

# **New indicators of how much agricultural policies restrict global trade**

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# **New indicators of how much agricultural policies restrict global trade**

## **Abstract**

Despite recent reforms, world agricultural markets remain highly distorted by government policies. Traditional indicators of agricultural and food price distortions such as producer and consumer support estimates (PSEs and CSEs) can be poor guides to the policies' trade effects. Two recent studies provide much better indicators of trade- (and welfare-)reducing effects of farm price and trade policies, but they provide somewhat differing numbers. This paper explains why those estimates differ and how they might be improved for use in on-going annual monitoring of the trade restrictiveness of agricultural policies in both high-income and developing countries.

**Keywords:** Agricultural policies, trade restrictiveness indexes, food price distortions

**JEL classifications:** F13, F14, Q17, Q18

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## **New indicators of how much agricultural policies restrict global trade**

World markets are far less integrated for agricultural products than for other goods. In 2004, for example, the share of global production exported (excluding intra-European Union trade) was only 8 percent for agricultural and food products compared with 31 percent for other primary products and 25 percent for manufactured goods. Trade negotiators and policy advisors are keen to know the extent to which agricultural policies are responsible for that low degree of international trade in farm products, as an aid to prioritizing negotiating efforts and unilateral policy reform agendas. There are various indicators used for that purpose. Perhaps the most common are nominal rates of assistance to farmers and related consumer tax equivalents affecting the prices that domestic consumers pay for farm products. These indicate the extent to which domestic prices exceed those at a country's border. Similar indicators are the OECD's producer and consumer support estimates (PSEs and CSEs), although they are expressed as a percentage of the distorted domestic price rather than the border price. More precise results can be obtained using sectoral or economy-wide models, but economic models are calibrated to just one particular past year and so are not well placed for up-to-date regular monitoring of policies or for examining long historical time series. An alternative way to indicate the extent to which trade is reduced is to use scalar index numbers from the family of trade restrictiveness indexes. These measures provide a single theoretically sound indicator of the trade effects of different policy measures that is directly comparable across countries and over time.

Drawing on the seminal theoretical work of Anderson and Neary (1994, 2005), two recent World Bank studies have attempted to answer the question of how much agricultural policies restrict trade nationally, regionally and globally. Kee, Nicita and Olarreaga (2009) estimate, among other indices, a single trade reduction index (called an Overall Trade Restrictiveness Index or OTRI in their paper) for 78 developed and developing countries for a snapshot in time (a single year in the early

or mid-2000s). Updates of these have been reported regularly in the World Bank's *Global Monitoring Report*, with estimates for circa 2007 reported in Chapter 5 of World Bank (2009), for example. The OTRI has become a World Bank 'core' trade indicator because it can be generated for many countries every year using regularly updated published data from UNCTAD's TRAINS database. The estimates are based on distortions to the import-competing sub-sectors of both agricultural and manufacturing sectors due to each of these countries' import tariffs and non-tariff import-restricting measures (NTMs). Kee, Nicita and Olarreaga report separately the OTRI for the agricultural sub-sector in each of the countries in their study.

Anderson and Croser (2009) provide alternative annual estimates of a similar index which they call a trade reduction index (abbreviated hereafter as TRI) for the agricultural sector of 75 developed and developing countries for the period 1955 to 2007, using a methodology set out in Lloyd, Croser and Anderson (2010). That TRI is available separately for the import-competing and exporting sub-sectors as well as for the overall agricultural sector of those countries. This alternative set is based on sectoral estimates of the nominal rate of assistance to farmers and the consumer tax equivalent (NRA and CTE) of domestic and border policy measures that affect each country's agricultural trade. Those NRAs and CTEs, provided by Anderson and Valenzuela (2008) and summarized in Anderson (2009), are derived by comparing domestic prices with prices of like products at a country's border (see Anderson et al. 2008 for the detailed methodology). The contributions to the total NRA and CTE, and hence to the TRI, of various policy instruments have also been distinguished (Croser and Anderson 2010a).<sup>1</sup>

In this paper, we compare the results of these two recent contributions by World Bank researchers to measuring indicators of trade reductions from agricultural policies. We then explore how the two series complement each other and why they differ. With those insights, we suggest how estimation of the trade restrictiveness of agricultural policy can be improved in the future.

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<sup>1</sup> The Anderson and Croser (2009) database also contains estimates of a TRI for the global market of individual commodities, based on a methodology reported in Croser, Lloyd and Anderson (2010). These measures are novel because all previous work within the trade restrictiveness index literature has focused on constructing index numbers from the perspective of a single country.

## Two complementary estimates of agricultural trade restrictiveness indexes

We summarize in this section two new sets of estimates of trade indices: the Anderson and Croser (2009) country-level TRI estimates (AC), and the Kee, Nicita and Olarreaga (2008) OTRI estimates available on the World Bank website (KNO).<sup>2</sup> We start with the time-series trends in the AC estimates. Figure 1 presents the TRI aggregate estimates by AC for the import-competing and exportables sub-sectors and the overall agricultural sector for high-income and developing countries from 1960 to 2004. For developing countries as a group, the trade restrictiveness of agricultural policy was slightly increasing until the 1990s. Thereafter it declined, mostly due to reductions in Africa and Asia. The aggregate results for developing countries are driven by the exportables subsector which has been taxed, and the import-competing sub-sector which is being protected but by less than in high-income countries. For high-income countries, the TRI time path was similar but the causes differ: policies in high-income countries support both exporting and import-competing agricultural products and, even though they favour the latter much more heavily, the assistance to exporters somewhat offsets the antitrade bias from the protection of import-competing products in terms of impacts on those countries' aggregate volume of trade in farm products. This is reflected in Figure 1(a) in a much smaller TRI for high-income countries overall for agriculture as compared with that for just the import-competing subsector, and the negative values for the exporting subsector.

Figure 2 presents the country level detail from the two studies for 2000–04 (for which there are 49 countries in common), showing the KNO estimates for the agricultural sector OTRI based on import tariffs and NTMs alongside the AC estimates of the TRI for the import-competing agricultural subsector, with countries ranked according to the AC estimates. In both studies there is considerable diversity in the country-level index estimates. In line with the results in Figure 1(a), all high-income and transition economies have positive index estimates, indicating unsurprisingly that farm policies in the import-competing sectors of these economies were trade-reducing in that period. There is a high degree of correlation between the estimated series in the two studies for many countries, especially the European Union

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<sup>2</sup> The Kee et al. (2008) estimates are slightly different to those in Kee et al. (2009), but we use the former because they include a disaggregation of the OTRI into manufacturing and agricultural sub-sectors of each national economy.

(EU) countries and most of Central and Eastern Europe's transition economies. (Note that the common KNO estimate of the OTRI for member countries of the EU as a whole — 49 percent — is allocated to each member country in Figure 2.)

The differences between the two sets of estimates are most noticeable at the top and bottom of Figure 2(a). For the EFTA countries (Switzerland, Iceland and Norway) and Japan — countries with a strong comparative disadvantage in agricultural products — the AC estimates are much higher than the KNO estimates; while for Australia, the United States and New Zealand — countries with a strong comparative advantage in farm products — the AC estimates are much smaller than the KNO estimates.

Figure 2(b) presents the estimates for those developing countries present in both data sets. Most countries had policies that were overall trade-reducing in the time-period shown. For a few developing countries, the TRI estimate by AC is negative, indicating that their agricultural policies in aggregate were implicitly subsidizing imports slightly. The AC estimates for developing countries are generally smaller than the KNO estimates. This tendency holds across the three main developing country regions (Africa, Asia and Latin America). There are only a few developing countries for which the KNO estimate is lower than the AC estimate, most noticeably Ghana and Sri Lanka.

Because the KNO study has estimates of the OTRI for both agricultural and manufacturing sub-sectors of each country, it is possible to gauge from the KNO study the relative restrictiveness of trade policy in these two sub-sectors. The results in Figure 3 indicate that, with the exception of some African nations and Ukraine, the agricultural sector policies are more trade-reducing than those of the manufacturing sector in the countries sampled.

These results are complementary. The AC estimates, based on historical data, enable greater insights into the restrictiveness of policy over time. Also, the AC estimates for import-competing and exportable sub-sectors give a stronger indication of the antitrade policy stance in many countries, especially in previous decades, than is obtainable by examining indexes for just the import-competing farm industries. Nonetheless, the KNO series has the benefit of being able to be readily updated from secondary data as and when UNCTAD's TRAINS database is revised each year. For that reason the OTRI estimates are likely to continue to be part of the World Bank's

core trade indicators. Even so, it is important to be aware of why the estimates differ, and to explore the scope for improving on these existing measures.

### **Why the two studies' estimates differ**

There are at least five reasons why the KNO and AC estimates differ. Some are empirical, others are methodological.

The most obvious empirical reason for the series to differ is that the two studies take their distortions data are from different sources. In the KNO study, the main source of tariff data is the WTO Integrated Data Base and UNCTAD's TRAINS database. NTM data are mostly from TRAINS, supplemented by the WTO's national *Trade Policy Review* reports. Agricultural domestic support data (which are included in the KNO NTM estimate) are based on WTO members' notifications during the period 1995–98. By contrast, the data used in the AC estimates are obtained from the World Bank's new Distortions to Agricultural Incentives database, which provides price-equivalent distortion estimates for the production and consumption sides of each commodity market based on direct price comparisons. By calculating domestic-to-border price ratios, the estimates include the price effects of all tariff and non-tariff trade measures plus any domestic price support measures (positive or negative), plus an adjustment for the output-price equivalent of direct interventions in farm input markets. Where multiple exchange rates operate, an estimate of the import or export tax equivalents of that distortion are included as well. The domestic-to-border price ratio is an appropriate measure for the TRI analysis since it captures agricultural price and trade policies by comparing like products at the same point in the value chain, namely, the farm-gate level.

The different sources of data (and their different years), and the way they are used, can potentially explain some of the difference in the estimates. For example, the KNO estimates of their OTRI are higher than the TRI estimates by AC for agricultural-exporting countries potentially because of the methodology used by KNO to capture the effects of NTMs. The KNO method involves (1) estimating the restrictiveness of NTMs on import volumes by product and country, and (2) using import demand elasticities to transform the estimated import quantity to an ad-valorem tariff equivalent measure. The former step includes in the estimating equation a dummy variable for each quarantine measure (e.g. sanitary or phytosanitary

regulation) regardless of the extent of restrictiveness of that measure. For countries such as Australia, the United States and New Zealand, almost half of the OTRI estimates by KNO are due to NTMs.

The AC method of domestic-to-border price comparisons for like products at the farmgate level of the value chain, by contrast, provides an ad valorem equivalent directly. While such measures based on price comparisons are likely to be more accurate for covered products, there are many food products imported for consumers that are not selected for coverage in the study because they were not important in domestic production (see below). Also, generating such measures can be computationally intensive, and while efforts are underway to update the Anderson and Valenzuela (2008) database, such updates are not yet as mainstreamed as the annual updates of UNCTAD's TRAINS database.

The second reason to expect differences between the two series is that the AC estimates are computed with the simplifying assumption within each country that domestic price elasticities of supply are equal across commodities, and the same for domestic price elasticities of demand. That assumption allows the AC estimates to be constructed by aggregating distortions using as weights just the sectoral share of each commodity's domestic value of consumption or production at undistorted prices. While this simplification means that the estimates do not fully capture the differential responses of various commodity trades to a given policy distortion, sensitivity analysis leads AC to expect the assumption to have only a minor effect on their overall results. The KNO OTRI estimates, calculated with a full set of country- and commodity-specified import demand elasticities, has the benefit of capturing precisely the differential responses of various commodity trades to a given policy distortion.

The third reason to expect differences between the two series is that the KNO estimates are generated from a very disaggregated dataset (at the HS six-digit tariff line level, which has more than 4000 tariff lines) whereas the AC estimates are based on a sample that averages just 15 farm products per high-income country and 9 per developing country (so as to cover around 70 percent of the gross value of each country's farm production). If the level of disaggregation had been the only difference between the two series so that the product and instrument coverage (see below) were the same and the series used the same distortions data, then the greater level of disaggregation in the KNO study would result in more-accurate TRI estimates. This is because the KNO estimates correctly aggregate distortions from the more

disaggregated base, and the estimates reflect the full diversity of distortions across industries within the agricultural sub-sector under study. The OTRI for industries distorted by import restrictions alone (the KNO approach) would give a higher estimate than a comparable TRI estimate by AC because the former would be based on data that contain a fuller diversity of distortions across the import-competing sub-sector.<sup>3</sup>

The fourth reason why the two series could differ is the difference in the products included in the two studies. The KNO estimates are based on a methodology where distortions to just import-competing products are weighted by observed import values (multiplied by import demand elasticities, as per the Anderson/Neary formulation of the index). That is, the KNO estimates will only include products that show up with some imports in the HS six-digit data, regardless of the importance of each industry to domestic production or consumption.

By contrast, the AC estimates are computed using a methodology where the weights are production and consumption based. From a practical point of view, the data in Anderson and Valenzuela (2008) is such that agricultural products are selected for inclusion in the database because they are important contributors to the gross value of national production at undistorted prices, thereby minimizing the number of products needed to achieve the target coverage of 70 percent of that total value. The AC estimates are based on policy distortions to those 70 percent of products, which includes for both import-competing and exportable sub-sectors. The TRIs are computed for the sub-sectors of import-competing and exportable products separately as well as together; and they can be extended to include the nontradables sub-sector as well.

If the only difference between the two series was that KNO limit their sample to products facing actual import competition, the AC estimates would give a more accurate indication of distortions to the domestic agricultural markets of a country because they include both import-competing and export sub-sectors (and potentially nontradables). However, the AC estimates could be improved by including more coverage of production and consumption beyond the current 70 percent coverage of

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<sup>3</sup> Another index reported in both the KNO paper and the AC database is a welfare reduction index, for which the variance of sectoral distortions is a component of the index. In this case, the more disaggregated dataset, which is likely to have a greater variance of distortions, would result in a higher welfare reduction index estimate than the estimates using the more aggregated dataset. This is in fact what Laborde, Martin and van der Mensbrugge (2009) find when they aggregate HS six-digit tariff line data to the commodity level in the GTAP global economy-wide model.

production and somewhat less of consumption on average. At the same time the KNO methodology and OTRI estimates could be improved by including exportable products.

The fifth and related reason for the difference between the two series has to do with differences in the policy instruments included in the analysis. The KNO estimates include only import-restricting policy distortions, whereas the AC estimates are based on all distortions (positive and negative) to import-competing and exportable industries. That set includes import and export taxes and subsidies and ad valorem equivalents of non-price border measures such as quantitative trade restrictions or technical standards, and the implicit trade taxes associated with multiple exchange rates, as well as domestic production or consumption taxes and subsidies and the output subsidy equivalent of farm input subsidies net of input taxes. As noted, the AC methodology can be further extended to include domestic distortions to the nontradables sub-sector of agriculture also (Croser and Anderson 2010b). By definition this sub-sector involves no trade distortions, so its inclusion in the set of products necessarily will lower the sectoral TRI estimates.

Differences in the estimated TRI series due to differing extents of product disaggregation, product coverage, and instrument coverage are evident from a comparison of the KNO estimates with two alternative sets of AC estimates. The first comparison is between the KNO estimates and the TRI estimates by AC for import-competing products in each country (Figure 2). Given the five differences between the two series analysed above, it is not possible to say a priori whether the TRI estimates by AC should be larger or smaller than the KNO counterparts. For example, whilst the latter will include many more products — including ones involving little or no restriction because there is no local industry demanding protection from import competition – it will only include import restrictions and hence only a subset of distortions to agricultural trade (albeit probably the most distortive subset). For high-income and transitional economies, where almost all import distortions are protective, the AC estimates (with fewer sectors) are higher than KNO estimates, most likely because the effect of including more lightly protected products dominates. This could be partly why temperate-climate countries such as Japan, Switzerland, Norway and Iceland, despite having highly protected import-competing agricultural sectors, have low OTRIs: many of their imports from tropical countries would face few if any restrictions (Figure 2(a)). In African countries such as Zambia, where there have been

implicit import subsidies for staple foods, the lower TRI estimate by AC is lower than the OTRI estimate by KNO, suggesting that the effect of including more policy instruments dominates the explanation for the difference between the two studies' estimates (Figure 2(b)).

The second comparison is between the KNO estimates and AC's TRI estimates for *all* covered tradables (both exportable and import-competing sectors). This comparison brings the two series closer together in terms of product coverage, but the AC estimates also include distortions to exportable industries. Once again it is not possible to say a priori whether the AC estimates should be larger or smaller than the KNO estimates. The extent to which the increased product coverage in the AC estimates brings them closer to the KNO estimates will depend on the type and extent of distortions to exportable versus import-competing sub-sectors. A comparison and Figures 2 and 4 reveals that when exportable sub-sectors are included to generate a TRI for all agricultural tradables, the TRI estimates generally are lower in 2000–04 than those involving just import-competing sub-sectors. This is because the exportable sub-sector tends to be less trade restricted than the import-competing sub-sector. For example, Switzerland and Iceland have large export subsidies in 2000–04 for several agricultural products (Josling 2009). These trade-expanding subsidies reduce the TRI estimate quite significantly when the exportable sub-sector is included. In contrast, Norway provides much lower assistance to its exportable sub-sector than to its import-competing farmers, so the inclusion of exporting industries has a less significant effect on that country's TRI estimate (compare the grey shaded bar for Norway in Figures 2 and 4). As for developing countries, Cote d'Ivoire, Tanzania and Zambia each have trade-reducing policies in their exportable sub-sector, which leads to a higher TRI estimate for them in Figure 4 than in Figure 2.

As mentioned in footnote 3, welfare reduction indexes (WRIs) are also included in the AC database, and KNO estimate a comparable measure in their work (see, for example, World Bank 2007, Appendix Table A.3.a). In the AC estimates, since both tariffs and export subsidies have welfare-reducing effects, one does not see the offsetting effects in their WRI that are present above in their TRI. Instead there is a compounding effect when exportables are added to the product set. This can be seen in Figure 5, where Switzerland has one of the highest WRI estimates for all covered tradables. True, the WRI measure fails to capture potential welfare benefits from some NTMs such as sanitary or phytosanitary measures that prevent the importation

of disease, and for that reason the WRIs may be overstated. But on the other hand they are understated to the extent that they are based on broad aggregate commodity data instead of disaggregated data such as at the HS 6-digit level, so the net bias is unclear.

## **Conclusion**

In recent years very considerable progress has been made in answering the question: how much do agricultural policies restrict trade? The two World Bank studies surveyed here have approached the question from different angles, each producing complementary results as to the restrictiveness of import-competing agriculture in developed and developing countries in the 2000s. The Anderson and Croser (2009) estimates have the benefit of being part of a longer time-series of estimates, giving historical context to the current policy position. The import-competing sub-sector estimates can be compared to estimates for the other sub-sectors of agriculture (exportables and nontradables), thereby offering further insight into the antitrade bias in different countries' policies. The Kee, Nicita and Olarreaga (2008) indexes, constructed from a somewhat different methodology and dataset, have the benefit of allowing for a comparison between the trade restrictiveness of agricultural and manufacturing import-competing policies, offering insight into the extent of the sectoral bias in protectionist national trade policies (usually favoring agriculture). The KNO estimates are more theoretically precise than the AC estimates because they are based on a more disaggregated dataset and they capture the differential responses of various commodity trades to a given policy distortion through the inclusion of price elasticity data. Because the KNO estimates are based on a routinely amended UNCTAD data source, they can be regularly updated at low cost by the World Bank or other institutions.

We have shown that the level of disaggregation of the distortions data, the proportion of the sector included in the aggregation, and the types of policy instruments included in the analysis are all important determinants of indices of agricultural trade restrictiveness. The more prevalent are NTMs, the more difficult it will be to avoid domestic-to-border price comparisons to get an accurate measure. But such price comparison studies need to include not only products important in domestic production but also those important in domestic consumption but which may

not be produced domestically (such as tropical products in temperate countries, and conversely). Such price comparison studies are laborious and therefore expensive. Nonetheless, they are being undertaken regularly by the OECD for gradually more and more countries, including (from 2010) for a sample of African countries under a new joint project with the FAO and national governments funded by the Bill and Melinda Gates Foundation. Adding TRIs to the list of calculated indicators by the OECD would enrich the policy analysis that will be possible with those estimates, and without requiring any more information that is currently needed to estimate NRAs/CTEs or PSE/CSEs if one is willing to adopt some restrictive assumptions about price elasticities.

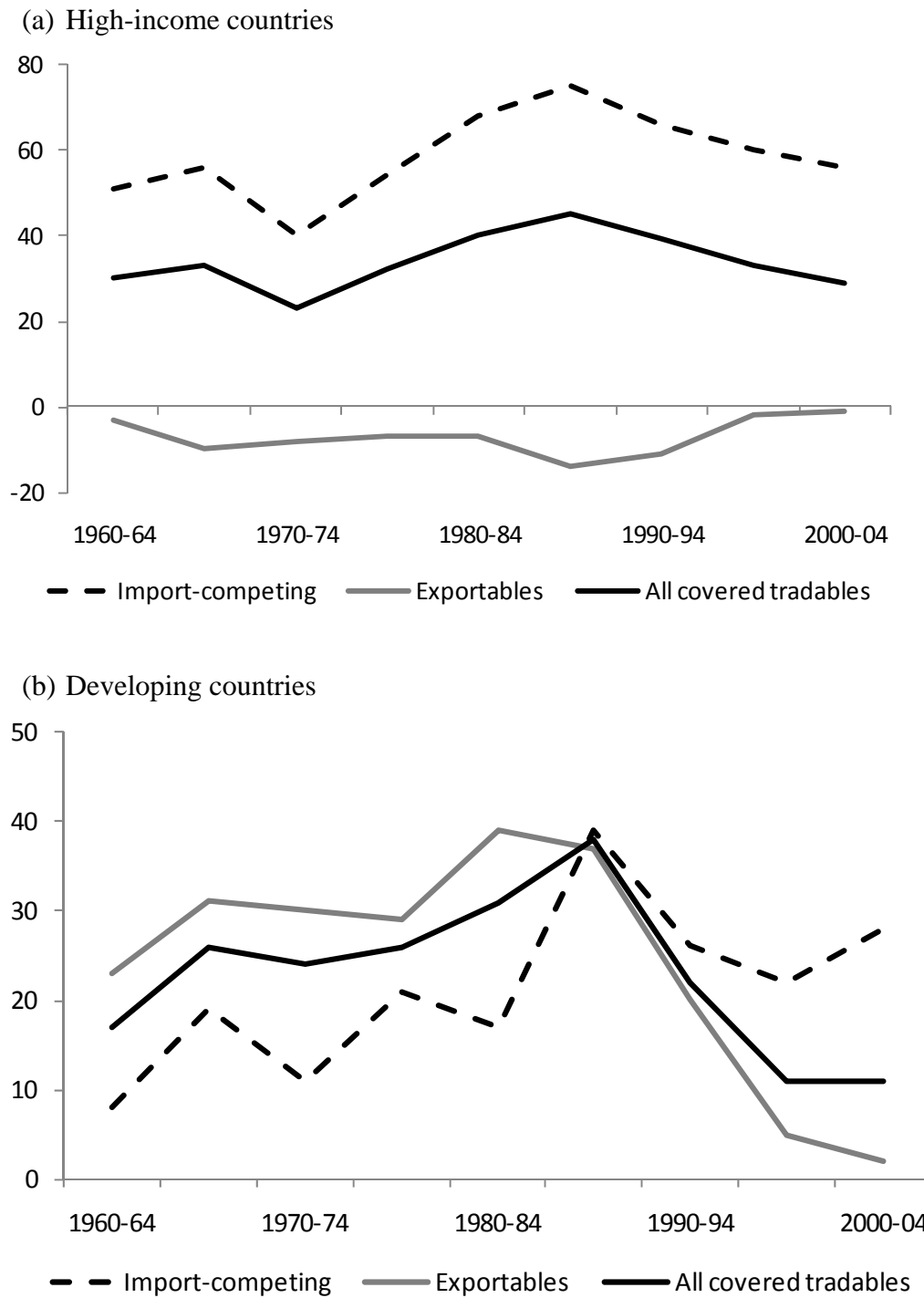
One final point: the TRI, with its inclusion of export sub-sectors, will be especially useful when assessing the restrictiveness of policy responses to spikes in international food prices, as in 2008 when many developing countries placed restrictions on exports of food. Efforts are currently under way to update the Anderson and Valenzuela (2008) and Anderson and Croser (2009) databases to include that year, as developing country data gradually become available.

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Figure 1: Trade reduction indexes for the agricultural sector's import-competing and exportables sub-sector and overall, all covered tradable farm products, 1960 to 2007



Source: Anderson and Croser (2009).

Note: Regional aggregates are weighted using the average of the value of production and consumption at undistorted prices.

Figure 2: Trade reduction indexes for the agricultural sector's import-competing sub-sector, selected focus countries, 2000–04<sup>a</sup>

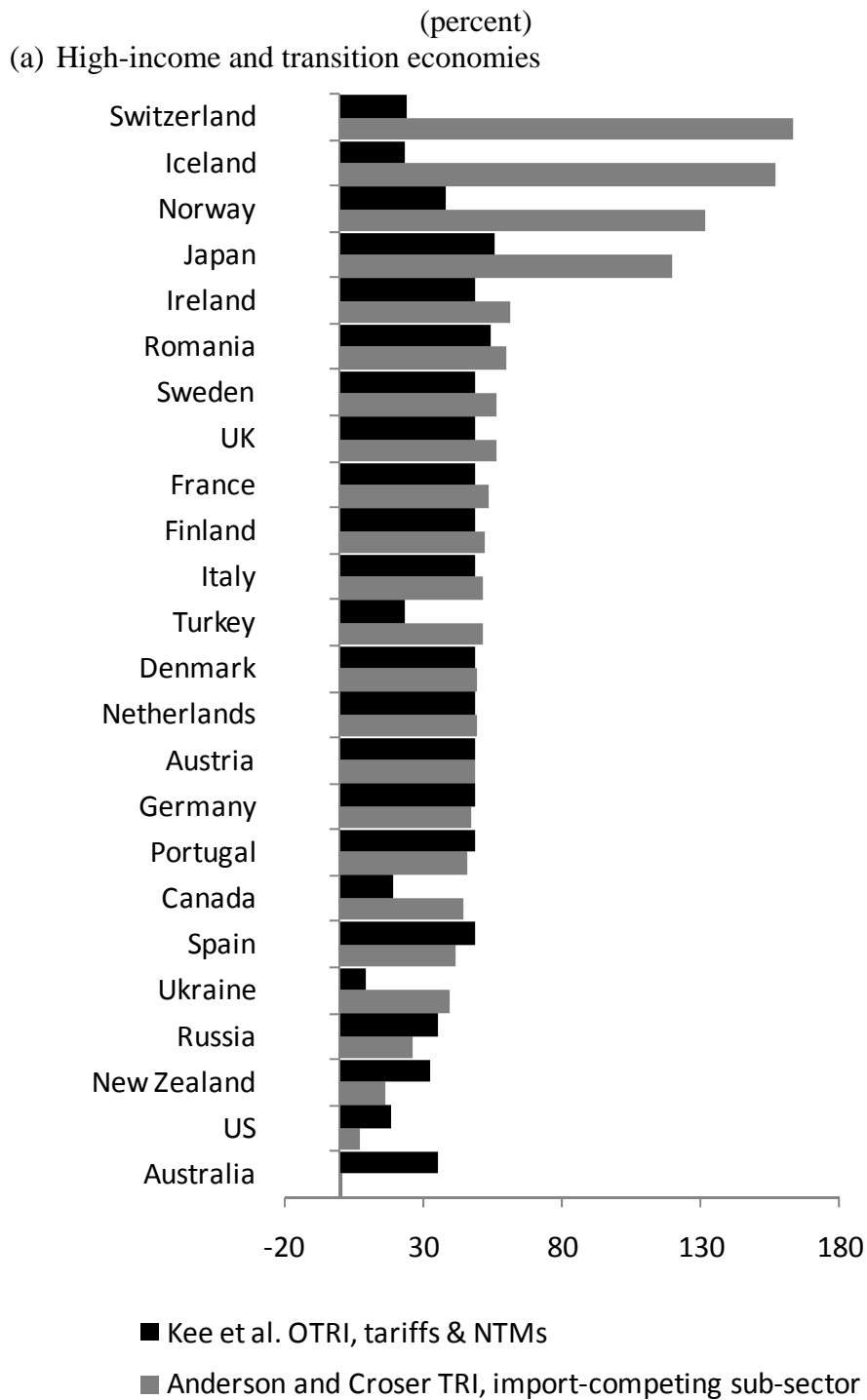
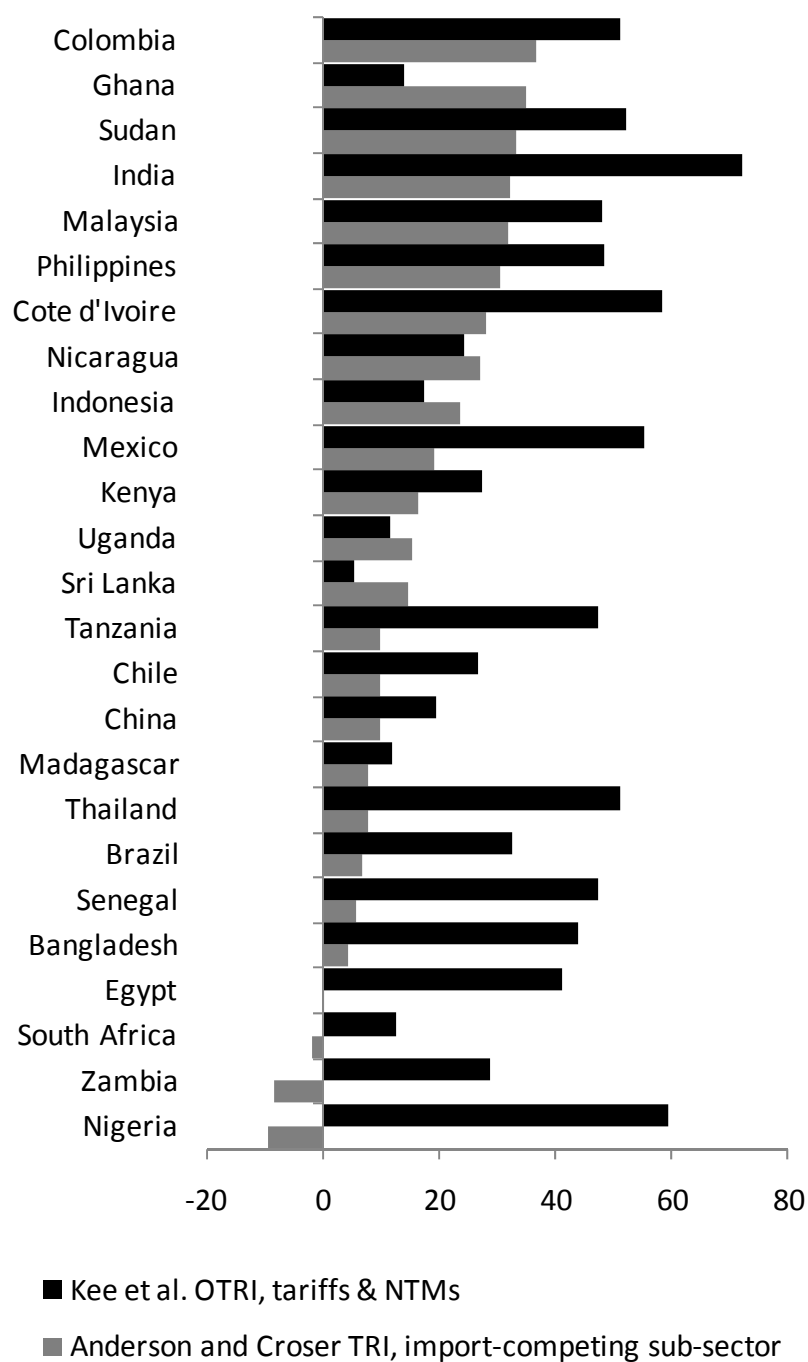


Figure 2 (continued): Trade reduction indexes for the agricultural sector's import-competing sub-sector, selected focus countries, 2000–04<sup>a</sup>

(b) Developing countries



Sources: Anderson and Croser (2009) and Kee, Nicita and Olarreaga (2008).

a. The Kee, Nicita and Olarreaga estimate for each country is for a single year in the mid-2000s for which the most recent data is available.

Figure 3: Trade reduction indexes for the agricultural and manufacturing sub-sectors, selected focus countries, mid-2000s<sup>a</sup>

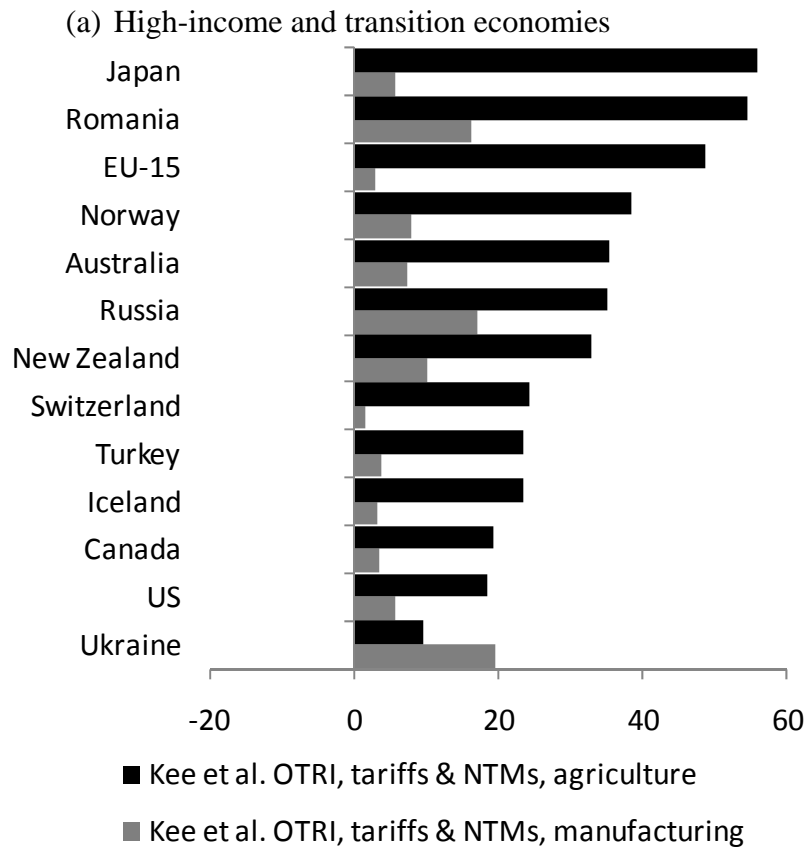
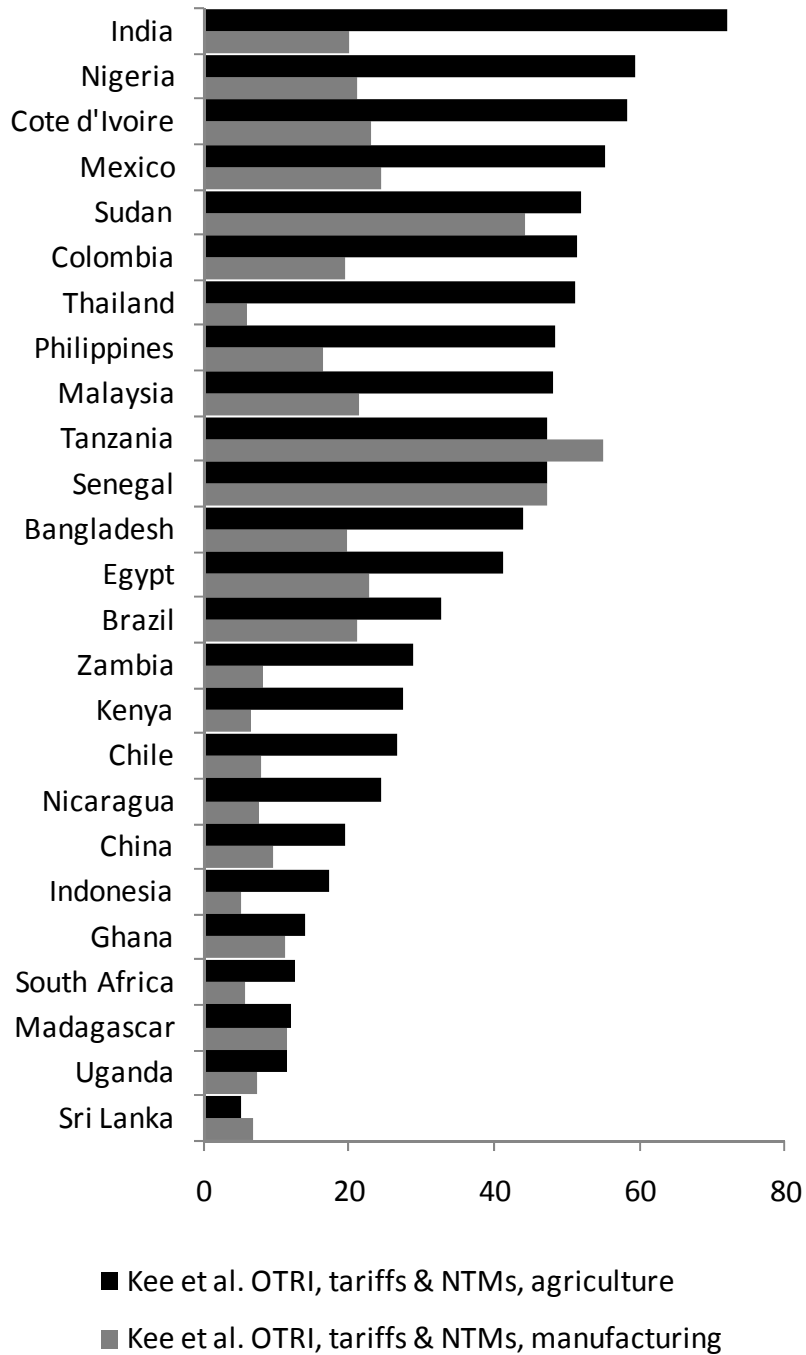


Figure 3 (continued) Trade reduction indexes for the agricultural and manufacturing sub-sectors, selected focus countries, mid-2000s<sup>a</sup>

(b) Developing countries



Source: Kee, Nicita and Olarreaga (2008).

a. The for each country is for a single year in the mid-2000s for which the most recent data is available.

Figure 4: Trade reduction indexes for the agricultural import-competing sub-sector and for all covered tradable farm products, selected focus countries, 2000-04<sup>a</sup>

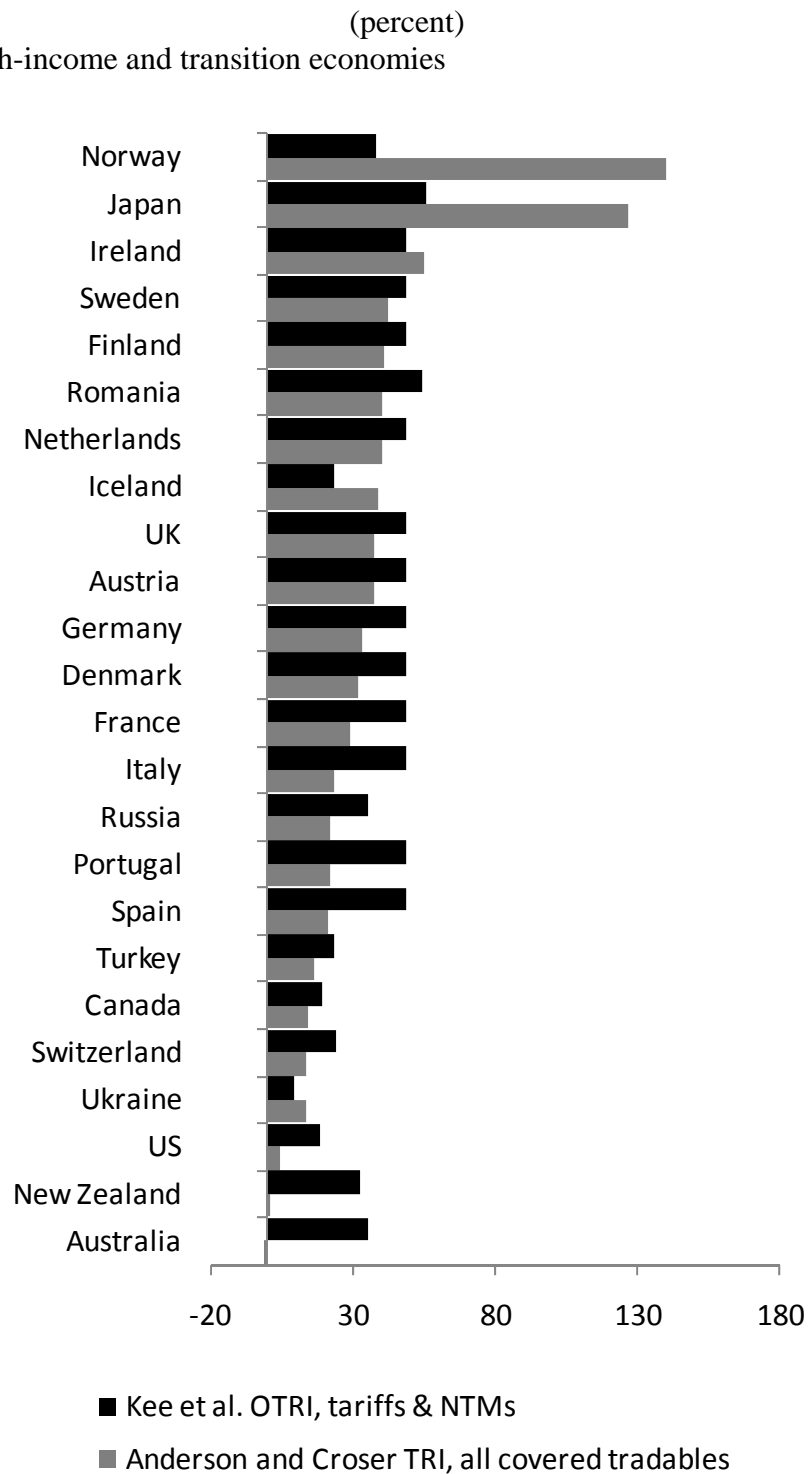
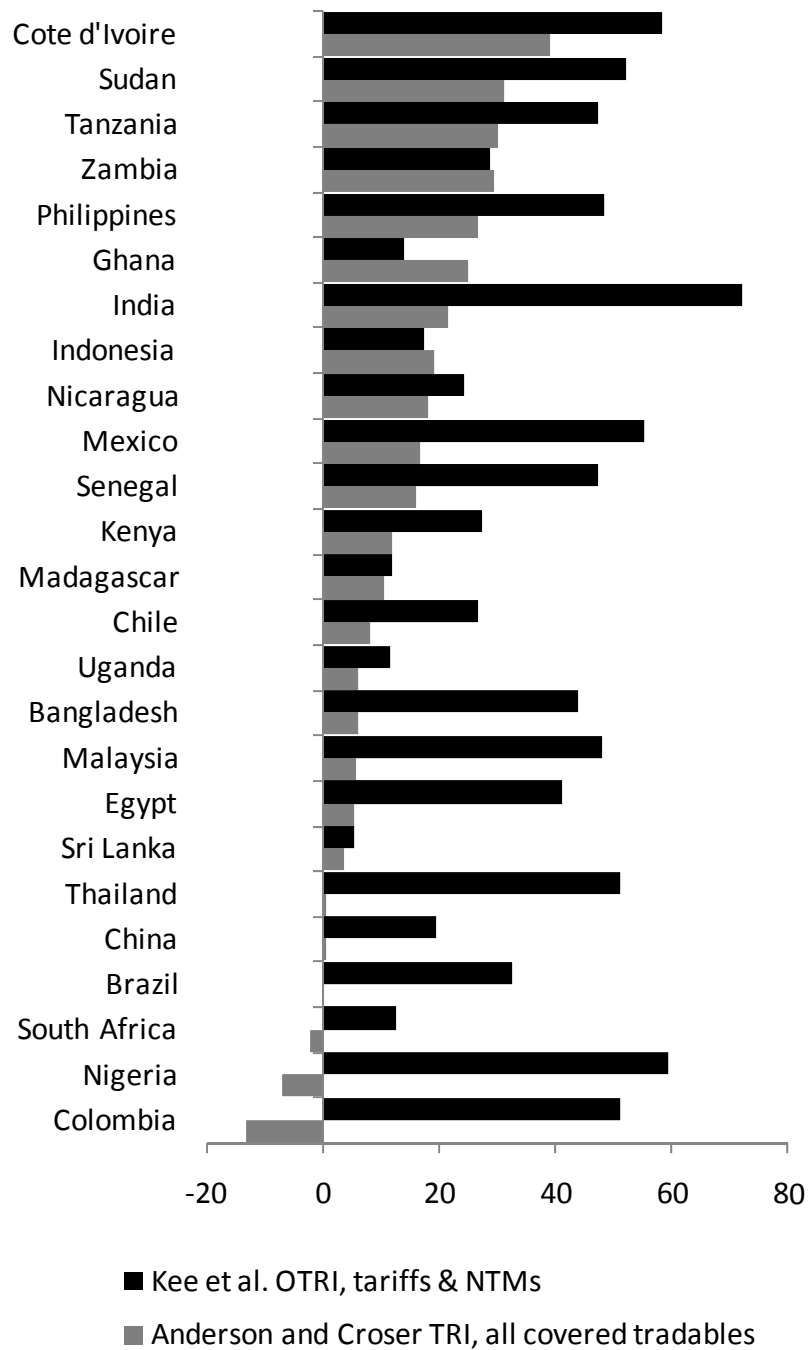


Figure 4 (continued): Trade reduction indexes for the agricultural import-competing sub-sector and for all covered tradable farm products, selected focus countries, 2000-04<sup>a</sup>

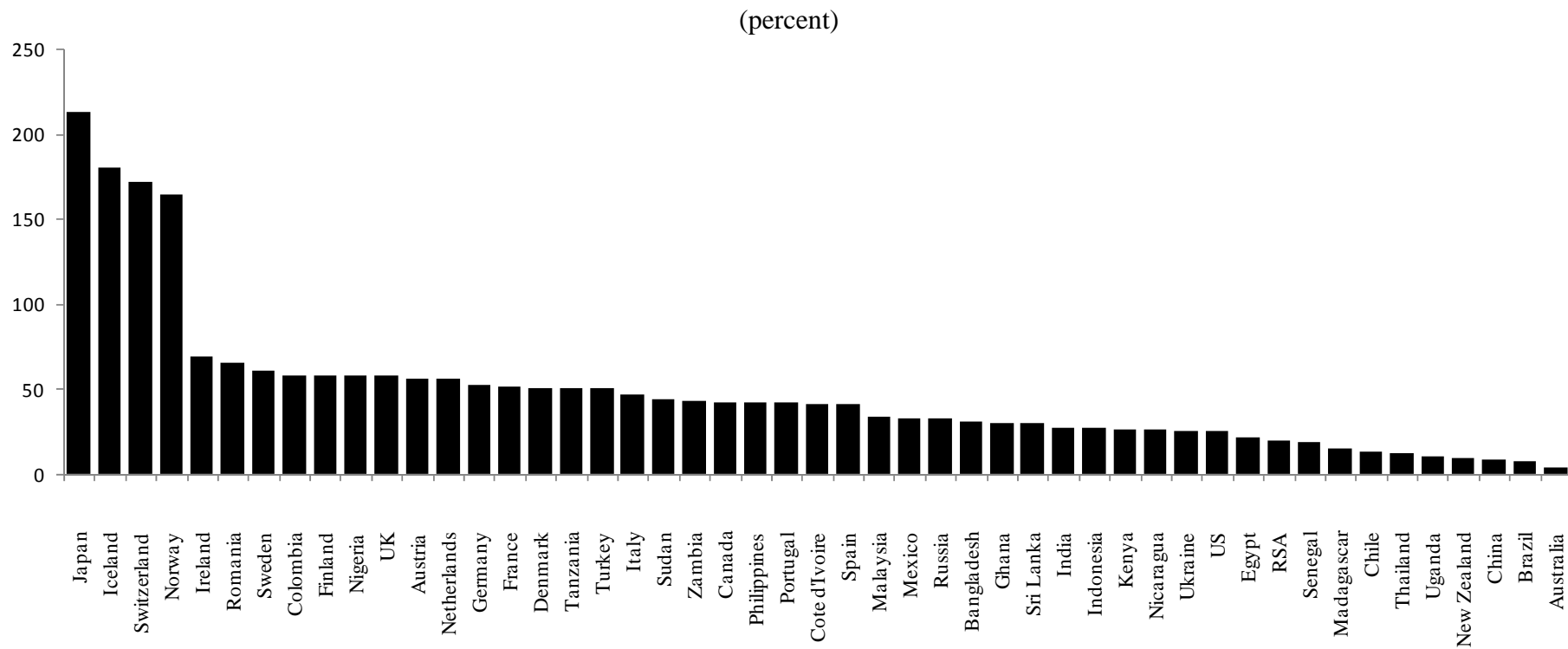
(b) Developing countries



Source: Anderson and Croser (2009).

a. The Kee, Nicita and Olarreaga estimate for each country is for a single year in the mid-2000s for which the most recent data is available.

Figure 5: Welfare reduction indexes for the all covered tradable farm products, selected high-income and transition economies and developing countries, 2000-04



Source: Anderson and Croser (2009).