as proposed by WTO negotiators are much greater by, say, 2030 when compared not with a projection assuming no policy changes but rather with a projection involving a return to agricultural protection over the period to 2030 (see revised results in Anderson et al. 2016).

8. Conclusion: lessons and implications

Advocates for empirical research will point to the liberalization of markets over the past three-plus decades and claim some credit for having revealed far more comprehensively and precisely the changing extent and adverse effects of price- and trade-distorting policies. There is no way of knowing how much of those reforms can be attributed to such policy transparency of course, but certainly some key individuals and institutions have been influential at crucial times in the ANZ policy reform processes.

One of Australia's early agricultural economists, John Crawford, had a huge policy influence in Australia including as founding Director of the Bureau of Agricultural Economics, and globally as Chair of the Technical Advisory Committee of the CGIAR (in which role he was instrumental in creating the International Food Policy Research Institute, the aim of which was to do globally what the BAE was doing in Australia). Subsequent BAE Directors (especially Stuart Harris and Geoff Miller) drew on the expertise and policy analyses of academic agricultural economists through to the 1970s as BAE – and the IAC from 1974 – gradually built up internal analytical capacity in Canberra. Even while the size, influence and independence of BAE/ABARE/ABARES has declined this century, the IAC/IC/PC (including throughout the Chairmanship of long-serving Gary Banks) has remained very important via its public inquiry process and evidence-based advocacy for policy reform in Australia.

At the multilateral level, the General Agreement on Tariffs and Trade did little for agriculture during its first seven rounds of trade negotiations but, in its final

(Uruguay) round before becoming the WTO, the US together with the Australian-led Cairns Group helped to ensure that an agreement on agricultural policy reform was signed (Higgott and Cooper 1990). The OECD Secretariat was important as a transparency agency during and subsequent to that Round via its annual updating of and report on its PSE/CSE estimates (OECD 2015). And international financial institutions such as the World Bank were helpful contributors to policy reforms in developing countries via research, advocacy and loan conditionality.

Perhaps the biggest contribution of ANZ agricultural (and other applied) economists to the global agricultural economics profession was the embracing of sectoral issues in an economywide framework. In Australia that framework was adopted by the newly formed National Farmers Federation in the mid-1970s which, with a Lerner/Corden/Gruen perspective, advocated strongly for a cut to manufacturing protection even if that was to be accompanied by cuts in assistance to agriculture. The government-sponsored development of CGE modelling of the economy raised substantially the quality of the national policy debate in Australia, but also of trade policy dialogues abroad via analyses using the GTAP model of the global economy.

The political challenge of encouraging countries to switch from trade to domestic policy instruments for addressing non-trade domestic concerns is evidently non-trivial. Yet the evidence summarized above shows much reform has been possible during the past three decades, contradicting the view of some that natural resource abundance (including a comparative advantage in agriculture) is a curse rather than a blessing (Anderson 1998-S). Even where that reform was accompanied by generous adjustment assistance, such support was time-bound (Edwards and Bates 2016). With luck, the emergence of new, lower-cost social protection mechanisms involving conditional cash e-transfers might edge governments one more step away from the use of beggar-thy-neighbour price- and trade-distorting measures.

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Supporting Information

Appendix S-1: Table S-1. Nominal rates of assistance to selected agricultural industries in ANZ, 1946 to 2011

Appendix S-2: Figures S-1, S-2, S-3, S-4 and S-5.

Appendix S-3: The political economy of price-distorting policy choices

Appendix S-4: Supplementary references

Appendix S-1: Table S-1. Nominal rates of assistance to selected agricultural industries in ANZ, 1946 to 2011 (%, fiscal years starting 1 July)

(a) Australia	1946-49	1950-54	1955-59	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-11
Exportables	**-7.5**	**0.9**	**6.4**	**7.0**	**10.0**	**7.6**	**3.6**	**4.6**	**5.6**	**4.8**	**3.0**	**0.0**	**0.0**
Rice	-3.2	-1.1	11.4	15.0	14.8	22.0	20.4	15.2	10.6	2.5	2.3	1.7	1.4
Wheat	-24.2	-8.4	1.9	6.1	10.1	7.2	-0.4	2.6	3.8	2.1	1.1	0.0	0.0
Barley	-14.1	-5.8	4.1	3.1	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oats	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grapes, total	10.5	4.5	5.6	9.7	18.7	39.7	19.2	21.3	18.3	13.3	4.9	0.0	0.0
Sugar	-8.2	0.7	12.8	15.9	32.8	7.6	-6.2	4.6	12.4	5.8	1.7	0.0	0.0
Cotton	0.8	2.0	26.7	52.1	73.9	53.4	17.6	4.4	2.0	0.0	0.0	0.0	0.0
Wool	0.0	0.0	0.0	0.0	0.0	6.0	1.4	1.0	1.0	5.4	0.7	0.0	0.0
Beef and veal	0.0	0.0	0.0	0.0	0.0	1.4	1.8	1.4	1.2	0.3	0.0	0.0	0.0
Mutton and lamb	0.0	0.0	0.0	0.0	0.4	1.6	1.8	1.4	1.8	0.9	0.0	0.0	0.0
Pigmeat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Milk	2.1	18.7	46.9	43.1	74.5	32.8	35.8	32.2	39.6	23.8	19.3	0.0	0.0
Apple	na	na	6.0	6.0	6.0	9.0	5.4	3.4	1.2	0.4	0.1	0.0	0.0
Sunflower	na	na	na	na	na	na	na	5.6	1.4	0.0	0.0	0.0	0.0
Import-competing products	**0.0**	**10.1**	**13.4**	**12.5**	**13.1**	**18.3**	**11.6**	**8.0**	**3.7**	**1.8**	**0.4**	**0.1**	**0.0**
Maize	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sorghum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	2.0	0.0	0.0	0.0	0.0
Oilseeds	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tobacco	0.0	34.2	51.0	46.9	51.3	250.0	122.2	56.4	37.6	48.5	19.8	0.0	0.0
Poultry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Banana	na	na	0.0	0.0	0.0	0.0	0.0	4.8	1.0	0.1	0.0	0.0	0.0
Olive	na	na	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orange	na	na	25.0	25.0	25.0	25.8	32.8	38.2	13.0	2.7	0.7	0.6	0.5
Soybean	na	na	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Nontradables	**-1.2**	**12.6**	**31.4**	**41.6**	**78.1**	**25.3**	**19.5**	**24.2**	**12.2**	**1.8**	**0.2**	**0.0**	**0.0**
Eggs	-1.7	14.7	43.7	61.8	141.2	35.0	26.0	35.8	18.4	3.4	0.4	0.0	0.0
Potatoes	0.0	8.0	8.0	8.0	8.0	7.2	7.2	8.0	3.2	0.0	0.0	0.0	0.0
Wted. average of above products[a]	**-7.0**	**1.8**	**7.8**	**8.5**	**12.3**	**8.8**	**4.6**	**5.4**	**5.7**	**4.4**	**2.6**	**0.0**	**0.0**

(b) New Zealand	1955-59	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-12
Exportables	**0.1**	**0.1**	**0.2**	**2.8**	**13.1**	**18.8**	**11.8**	**1.2**	**0.8**	**0.9**	**0.0**
Barley	na	na	na	na	na	10.6	1.8	0.0	0.0	0.0	0.0
Beef	0.1	0.1	0.3	5.0	10.0	15.6	11.0	1.4	1.0	1.0	0.0
Coarse grains	4.0	4.0	4.0	4.0	4.0	4.0	2.2	0.4	0.0	0.0	0.0
Other fruit and veg.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maize	na	na	na	na	na	12.0	2.2	0.0	0.0	0.0	0.0
Milk	0.2	0.2	0.2	-1.0	16.0	18.0	11.6	1.4	1.0	1.0	0.0
Oat	na	na	na	na	na	9.2	2.4	0.0	0.0	0.0	0.0
Other crops	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sheepmeat	0.1	0.1	0.3	5.0	19.0	32.9	27.8	1.8	1.0	1.0	0.0
Wool	0.0	0.0	0.0	5.0	11.0	19.0	10.2	1.4	1.0	1.0	0.0
Import-competing	**28.3**	**28.3**	**28.8**	**32.0**	**27.0**	**28.1**	**41.1**	**22.5**	**19.6**	**15.8**	**6.6**
Egg	59.0	59.0	59.0	59.0	59.0	59.0	80.2	38.2	50.4	36.4	13.5
Pigmeat	2.0	2.0	2.8	5.4	-19.9	10.3	-2.8	0.0	0.0	0.2	0.0
Poultry	31.0	31.0	31.0	31.0	31.0	31.0	61.6	57.0	40.8	34.6	23.1
Wheat	11.0	11.0	11.0	11.0	11.0	11.0	6.6	0.6	0.0	0.0	0.0
Mixed trade status											
Grapes	120.0	120.0	134.0	106.0	53.8	23.2	23.8	5.0	5.0	5.0	na
Wted. av. of above products[a]	**1.8**	**1.8**	**1.9**	**5.0**	**14.3**	**20.0**	**14.9**	**2.9**	**2.1**	**2.0**	**0.8**

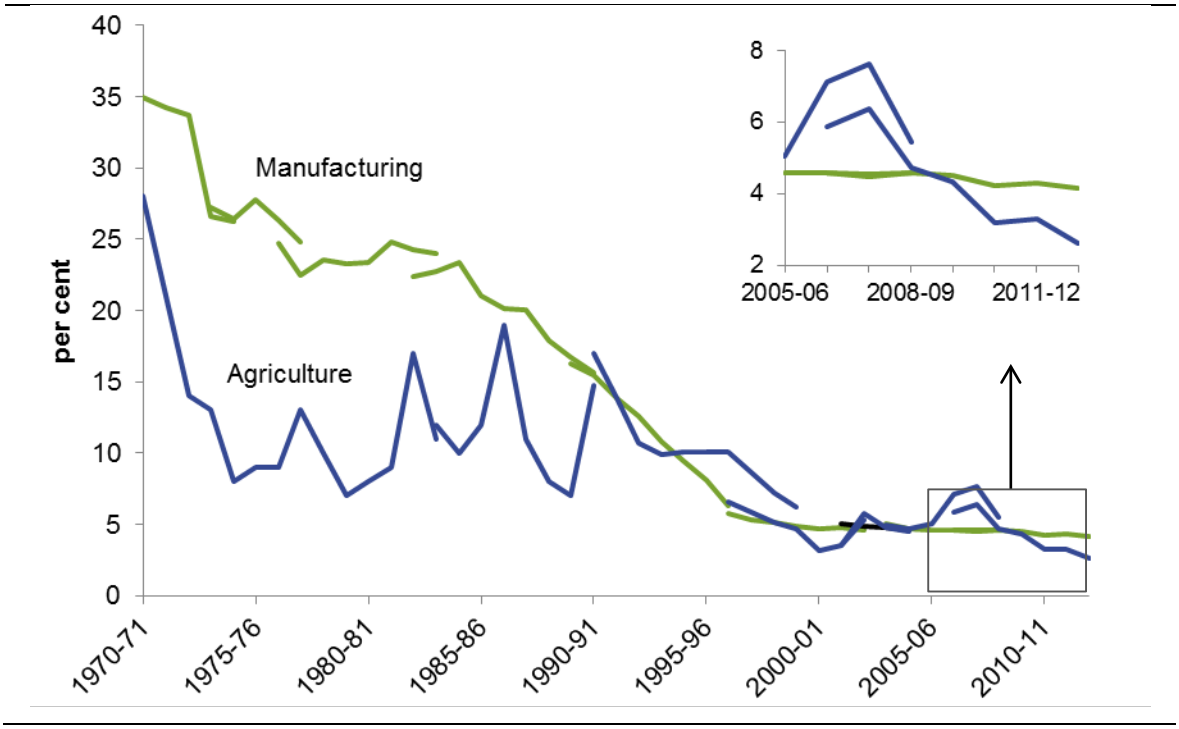
[a] Weighted averages, with weights based on the unassisted value of production.

Source: Updated from Tables 5.1 and 5.2 in Anderson, K., R. Lattimore, P.J. Lloyd and D. MacLaren (2009), 'Australia and New Zealand', Ch. 5 in K. Anderson (ed.), *Distortions to Agricultural Incentives: A Global Perspective, 1955-2005*, London: Palgrave Macmillan. The updated NRAs from 2008 to 2011 are from Anderson, K. and S. Nelgen (2013), *Updated National and Global Agricultural Trade and Welfare Reduction Indexes, 1955 to 2012*, spreadsheet at www.worldbank.org/agdistortions

Appendix S-2: Figures S-1, S-2, S-3, S-4 and S-5

Figure S-1. Effective rates of assistance to manufacturing and agriculture,[a] 1970-71 to 2012-13

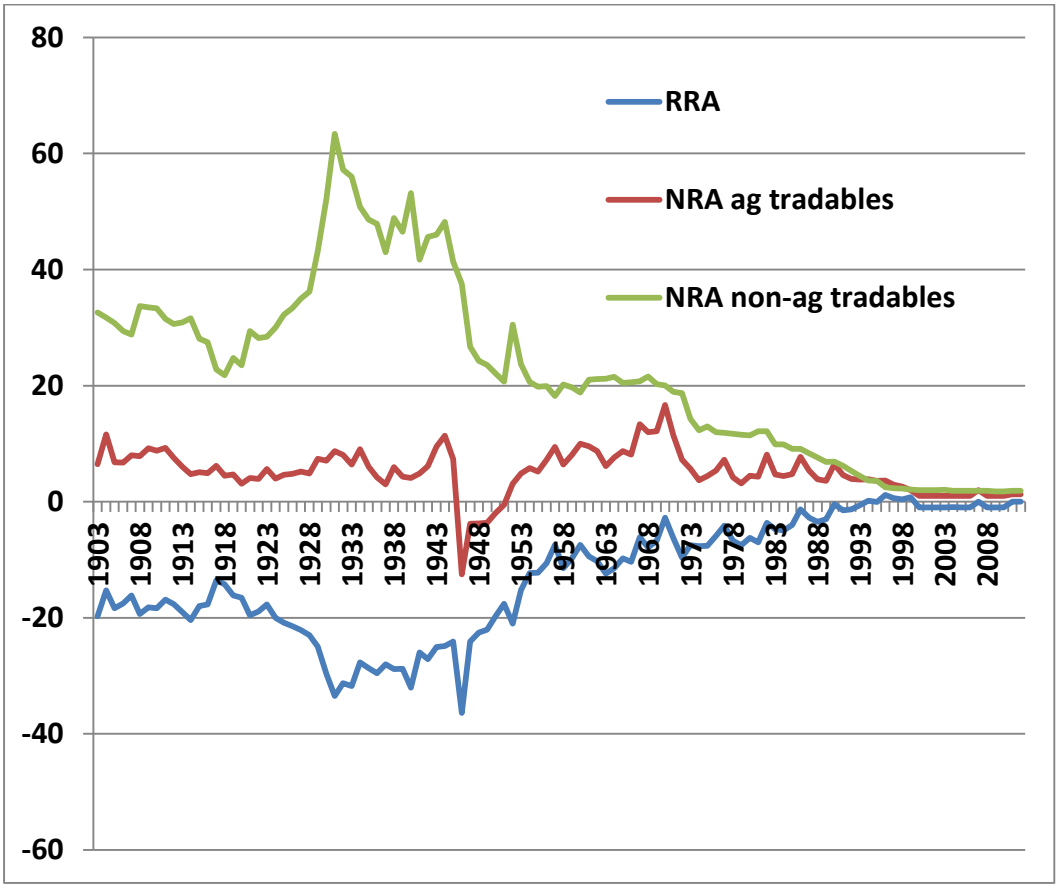
(%)



[a] Refers to selected agriculture activities up to and including the year 2000-01. From 2001-02, estimates refer to division A of the Australian and New Zealand Standard Industrial Classification which covers agriculture, forestry, fishing and hunting.

Source: Productivity Commission (2014), *Trade and Assistance Review, 2012-13*, Canberra: Productivity Commission, Figure 4.5.

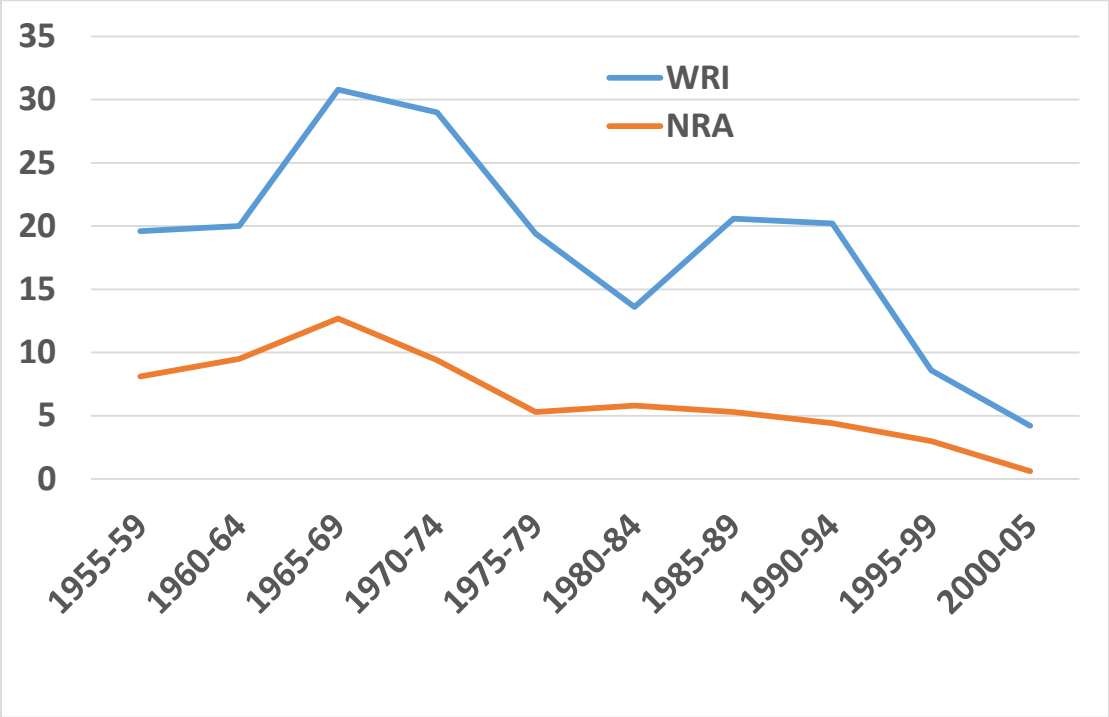
Figure S-2. Agricultural and non-agricultural NRAs and RRA, Australia, 1903 to 2012 (%)



Source: Lloyd, P.J. and D. MacLaren (2015), 'Relative Assistance to Australian Agriculture and Manufacturing Since Federation', *Australian Journal of Agricultural and Resource Economics* 59(2): 159-70.

Figure S-3. Agricultural NRA and WRI, Australia, 1955 to 2005

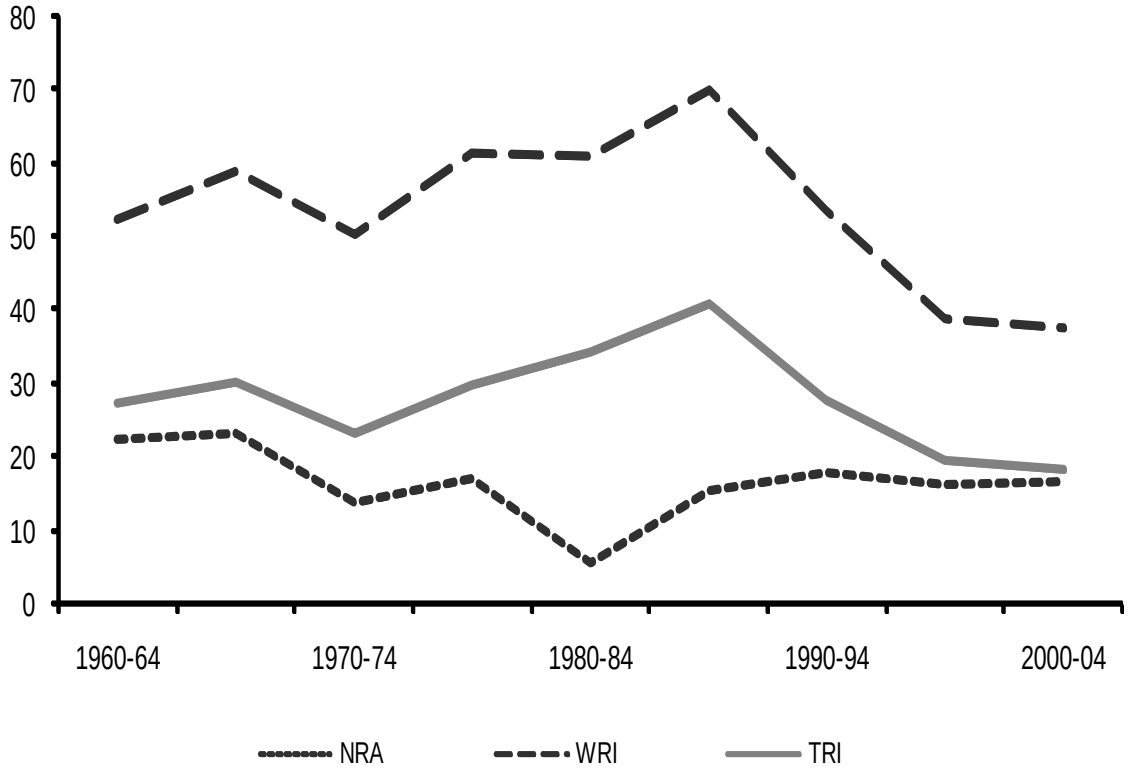
(%)



Source: Extracted from Anderson, K. and S. Nelgen (2013), *Updated National and Global Agricultural Trade and Welfare Reduction Indexes, 1955 to 2012*, spreadsheet at www.worldbank.org/agdistortions, Washington DC, June.

Figure S-4. Agricultural NRA, TRI and WRI, global averages, 1960 to 2004

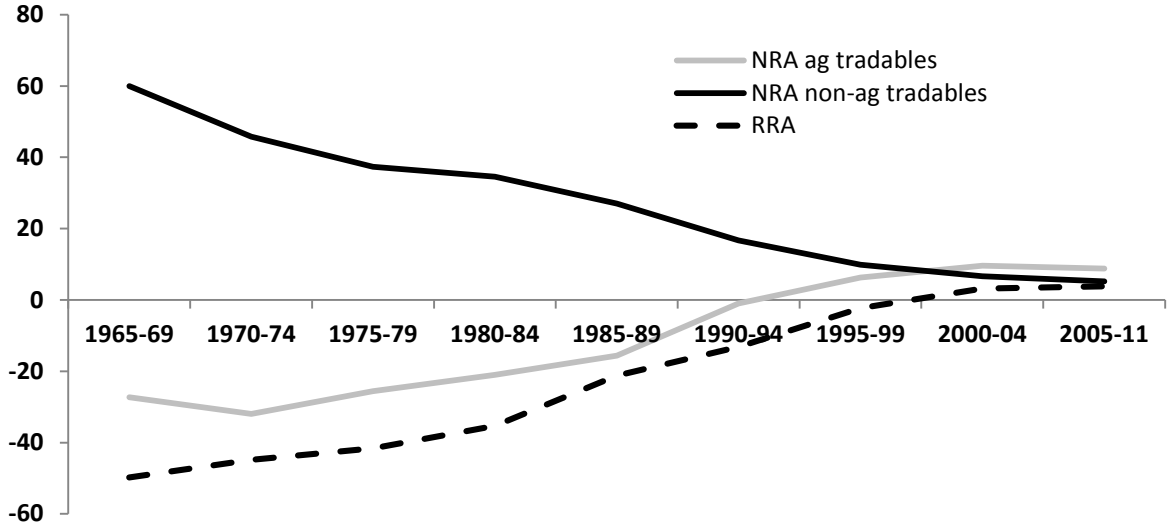
(%)



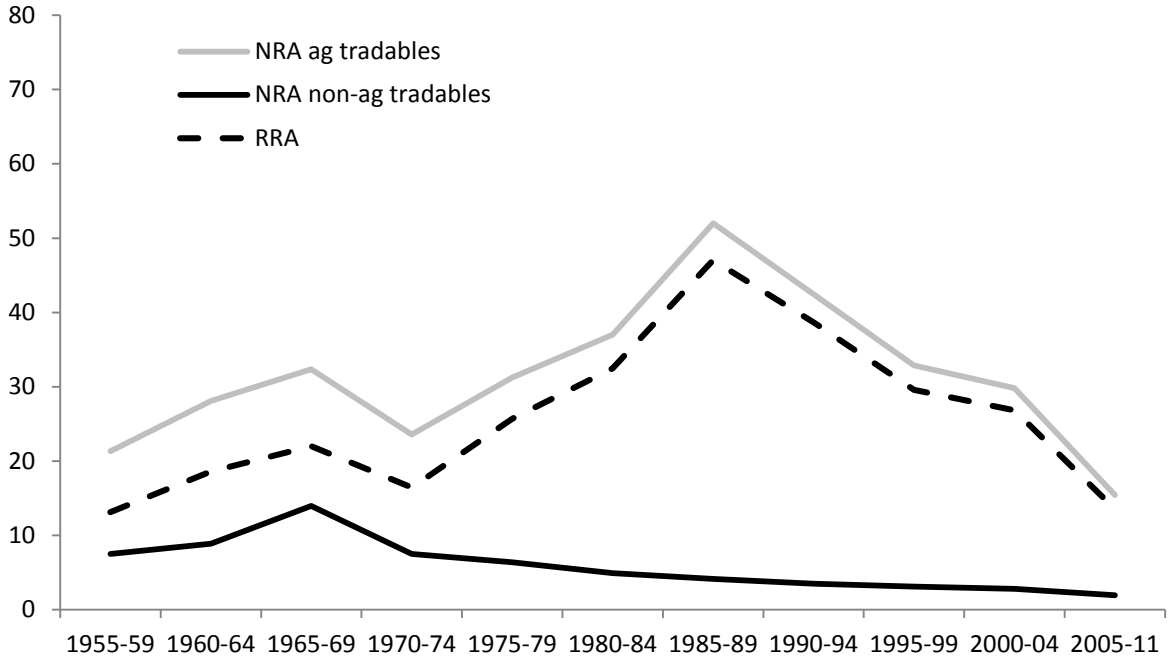
Source: Lloyd, P.J., J.L. Croser and K. Anderson (2010), 'Global Distortions to Agricultural Markets: New Indicators of Trade and Welfare Impacts, 1960 to 2007', *Review of Development Economics* 14(2): 141-60.

Figure S-5. Developing and high-income countries' NRAs to agricultural and non-agricultural tradable sectors, and RRAs,[a] 1955 to 2011 (%)

(a) Developing countries



(b) High-income countries



[a] Five-year averages. Calculations use farm production-weighted averages across countries. RRA is defined as $100*[(100+NRAag^t)/(100+NRAnonag^t)-1]$, where $NRAag^t$ and $NRAnonag^t$, respectively, are the percentage NRAs for the tradable segments of the agricultural and non-agricultural sectors.

Source: Anderson, K. and S. Nelgen (2013), *Updated National and Global Agricultural Trade and Welfare Reduction Indexes, 1955 to 2012*, spreadsheet at www.worldbank.org/agdistortions, Washington DC, June.

Appendix S-3: The political economy of price-distorting policy choices

Given that the pro-agricultural policies of high-income countries and the pro-industrial, anti-agricultural policies of many developing countries have reduced national and global welfare and appear to have added to inequality and poverty, economists have put much effort into trying to understand the political economy forces behind these policy choices. Attempts to explain the pattern of agricultural distortions across countries and over time made some progress from the late 1970s to the early 1990s. Initial empirical efforts in Australia focused on explaining differences in rates of assistance within the agricultural sector (Anderson 1978), and on the choice of farm policy instrument used (Anderson 1983). Australia's most senior agricultural policy bureaucrat in the latter 1980s offered a broader view on why agricultural markets are distorted and why progress in reforming them had been slow prior to the Uruguay Round's launch (Miller 1987). Then Sandry and Reynolds (1990) brought together a series of papers on the experience of New Zealand moving towards farming without subsidies.

Those earlier analyses took us part of the way towards understanding the evolution of agricultural price-distorting policies using a sectoral approach (Anderson, Hayami and Others 1986). That was subsequently broadened conceptually to an economy-wide focus. The latter sought to understand why countries gradually switched from negative to positive assistance to agriculture relative to manufacturing as their per capita income grows, and more so if their agricultural comparative advantage declined in the process of that economic development (Anderson 1995).

A few years into the new century there were renewed attempts, including by ANZ economists, to understand the politics behind farm policies. They have focused on improving our conceptualization of the issue, suggesting testable hypotheses, compiling appropriate data, and using political econometrics to test those hypotheses (see, e.g., Anderson 2010; Anderson, Rausser and Swinnen 2013).

The experiences in high-income countries since the 1980s suggest agricultural protection growth can be slowed and even reversed if accompanied by re-instrumentation away from price supports to decoupled measures or more direct forms of farm income support.

In developing countries, however, there are fewer signs of a slowdown of the upward trend in agricultural protection from import competition over the past half-century. Indeed there are numerous signs that developing country governments want to hold on to their options to raise agricultural protection levels in the future, particularly via import restrictions. Already Asia's three biggest emerging economies, China, Indonesia and India, have levels of agricultural support that exceed the average of OECD countries (Anderson and Strutt 2014; OECD 2015). Unless new forces affect their polities, the governments of later-industrializing economies may well follow those of earlier developers along the agricultural protection path for some time yet.

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Working Papers in Trade and Development
List of Papers (as at 2016)

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15/14 PETER WARR and JAYANT MENON, 'Cambodia's special economic zone'

15/15 PREMA-CHANDRA ATHUKORALA and FAHAD KHAN, 'Global production sharing and the measurement of price elasticity in international trade' (Revised/updated version of Working Paper 2014/22).

15/16 KYM ANDERSON, HANS GRINSTED JENSEN, SIGNE NELGEN and ANNA STRUTT, 'What is the appropriate counterfactual when estimating effects of multilateral trade policy reform? (forthcoming in the (British) *Jou of Agric Econ* next Feb)

16/01 RAGHBENDRA JHA and SADIA AFRIN, 'Pattern and determinants of structural transformation in Africa'

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