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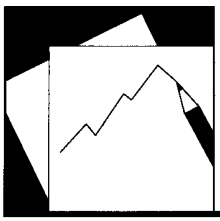

# IMF Working Paper

# Protectionist Responses to the Crisis: Damage Observed in Product-Level Trade

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# Protectionist Responses to the Crisis: Damage Observed in Product-Level Trade

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## Abstract

This paper investigates how trade flows are being affected by new discriminatory measures implemented during the global financial crisis. We match data on behind-the-border measures (e.g., bailouts and subsidies) and border measures implemented through April 2010 to monthly HS 4-digit bilateral trade data. Our estimation strategy relies on a first-differenced gravity equation and time-varying fixed effects to disentangle the impact of new discriminatory measures. Trade in exporter-importer pairs subject to new measures decreased by 5 to 8 percent relative to trade in the same product among pairs not subject to new measures. These product-level results imply global trade declines at the aggregate level of about 0.2 percent, or $30-35 billion a year. These aggregate figures would be higher, if one third of measures had not been excluded due to incomplete data.

The paper then goes on to dissect protectionism's trade impact by disaggregating measures by type, advanced/developing countries, regions, sectors, and time. Behind-the-border measures are found to have been more harmful than border measures at the product level. Among border measures, impacts tend to be higher for less transparent measures. Advanced countries are found to be responsible for 2/3 of the trade decline due to crisis protectionism, but their exports also absorbed 2/3 of this decline. When breaking down measures in a time dimension, we find that those taken in the first nine months after the Lehman collapse were most harmful and likely continue to constitute a drag on trade.

JEL Classification Numbers: F10, F15, C11

Keywords: Protectionism; Trade Restrictions; Global Crisis; First-differenced Gravity Equation; Time-varying Fixed Effects; WTO.

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# I. INTRODUCTION[1]

1. **New acts of protectionism since the start of the global financial crisis have been well documented.** The early, high-level attention, particularly by the G-20, fostered both official and unofficial exercises to track the introduction of trade and industrial policies that discriminated against foreign products.

2. **The two main monitoring exercises differ somewhat on their conclusions about the prevalence of protectionism during the crisis.** These two monitoring exercises are undertaken by the World Trade Organization (WTO) and the independent watchdog Global Trade Alert (GTA). Together with the debate that has surrounded them, these exercises have brought transparency of governments' trade-related policy responses to the crisis. Important parts of this debate—including the question of the extent of the protectionist response—nonetheless remain unresolved: WTO reports acknowledge "instances of trade restrictive measures" in concluding that "governments have largely resisted resort to trade barriers" during the crisis (WTO, 2010a). Evenett (2010), however, based on the GTA data, argues that protectionism rose during the slump in world trade and has risen further as trade flows recovered.

3. **This paper aims to advance the debate about crisis protectionism by going beyond stocktaking to quantify the impact of measures on merchandise trade flows.** Quantifying trade impacts is crucial to assess crisis protectionism. Even if one thinks that only few measures were taken, it may be that trade has been severely impacted if those measures were particularly discriminatory and affected large trade flows. On the other hand, if measures were low impact, relatively less harm is being done.

4. **To our knowledge, our paper is the first to provide a comprehensive assessment of crisis protectionism's trade impact.** Aiming for comprehensiveness poses data and methodological challenges, mainly because crisis protectionism took many forms: from tariffs to export policies, "buy national" provisions, bailouts, and domestic subsidies—what Evenett (2010) calls the "diversity in contemporary protectionism." To deliver an assessment across broad types of measures, data constraints imply that our estimation strategy needs to rely on dummy variables and thus focuses exclusively on *whether* a product has been affected by protectionism. Information on the magnitude of a new measure (e.g., the extent of a tariff increase) is not used because we have no reliable way to characterize the magnitude of non-tariff barriers. This also allows us to avoid issues of aggregation. Studies that focus on particular types of measures include Kee et al. (2010) for tariffs and Bown (2010) for antidumping, safeguards, and countervailing duties. Shingal (2009) considers a broader array of measures, but limits his analysis to Japan. Bussiere et al. (2011) instead rely on simulations to gauge the impact that a protectionist surge may have on broad macroeconomic variables. Gregory and others (2010) emphasize the macroeconomic risks of protectionist

[1] We thank Tushara Ekanayake, Emmanuel Hife, Yoichiro Kimura, Ioana Niculcea, and Nicolas Young for outstanding research assistance. We are also grateful for many useful comments received from seminar participants at the WTO, the OECD, the European Commission, the European Central Bank, the Central Bank of the Philippines, the Swedish Ministry of Trade, and the IMF headquarters as well as its offices in Tokyo.

responses, with reference to the 1930s experience.[2] That paper includes an earlier and less comprehensive version of the work presented here.

5. ***Product-level results.*** **Our results provide strong evidence that crisis measures are significantly decreasing trade in the products and trade pairs to which they apply** (the "affected trade flows"). Estimates show that affected trade flows fell by 5 percent in response to border measures and 7 percent in response to behind-the-border measures, with these impacts possibly being somewhat underestimated.[3] Surprisingly, tariffs and other traditional trade measures have a relatively small impact, while antidumping duties and other unconventional types of protectionism such as non-tariff barriers, discriminatory purchasing policies, bailouts, and domestic subsidies have substantially reduced affected trade flows. It has been documented elsewhere that unconventional measures have been an important feature of the trade policy response to the crisis, but our data and method have allowed the first comprehensive assessment of their impact on trade flows. Protectionism was very harmful for exports of developing countries, particularly affecting those of poorer nations within this group.[4] Interestingly, border restrictions most hurt the developing world. In contrast, developing country exports were little affected by trade partners' bailouts, which distorted affected trade less than the measures of developing countries. To the contrary, the incidence of advanced countries' behind-the-border measures is seemingly falling mainly on their peers.

6. ***Aggregate results.*** **Despite substantial product-level impacts, the impact of crisis protectionism on aggregate world trade flows is moderated by the small share of global trade actually subject to new measures.** Our estimates suggest that crisis protectionism measures are decreasing global trade by at least $30-35 billion, or 0.2 percent, annually. Protectionism was not an important factor in causing the global trade collapse (Baldwin and Evenett, 2009 and OECD, 2010), however, removing the crisis protectionist measures included in our study could increase aggregate global trade by about 1/7 of the amount that could be expected from a Doha Round conclusion—not negligible, considering that Doha negotiations have been enormously divisive and conclusion of the round is not assured. The fact that new trade measures are not interfering substantially with the global recovery is due

[2] With regards to the 1930s experience, Hall (1933) is an intellectual ancestor to our study, although he used a much more simplified approach and focused exclusively on tariffs. He compared the 56 percent contraction in U.S. imports subjected to higher tariffs under Smoot-Hawley to the 40 percent contraction among products that were not subjected to higher tariffs, and attributed the additional 16 percentage point contraction among the former to the new tariffs.

[3] Underestimation of product-level effects could result from a mismatch between the disaggregation of the trade data (HS 4-digit) and the granularity of the trade flow to which many of the measures apply.

[4] Protectionist measures are estimated to be reducing affected lower middle income country exports by 8 percent, while upper middle income countries' exports are only reduced by 5 percent (Table 7). Affected exports of low income countries (LICs) are estimated to be reduced by over 10 percent, but the respective coefficient remains statistically insignificant, potentially because LICs are affected by a much smaller number of measures.

solely to the restraint that countries have shown—it is not because the individual measures themselves have been innocuous.

7. **The remainder of this paper is organized as follows.** Section 2 presents our data. Section 3 illustrates graphically the impact of new discriminatory measures on detailed trade data. Section 4 sets out our estimation strategy, and section 5 presents the econometric results. Section 6 concludes.

## II. DATA

8. **We obtained our monthly bilateral 4-digit HS merchandise trade data under subscription from Global Trade Information Services (GTIS)**, a commercial service that harmonizes data from various national statistics institutes. Our data include the external imports and exports reported by the European Union (EU) and fourteen other major G-20 reporting countries.[5] The data cover some 80 percent of global merchandise trade, missing only flows for which neither the exporter nor importer is among those fifteen major reporters. For many reporters, the data cover the period of July 2007-April 2010; data for all reporters are available through December 2009.[6] When year-on-year log differences in trade flows are constructed for our dependent variable, the data series starts in July 2008. For use in our regressions, we thereby obtain a total of 9.9 million monthly observations of import values in country-pair/product combinations. The GTIS data also provide us with import volumes, which we use in our robustness analysis.[7]

9. **We match information on discriminatory measures taken from Global Trade Alert (GTA) to the trade data.**[8] With exceptions, the GTA database provides, for each measure: (i) the implementing country, (ii) trade partners affected, (iii) the 4-digit Harmonized System (HS) product categories affected, (iv) month of implementation (and removal, if any) and (v) a description of the measure. We include in our database only those measures reported by GTA as having been implemented during our study period and classified by GTA as almost certainly discriminating against foreign interests ("red" measures). Our analysis is based on measures reported by GTA as of the beginning of June 2010, at which time 508 GTA measures met these criteria. Of these measures, in turn,

[5] Taking into consideration that Germany, France, Italy, and the U.K. are part of the EU, this implies that our dataset includes all G-20 countries except Saudi Arabia.

[6] The trade flow data were obtained from GTIS at the beginning of June 2010. Due to reporting lags, the data from some of our reporters ends earlier than April 2010. Here a list of our reporters with the last month of data contained in our dataset in parentheses: Argentina (3/10), Australia (3/10), Brazil (4/10), Canada (3/10), China (4/10), EU-27 external trade (2/10), India (12/09), Indonesia (2/10), Japan (4/10), Mexico (2/10), Russia (3/10), South Africa (3/10), South Korea (4/10), Turkey (3/10), United States (3/10).

[7] Our data on import volumes are somewhat less reliable than our import value data. This is because the 4-digit flows are calculated by GTIS by aggregating flows in corresponding subcategories. This aggregation is unreliable if there are subcategories for which quantities are measured using different units of measurement. Nonetheless, the volume data confirm our main results derived from trade value data (Table 3).

[8] See www.globaltradealert.org.

314 featured all information necessary to be included in our analysis. The excluded measures (38 percent of the total) were mostly behind-the-border measures, such as financial sector bailouts, for which GTA could not identify affected partners or merchandise trade categories.

10. **Based on measure descriptions provided by GTA, we classified our 314 measures to identify whether they aim at increasing or decreasing imports or exports** (Table 1). Measures were classified as import restrictions, export restrictions, export support measures, and behind-the-border measures.[9] Among import restrictions, we distinguish (a) tariffs and import bans, (b) trade defense measures, consisting of anti-dumping, countervailing duty, and safeguard measures, (c) non-tariff barriers, and (d) discriminatory purchasing policies, such as government procurement provisions and consumption subsidies tied specifically to the purchase of domestically-produced products. Behind-the-border measures are separated into bailouts, domestic subsidies, and investment subsidies. Table 1 provides summary statistics for our categorization, and Appendix Table A1 provides measure-by-measure details. Table 1 illustrates that most protectionist measures were border measures aimed at import restricting imports. Behind-the-border measures are a far second, partly because many of these

**Table 1. Summary of Measures used in the Study**

| | Total | By region of implementing country 1/ | | | | |
|---|---|---|---|---|---|---|
| | | Africa | Asia | Europe | LAC | North America |
| Protectionist measures reported by GTA 2/ | 508 | 68 | 181 | 163 | 75 | 21 |
| Protectionist measures used in study 3/ | 314 | 50 | 132 | 47 | 70 | 15 |
| Import restrictions | 239 | 42 | 97 | 23 | 65 | 12 |
| Tariffs and Import bans 4/ | 99 | 29 | 41 | 4 | 22 | 3 |
| Trade defense | 102 | 4 | 45 | 13 | 33 | 7 |
| Non-tariff barriers | 16 | 5 | 4 | 0 | 7 | 0 |
| Discriminatory purchasing | 22 | 4 | 7 | 6 | 3 | 2 |
| Behind the border measures 5/ | 40 | 2 | 16 | 18 | 3 | 1 |
| Bailouts | 27 | 0 | 14 | 11 | 1 | 1 |
| Domestic subsidies | 7 | 0 | 1 | 5 | 1 | 0 |
| Investment subsidies | 6 | 2 | 1 | 2 | 1 | 0 |
| Export restrictions | 19 | 4 | 14 | 0 | 1 | 0 |
| Export support 6/ | 16 | 2 | 5 | 6 | 1 | 2 |

1/ Countries categorized into regions using World Bank classification. Africa includes the Middle East. Asia includes Russian Federation. Latin America and Caribbean (LAC) includes Mexico. For convenience, Appendix Table A2 provides the regional classification of all countries in the dataset.
2/ Implemented measures reported as of end-June 2010 by Global Trade Alert as almost certainly discriminating against foreign commercial interests ("red" measures).
3/ Number of measures with complete data on implementing jurisdiction, affected jurisdiction, and affected products among those described under 2/.
4/ Also includes import quotas and competitive devaluations.
5/ For our purposes we define behind-the-border measures as those consisting of direct discriminatory assistance to domestic firms. A priori, these measures could be expected to cause a decrease in imports and/or an increase in exports.
6/ Largely consists of export subsidy measures.

[9] Behind-the-border measures, such as a bailout of a domestic firm, may decrease domestic imports as well as increase domestic exports vis-à-vis the counterfactual of the firm's closure. Our estimates indicate that only the import effects are economically important, and we drop the export effects in most regressions. Analogs of our baseline regressions, including behind-the-border measures' export effects, are reported in Table 3.

measures could not be included in the analysis as noted above. Export restrictions and export support measures number less than 20 each, which, in light of the volatile disaggregate trade data, makes it difficult to establish significant impacts for these measures. We thus exclude them from much of our analysis (without affecting other results).[10]

11. **To interpret our results below, it is important to note that some measures may target only a portion of a 4-digit observation.** It is apparent that many narrowly-targeted measures are targeted at more detailed product categories (6-digit or higher). This is particularly true for import restrictions imposed at the border, such as anti-dumping measures, which are generally very specific. Thus, to the extent that only portions of 4-digit categories are actually affected by the measures, our estimates likely underestimate product-level effects. (However, this potential bias cancels out, when we calculate impacts on aggregate imports.) Use of more detailed trade data (such as at the 6-digit level) would likely have led to more precise coefficient estimates, but was not possible given that GTA codes affected products at the 4-digit level. Nevertheless, as we shall see now, even 4-digit data reveal clearly the trade effects of the discriminatory measures.

## III. A First Peak at the Protectionist Impact

12. **We begin with a look at the raw data to provide an intuitive sense of whether new discriminatory measures have affected trade.** We ask how trade evolved for a particular 4-digit product category in the months following the implementation of a new import restriction that affected trade in one or more country-pair combinations of that product. We track trade in affected country-pair combinations relative to global trade in the same product. This allows us to separate the impact of the new restriction from worldwide product-specific influences.[11] This separation is particularly important for the sample period, for instance because trade in durables fell much more than in nondurables at the beginning of the crisis (Baldwin and Taglioni, 2010). We normalize the "market share" of affected country-pairs to 100 in *T-1*, the month prior to the implementation of a new import restriction. With the imposition of a new import restriction affecting certain country-pairs in the market for a good *i*, we expect trade of good *i* among those country-pairs to fall, as a share of global trade in *i,* in the months after a new measure is implemented.

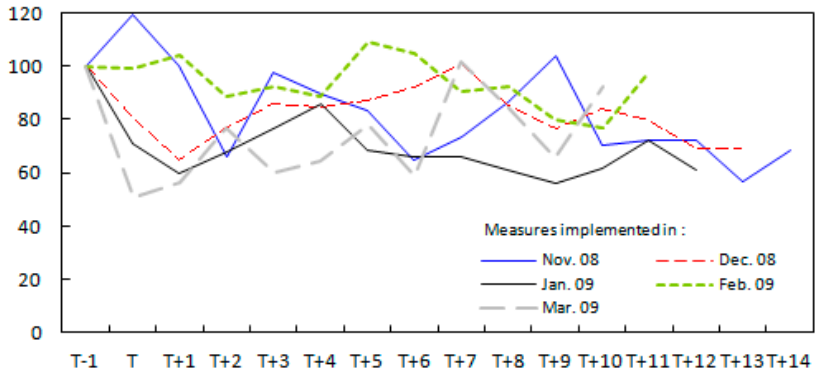
13. **The raw data strongly suggest a trade impact of import restrictions.** Figure 1 presents the raw data organized in the way described above, broken down by the month in which a new import restriction was implemented. In order to avoid presenting one chart for each of hundreds of protected 4-digit products, we sum over products. We follow the market

[10] Exclusion of export measures does not change our results on import restrictions and behind-the-border measures. Table 3 reports analogs to our baseline results including export measures.

[11] As our focus in this section is to give readers a sense of the data and identification strategy, we account only for product-specific influences. The econometric analysis in the following section allows us to introduce many different types of fixed effects and to isolate more perfectly the impact of the new import restrictions on trade, e.g., by accounting in addition for country, country-pair, or country-product specific shocks.

share of trade affected by import restrictions implemented in a given month. This gives us one series per implementation month. Figure 1 charts these series for implementation months through March 2009.[12] For these early implementation months we have both the longest series and they also affect higher amounts of trade than measures implemented thereafter.[13] Although the resulting series demonstrate some volatility, as expected, they leave the strong impression that the market share of trade covered by the restrictions declined. In other words, the decline in restricted trade consistently outpaced that in global trade for the same product. These declines also appear to persist.

**Figure 1. Performance of trade affected by import restrictions**
(by month import restrictions were implemented) 1/




Source: Authors' calculations.
1/ Value of trade in country pair-product combinations subject to import-restricting border measures implemented in month T divided by world trade in the same 4-digit HS product categories and normalized to equal 100 for month T-1. Only series with observations through T+10 are included. The series for October 2008 (the first month with implemented measures) is omitted because measures affected few country pair-product combinations, resulting in an excessively volatile series.

14. **Graphical analysis points toward a 10-20 percent trade reduction in response to import restrictions,** with regression estimates being somewhat lower. Figure 2 averages the series from Figure 1 using alternative averaging techniques over implementation months based on (i) the number of observations affected and (ii) the value of trade affected. Depending on the technique chosen the figure suggests that import restrictions may have decreased trade by 10 to 20 percent. Our regressions in Section 4 give qualitatively similar results, but estimated magnitudes are somewhat lower.[14] While the graphical analysis is

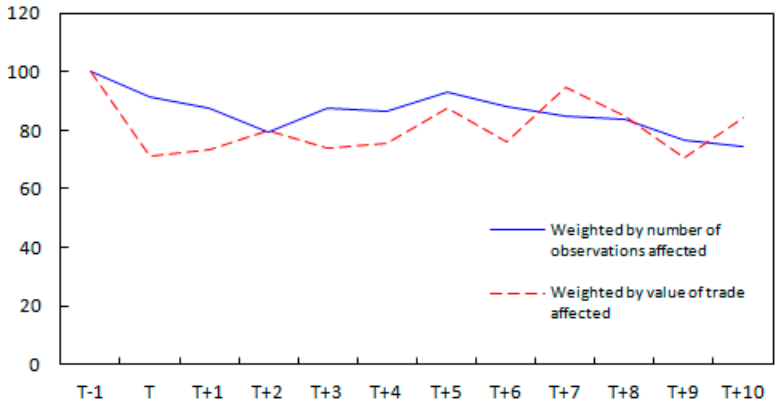
[12] The implementation month of the first protectionist measures included in the GTA database is in fact October 2008. However, measures implemented in October 2008 affected very small trade flows. As a consequence, the resulting market share series are very volatile and were omitted from Figure 1.

[13] Measures implemented up to March 2009 cover more than 80 percent of total trade affected by protectionist measures covered in this study.

[14] Our closest regression analog to the figures is Regression 1 (Table 2). It reports the trade-reducing impact of import restrictions at roughly 5 percent ($=e^{-0.048}$).

undoubtedly useful, analog regression estimates are superior. This is because the regression's minimization of squared residuals provides a consistent way of weighing over (i) implementation months and (ii) products affected within each implementation month (over which we simply summed to construct the figures).

**Figure 2. Average performance of trade affected by import restrictions**
(averages over implementation months) 1/




Source: Authors' calculations.
1/ The graph shows different weighted averages (over implementation months) of the series shown in Figure 1. Measures included in this graph (implemented up to March 2009) cover more than 80 percent of total trade affected by measures in the study.

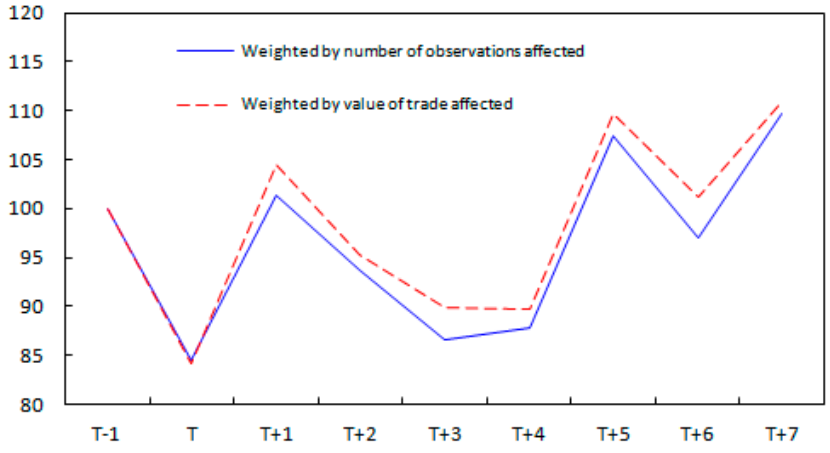
15. **The raw data for our behind-the-border measures show a more mixed picture.** Under our classification, behind-the-border measures are defined as direct assistance to domestic firms that is discriminatory, i.e. not available to foreign firms exporting to the domestic market. Figure 3 is the analog to Figure 2 for behind-the-border measures' impact on imports.[15] To cover the most relevant behind-the-border measures in the sample, while not unduly shortening available time series, we include measures implemented up to June 2009 in the construction of the figure.[16] Figure 3 indicates an 8 percent average decline in imports as a result of behind-the-border measures in the months immediately after implementation. From five months after implementation onwards, trade seems to return to its normal level. Superior regression analogs can provide further clarification also for behind-the-border measures and point to higher average impacts.[17]

[15] While behind-the-border measures could also be expected to increase exports, this does not seem to have been the case in practice, likely because firms receiving bailouts were too fragile to make further inroads into export market. For this reason, we do not further consider an export-enhancing effect of behind-the border measures. See also footnote 9.

[16] By including measures through June 2009, we achieve coverage of more than 80 percent of imports affected by behind-the-border measures throughout the entire sample.

[17] Our closest regression analog to the figures is Regression 1 (Table 2). It reports an average import-reducing impact of behind-the-border measures of roughly 15 percent ($=e^{-0.165}$).

**Figure 3. Average performance of imports affected by behind-the-border measures**
(averages over implementation months) 1/




Source: Authors' calculations.
1/ The graph shows different weighted averages (over implemenation months). Index is normalized at 100 for the month before implementation T-1. Measures included in this graph (implemented up to June 2009) cover more than 80 percent of total trade affected by measures.

16. **Analog figures for export restrictions and export support measures are presented in the appendix** (Figures A1 and A2). Results on export measures are less reliable given the small number of implemented measures, which is reflected in their insignificant regression coefficients.[18] Nonetheless, the graphs show that trade affected by export support measures gradually increased, as expected. However, contrary to initial intuition, trade in products subject to export restrictions actually increased. This could be due to high incentives for exports, such as a positive world-to-domestic price differential, in situations when export restrictions are imposed.

## IV. ESTIMATION

17. **We first estimate protectionism's trade impact at the product-level and then, in a second step, obtain impacts on aggregate global trade.** Econometric analysis, in addition to above-mentioned advantages, allows us to more extensively control for variations in trade that are unrelated to policy changes. Our regressions provide us with estimates of discriminatory measures' trade impact on product-level trade. In a second step, we can then multiply these product-level estimates with amounts of trade affected by measures to calculate impacts on aggregate global trade.

18. **It is crucial for identification to estimate crisis protectionism's impacts at the product level.** There are two reasons why evaluating the protectionist impact at the level of aggregate bilateral trade is not very promising. First, global trade experienced an unprecedented collapse as the global crisis broke out, which for the most part was unrelated

[18] Regression coefficients for export measures are generally not significant (see Table 3).

to protectionism. This collapse coincided with the implementation of many protectionist measures in our sample. Second, the scope of new protectionist measures was not widespread. The WTO estimates that between late 2008 and late 2010, new trade restrictions accumulated at a broadly steady rate to cover 1.9 percent of global trade in goods (WTO, 2010b). Our sample can provide an upper bound estimate of the amount of trade affected by protectionism. As of the last quarter of 2009, in our sample 3½ percent of trade was affected.[19] Given that large scale protectionism was prevented, it would be near impossible to detect any protectionist impact in aggregate trade data. This is particularly true given the contemporaneous trade collapse, which was mostly due to causes other than protectionism.[20]

19. **Our estimation to obtain product-level impacts of protectionism relies on the following a first-differenced gravity equation.**

$$\boldsymbol{\Delta \ln(Imports_{ijpt}) = TVFE + \Delta(ProtDummy_{ijpt}) + \varepsilon_{ijpt}}$$

$$\Delta \ln(Imports_{ijpt}) = TVFE + \beta \cdot \Delta(ProtDummy_{ijpt}) + \varepsilon_{ijpt}, \qquad (1)$$

where $\Delta \ln(Imports_{ijpt})$ is the 12-month change in the U.S. dollar value of log imports. TVFE stands for one or more sets of time-varying fixed effects, as described below; $\Delta(ProtDummy_{ijpt})$ is our indicator variable for observations subject to a protectionist measure and counts the number of crisis protectionist measures applied to any given trade flow;[21] $\varepsilon_{ijpt}$ is the error term; and $i$, $j$, $p$, and $t$ index importers, exporters, 4-digit HS product categories, and time (months), respectively.

20. **Given that our objective is to quantify short-run trade responses, a gravity equation in first differences is the obvious vehicle for our estimation.** Given the short time period for which GTA data on protectionist measures are available and the monthly frequency of our trade data, we are only interested in explaining *changes* in trade. First-differencing provides a straightforward way to comprehensively control for long run determinants of trade, whether country or country-pair specific, that are constant over time. These include many variables commonly included in gravity equations such as distance and other geography variables, common language, and colonial relationships, but also time-

[19] The last quarter of 2009 is the most convenient point of reference, because it is the quarter in which both most protectionist measures are in force and for which we have data from all reporters. Our figure overstates the true amount of trade affected to the extent that certain measures only target portions of 4-digit tariff lines.

[20] Rather, the collapse in trade in late 2008 and 2009 appears to have reflected three main factors: (i) a particularly sharp decline in the production and trade of durable goods (durable goods account for a much larger share of global trade than of production), (ii) supply chain and inventory adjustment effects, and (iii) a contributory role of constrained trade finance. The experience is analyzed further by Baldwin (2009), Levchenko et al. (2009), and Anderton and Tewolde (2011). Henn and McDonald (2010) provide an overview. However, as we will show, crisis protectionism's impact is not negligible when, instead of comparing it to the trade collapse, a more relevant comparison to the expected benefits of the Doha round is undertaken.

[21] In the event that multiple measures are applied, our protectionist indicator variable takes the value of 2 or more.

invariant unobservables.[22] In light of the short sample used in our estimation, first differencing should also mostly take care of slow-moving trade determinants.[23]

21. **Focusing on 12-month changes allows us to address product-level seasonality and improves the performance of the differenced gravity equation in volatile trade data.** Differencing between the same months in adjacent years will address seasonality that is country and product specific. Generally, this could also be accounted for by including country-pair-product fixed effects, but at the cost of a crucial computational disadvantage, which will be discussed below. The charm of fixed effects is that they compare trade in levels *in all months after* imposition of a protectionist measure to trade in *all* months before the imposition. In volatile product level trade data, this is an advantage over differencing over adjacent months, which evaluates whether trade changes *in the month directly after* imposition were unusual. By using 12-month changes, we amplify latter comparison—and thus soften the disadvantage of differencing—by comparing the *each of the 12 months after* imposition to the corresponding month one year earlier.[24]

22. **In our application, differencing the gravity equation has a crucial computational advantage over fixed effects.** Namely, differencing allows us to reduce the number of sets of fixed effects by one. This is crucial for two reasons. First, our estimation still needs to include various sets of time-varying fixed effects. Second, the number of sets of fixed effects that can be included in the estimation is limited to two, because our panel (i) is unbalanced, (ii) includes a large number of observations and (iii) has high-dimensional fixed effects. High dimensionality implies that thousands of dummy variables would have to be created, for instance for time-varying product fixed effects, because many different products are observed at many different points in time. With each of the dummies having 9.9 million observations, computer memory constraints bind. In an unbalanced panel, traditionally these constraints implied that only one high dimensional fixed effect could be considered via transforming the estimation equation pre-regression (Greene, 2003).[25] However, labor economists, who first faced the challenges of including more than one high dimensional fixed effect, have devised solutions, starting with approximations in Abowd et al. (1999). Guimaraes and Portugal

[22] These could include cultural affinities and institutional similarities. Hummels and Levinsohn (1995) first emphasized unobserved bilateral heterogeneity in gravity equations. Since then, a considerable literature has pointed out that gravity estimates may suffer from considerable omitted variable bias, if these time-invariant country-pair specific unobservables are not controlled for via first differencing or country-pair fixed effects. Baldwin and Taglioni (2006) label the omission of these controls the "gold medal of classic gravity model mistakes." See also Egger (2000), Cheng and Wall (2005), Baier and Bergstrand (2007), Eicher and Henn (2011a, b).

[23] These could include transport infrastructure, costs of doing business, and political relationships.

[24] The consistency of our estimate for $\beta$ is not affected by the use of differencing or by the use of country-pair-product fixed effects in the estimation. Estimation in differences, however, has the additional advantage that it is more efficient when serial correlation in the error terms of a corresponding gravity equation in levels cannot be ruled out (Wooldridge, 2002, chapter 10.6).

[25] In a balanced panel, two fixed effects could be stripped algebraically.

(2009) now provide an exact iterative technique, which we use in our estimation. Yet, their methodology is still limited to two high-dimensional fixed effects. It is thus crucial to eliminate time-invariant country-pair-product specific determinants via first differencing, so that our estimation can include two sets of time-varying fixed effects. We turn to these now.

23. **Time-varying product fixed effects are a first important step to disentangle the protectionist impact from that of other factors.** During the great trade collapse, trade in consumer durables and capital goods declined much more than that in nondurables. Our most basic specification uses time-varying product fixed effects (TVP) to control for this. The regression specification with TVP effects only is the closest econometric analog to our graphical analysis in section 3. Inclusion of TVP effects implies that $\beta$ in equation (1) is a between estimator, relying exclusively on cross-sectional variation, and making our estimation strategy similar to that of Amiti and Weinstein (2009).[26] In estimating $\beta$ we thus evaluate whether, for a given product and month, those country-pair relationships affected by e.g., an import restriction saw their trade decline by more than others. The TVP effects, however, can only control for global shocks to specific products.

24. **Adding other sets of time-varying fixed effects can further improve the estimation by controlling for country or pair specific shocks.** These additional fixed effects acknowledge that some countries and trading relationships may have been more impacted than others by non-protectionist factors during the great trade collapse. We discuss these additional fixed effects in turn, from the least to most specific:

- **Time-varying importer fixed effects** (TVIM) comprehensively control for any change in an importer's trade determinants, whether observable or unobservable, that affects all products equally. For instance, import demand may have fallen more strongly in some importers particularly exposed to the global crisis, for instance due to high debt levels. TVIM effects also control for importer-specific multilateral resistance (Anderson and van Wincoop, 2003), i.e., general equilibrium effects that could otherwise bias the $\beta$ estimate.

- **Time-varying exporter fixed effects** (TVEX) are analogs to TVIM effects on the exporter side and can control for country specific supply shocks. They also control for exporter-specific multilateral resistance. Thus, when TVEX and TVIM effects are jointly included, country-specific multilateral resistance is controlled for completely.

- **Time-varying country pair fixed effects** (TVCP) combine and generalize TVIM and TVEX effects. By accounting for TVIM effects and adding equivalent controls to the exporter side, they completely control for country-specific multilateral resistance. Beyond that they also control for any changes in *bilateral* trading costs that affect all

[26] Amiti and Weinstein (2009) estimate the impact of the 1992/93 Japanese banking crisis on Japanese exporters. Their estimation also only uses cross-sectional information at each point in time, comparing whether the performance of exporters in the same sector varied depending on how much their main bank was impacted by the banking crisis.

products, such as changes in exchange rates, political relationships, or transport connections.

- **Time-varying importer-product fixed effects** (TVIMP) allow product fixed effects to vary depending on the importer. This captures the notion that e.g., consumers in different countries reacted to the crisis differently by cutting expenditure on different items.

- **Time-varying exporter-product fixed effects** (TVEXP) allow product fixed effects to vary depending on the exporter. This captures the notion that crisis-induced supply shocks may have differed in each exporting sector in each country.

In our estimations, we are mindful that Guimaraes and Portugal's (2009) methodology can only accommodate two fixed effects at a time. Working around this does not impose a major constraint, however, because two different sets of fixed effects can often be easily combined into a more general one, as is the case for TVCP effects as mentioned above.

25. **Measures of fit will be the main determinants in selecting our preferred regression specifications.** This paper does not have a prior as to whether shocks to trade in the wake of the global crisis were heterogeneous across products, countries, country pairs, or combinations of those. Rather we let the data speak and rely on measures of fit to lead us to the appropriate set of fixed effects, which best controls for factors unrelated to protectionism.

26. **Our protectionist dummy is designed to capture the broad range of protectionist measures implemented during the global crisis and its aftermath.** Our protectionist dummy counts the number of protectionist measures that each observation is affected by and thus takes positive integer values of 0, 1, 2, and so on.[27] This coding ensures that $\beta$ coefficients can be interpreted as the average trade impact of one measure. To deliver comprehensiveness across measures, the data constraints only allow us to focus on *whether* a product has been affected by using protectionist dummy variables in our regressions. Information on *how much* a tariff or anti-dumping duty may have increased cannot be utilized. We partially address this shortcoming by later splitting up the protectionist dummies by types of measures, implementing countries etc. This at a minimum allows us to gauge for instance whether tariff or antidumping measures have been more harmful on average.

27. **After we have obtained our product-level estimates, we use them to calculate the total impact of protectionism.** We do so by, first, simply multiplying the estimated percentage reduction in product-level trade by the amount of trade affected and, second, then summing across all protectionist dummies (e.g., tariff dummy, antidumping dummy etc). In keeping this calculation straightforward, it is helpful that the large majority of observations

[27] Our robustness analysis shows that results do not vary if the protectionist dummy is instead coded as taking the values of 0 and 1 only. See Table 3.

affected by protectionism are affected by one measure only.[28] Any downward bias on protectionism's aggregate trade impact resulting from this simplification is thus minimal.

## V. RESULTS

### A. Baseline results

28. **Our baseline results allow us to arrive at our preferred TV product & country-pair FE specification by scrutinizing six different FE setups.** Our first specifications includes only TV product FEs in addition to the protectionist dummies; it is the closest, but not exact, econometric analog to our graphical analysis in Section 3. The F-Statistics suggest it is statistically outperformed by specification 2, which adds importer FEs to provide a better fit. This corroborates the common wisdom that importing countries and their demand were impacted differently by shocks emanating from the global financial crisis. Specification 3's country-pair FEs, in turn, additionally control for exporter-specific (supply) shocks and bilateral trade determinants such as exchange rate changes. Our data also confirm the importance of these shocks, resulting in specification 3 to outperform specification 2. Specification 4 generalizes specification 2 instead in another way—by supposing that demand shocks are not just country-specific, but vary also by product within each country. While preferred to specification 2, it is preferred by a smaller margin than specification 3.[29] Specifications 5 and 6 represent further generalizations of specification 4, so that specification 3 remains our preferred one.

29. **Low R-squared values are not surprising in our estimations.** Standard gravity equations normally show very high R-squared values, because they are estimated (i) in levels, (ii) on aggregate bilateral trade flows, and (iii) on annual data. Our estimation in contrast takes as the dependent variable the much more volatile differences in detailed monthly product-level trade flows. Not surprisingly then, even large sets of fixed effects do not have enormous explanatory power, because even within-group idiosyncratic fluctuations are high. Our protectionist dummies, despite being highly statistically significant, can also not boost R-squared by much, because they only take the value of "1" for a small number of observations. Thus, even if they explained these observations perfectly, R-squared would not increase by much.

[28] Protectionist import restrictions, our main variable of interest in estimation, break down as follows. Observations affected by one import restriction numbered 56,050 (0.57 percent of the total sample). There were 4,780 observations, 218 observations, and 2 observations contemporaneously affected by two, three, and four import restrictions, respectively. The remainder of the sample (9,817,431 observations) was unaffected by import restrictions.

[29] The F-statistic rejects specification 2 in favor of specification 3 with a value of 1.80, while specification 2 is rejected in favor of specification 4 only with a lower F-value of 1.12.

**Product-level results**

30. **Our baseline focuses on *average* effects of all import restrictions and all behind-the-border measures.**[30] Average implies here that we do not yet split the protectionist dummy to distinguish between different subcategories of measures such as tariffs, antidumping duties, nontariff barriers etc.

31. **The trade decline in response to import-restrictive border measures is estimated to be 5 percent, but may be as high as 8 percent** (Table 2, upper panel). Our preferred estimate for border measures from specification 3 indicates that such a measure on average decreased affected imports by 5 percent ($=e^{-0.051}$).[31] The more parsimonious Specifications 1 and 2 closely corroborate this result, despite neglecting to account for some shocks that may be of importance. All estimates are highly statistically significant. The more detailed importer-product fixed effects of specifications 4-6 allow us to evaluate whether there was any pattern with regards to the markets that countries selected to impose import restrictions. Interestingly, the impact of import restrictions is higher in these regressions: on the order of 8 percent. This implies that countries imposed import barriers in products where trade fell by less than in other products or where imports even rose during the crisis. Domestic industries most threatened by rising imports may, ceteris paribus, have a higher incentive to lobby for protection than others.[32]

32. **Behind-the-border measures are estimated to decrease trade by 7 percent.** Consequently behind-the-border measures are somewhat more trade distorting than border measures, according to our preferred estimates based on specification 3. Interestingly, Specification 1, which does not control for country-specific shocks, stipulates a much higher protectionist impact (-15.2 percent trade decline). Most of this higher impact, however, disappears when importer FEs are added in Specification 2. Thus, countries that resorted to behind-the-border measures, such as bailouts, were those with higher-than-average import declines across all products (and not just in those that they ended up protecting). These high import declines in turn suggest that they were also those countries most negatively impacted by the crisis and consequently their governments resorted to more domestic measures to support the economy, some of them discriminatory. When instead the more detailed TV Importer-Product FEs are included (Specifications 4-6), the identification strategy comes to rely on variation between trading partners only (for imports of the same product during the same month). This is problematic for behind-the-border measures, because they do not discriminate *among* trading partners, but only between domestic and foreign firms). Thus, impacts of behind-the-border measures—though they are most likely non-zero, as our

[30] Results for regressions which additionally include estimations of export measures' trade impact are reported in Appendix Table A2.

[31] Note that the protectionist coefficients are semi-elasticities, because changes in log imports are on the left-hand side of the equation, while the protectionist variables are dummies and not expressed in logs.

[32] As emphasized in the "protection for sale" literature, the result can depend on how well the affected domestic industry is organized (Grossman and Helpman, 1994). Imai et al. (2009) is an example of more recent work.

**Table 2. Baseline results**

| | Estimation of product-level trade impact 1/ | | | | | |
|---|---|---|---|---|---|---|
| Time-varying fixed effects | Product | Product & Importer | Product & Countrypair | Importer-Product | Imp.-Prod. & Exporter | Imp.-Prod. & Exp.-Prod. |
| Regression # | 1 | 2 | 3 | 4 | 5 | 6 |
| **Import Restrictions** | -0.048 *** | -0.050 *** | -0.051 *** | -0.076 *** | -0.084 *** | -0.083 *** |
| | (-5.09) | (-4.46) | (-4.77) | (-3.08) | (-2.94) | (-2.69) |
| **Behind-the-border measures** 2/ | -0.165 *** | -0.092 *** | -0.073 *** | 0.010 | -0.005 | -0.004 |
| | (-10.86) | (-5.37) | (-4.53) | (0.16) | (-0.05) | (-0.03) |
| F-Statistic vs. regression # | | 1 | 1 | 1 | 1 | 1 |
| F-Statistic | | 12.32 | 2.33 | 1.14 | 1.15 | 1.20 |
| Prob>F: | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| F-Statistic vs. regression # | | | 2 | 2 | 4 | 5 |
| F-Statistic | | | 1.80 | 1.12 | 4.82 | 1.23 |
| Prob>F: | | | 0.000 | 0.000 | 0.000 | 0.000 |
| Number of Time-varying fixed effects | 27,896 | 32,910 | 128,833 | 2,574,781 | 2,579,648 | 3,819,552 |
| Number of Observations | 9,878,481 | 9,878,481 | 9,878,481 | 9,878,481 | 9,878,481 | 9,878,481 |
| Adj. R-Squared (percent) | 1.80 | 2.36 | 3.12 | 5.20 | 5.44 | 8.97 |

| | | | | Calculation of aggregate trade impact 3/ 6/ | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | No. of meas. 4/ | Affec-ted obs. 5/ | Affected quarterly trade 6/ | Aggregate quarterly trade impact implied by regression #: | | | | | |
| | | | | 1 | 2 | 3 | 4 | 5 | 6 |
| **Total** | 279 | | $77,668 | -$7,313 | -$5,177 | -$4,568 | -$2,794 | -$3,605 | -$3,537 |
| | | 1.65% | 3.58% | -0.34% | -0.24% | -0.21% | -0.13% | -0.17% | -0.16% |
| **Import Restrictions** | 239 | | $42,722 | -$1,983 | -$2,099 | -$2,105 | -$3,136 | -$3,424 | -$3,410 |
| | | 1.11% | 1.97% | -0.09% | -0.10% | -0.10% | -0.14% | -0.16% | -0.16% |
| **Behind-the-border measures** 2/ | 40 | | $34,946 | -$5,330 | -$3,078 | -$2,462 | $342 | -$181 | -$127 |
| | | 0.54% | 1.61% | -0.25% | -0.14% | -0.11% | 0.02% | -0.01% | -0.01% |

Source: Authors' estimates.

1/ *, **, *** denote 10, 5, 1 percent significance levels. T-statistics in parentheses. Regression coefficients express impacts in log units, which are very similar to percentage changes for values close to zero. The exact percentage change implied by any coefficient b can be calculated as exp(b)-1.

2/ Refers to the impact of behind-the-border measures on imports.

3/ Aggregate trade impacts are expressed as the change in trade due to protectionism *per quarter*. Impacts are calculated by multiplying product-level regression coefficients by the amount of trade in countrypair-product combinations affected by protectionist measures ("affected quarterly trade"). Calculations are based on Q4 2009 data, the last quarter with data available from all reporters. As protectionist measures were implemented at different times but generally remained in place until end-2009 or longer, Q4 2009 data are best suited to approximate the steady-state impact of protectionism on trade.

4/ "Red" measures from Global Trade Alert database for which complete data were available. See Appendix Table A1.

5/ In percent of total observations in our dataset. Calculations are based on trade flows covered by the dataset in Q4 2009.

6/ Expressed in US$ millions and in percent of total trade. Calculations are based on trade flows covered by the dataset in Q4 2009. Aggregates in some tables may not equal the sum of their components, because the same trade flows may be affected by more than one measure.

previous specifications showed—will be absorbed into the TV Importer-Product FEs.[33] Conversely, multicollinearity with the TV Importer-Product FEs is not a problem for border measures, because many of those are only applied to a few trade partners (e.g., antidumping duties).

33. **Our product-level estimates of the protectionist impact should be interpreted as lower bounds.** Product-level estimates may be underestimated to the extent that measures affect very disaggregate trade flows. For instance, anti-dumping duties are commonly

[33] For example, a domestic subsidy by importing country *i* in product *p* introduced at time *t* will encourage additional domestic production. If that production displaces imports from all *j* exporting partner countries proportionately, the effect of the subsidy (and other behind-the-border measures) will be indistinguishable from any other TV importer-product fixed effects.

imposed on 6 or 8-digit tariff lines or even specific firms' exports within these. Our product-level estimates on the protectionist impact are coded at the 4-digit level for data availability reasons. If we could instead estimate at the more appropriate 6 or 8-digit tariff level for these measures, then estimates would in all likelihood be higher, because the largest part of trade in the corresponding 4-digit category is unaffected by protectionism and should therefore not exhibit a correlation with the protectionist dummy. This bias disappears, however, through the multiplication that we use to derive the aggregate results, to which we move on now.

**Aggregate results**

34. **Import restrictions are estimated to have reduced world trade by 0.21 percent in the last quarter 2009.** In our sample, which covers 80 percent of world trade, this 0.21 percent reduction translates into a *quarterly* trade loss of $4.6 billion, when (i) applied to quarterly trade flows in the last quarter of 2009 and (ii) product-level coefficients of specification 3 are applied. The lower panel of Table 2 summarizes these impacts for all specifications both in percent of world trade as well as in dollar values. Impacts are always calculated by multiplying the product-level coefficient estimates by the amount of trade affected by import restrictions (named "affected quarterly trade" in Table 2).[34] The latter stood at $77.7 billion in the last quarter of 2009, the last quarter in our sample for which data for all reporting countries is available. We chose this last complete sample quarter for the calculation because then the most protectionist measures were in effect contemporaneously. Consequently, this gives us the best notion of the steady-state impact of protectionism, given that most measures do not have automatic expiry dates or sunset clauses.

35. **Border and behind-the-border measures contributed about equally to the total impact.** In the last quarter of 2009, import restrictions at the border reduced trade by $2.1 billion. The corresponding figure for behind-the-border measures was $2.6 billion. However, there were only 40 behind-the-border import restrictions compared to 239 border measures. A typical single behind-the-border measure thus distorted trade about seven times more than a typical border measure, because it affected more trading partners and products and thereby larger trade flows. On the other hand, in the face of the global financial crisis, it is likely that governments' support to domestic economies—despite regrettably being partly discriminatory in design—averted an even larger across-the-board trade collapse and thus provided higher gains than protectionist measured did harm. Evaluating whether this indeed was the case is outside of the scope of this study.

[34] "Affected quarterly trade" in Table 2 reports the value of trade in country pair-product combinations that were affected by new measures. Calculating the percentage change implied by the estimated coefficient in any particular regression and multiplying that percentage change by the amount of trade covered gives an estimate of the amount of trade by which the new measures reduced imports. To the left of the "Affected quarterly trade" column, Table 2 also provides information on the number of measures implemented and number of observations thereby affected. These figures are given purely for informational purposes and do not enter into the calculation of aggregate impacts.

36. **Complete removal of crisis protectionist measures implemented up to early 2010 could boost annual world trade by some $30-35 billion.**[35] A 0.21 percent reduction in *annual* global trade amounts to just this amount in *non-crisis years*, when trade values are not as depressed as in 2009. This impact of protectionism is non-negligible when compared to benefits from trade liberalization initiatives such as the WTO Doha Round. For instance, tariff reductions in agriculture and industrial goods envisaged in the July 2008 Doha draft modalities are estimated to boost world trade by 1.5 percent (Decreux and Fontagne, 2009).[36] Thus, using our base case estimates, the aggregate trade impact of removing the crisis protectionist measures included in our study is equivalent to about 1/7 (=0.21/1.50) of the aggregate trade impact under the Doha draft modalities for agriculture and industrial goods. With the brunt of the global crisis over, policymakers would do well in unlocking these gains, particularly given that a Doha conclusion seems to remain elusive for the moment.

37. **Data limitations in our estimation imply that benefits of removing crisis protectionist measures may be even higher.** We are handicapped in quantifying the aggregate impact of crisis protectionist responses by inadequate information on 38 percent of GTA "red" measures implemented during our study period. Their exclusion leads to an underestimation of the amount of trade affected by measures and therefore likely also of our 0.21 percent trade reduction. By how much the aggregate impact is underestimated additionally depends on how excluded measures would affect product-level estimates. If we suppose that the excluded measures were exactly as restrictive as those in the estimation sample, then the impact would rise to 0.34 percent or $50-60 billion annually.[37] Excluded measures are disproportionately behind-the-border measures, because GTA more often lacks information on the affected sectors or trading partners for these measures. Yet a single behind-the-border measure typically distorts more trade than does a typical border import measure. If—in the extreme case—all excluded measures were behind-the-border measures and the same product-level coefficients apply, the total trade impact would reach 0.75 percent of world trade or $110-125 billion a year, with behind-the-border measures accounting for most of the trade distortion.[38]

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[35] The lower panel of Table 2 illustrates dollar values of the impact based on *quarterly* trade flows in the last quarter of 2009. The $30-35 billion impact stated here is derived from applying the 0.21 percent reduction (that corresponds to the $4.6 billion quarterly figure) to *annual* global trade flows in both 2008 and 2010.

[36] The authors also estimate that an ambitious services package and a trade facilitation deal could together increase trade by an additional 1 percent, but estimates in these areas are subject to higher uncertainty.

[37] Calculated as 0.21*(508/314), where 508 is the total number of measures in GTA and 314 is the number of measures that could be included in our estimation sample, including export measures (see Table 1). Dollar values are given as ranges resulting from applying the 0.34 percent to average world trade in 2008 and 2010.

[38] Calculated as 0.11*((508-314+40)/40)+0.10, where 40 is the number of behind-the-border measures in the estimation sample and 0.10 percent is the estimated trade distortion from border measures. Dollar values are given as ranges resulting from applying the 0.75 percent to average world trade in both 2008 and 2010.

**Robustness**

38. **Robustness checks confirm the baseline results.** We now undertake some robustness analysis for our baseline estimates. Our robustness analysis is necessarily compact for two reasons. First, we already explored all FE specifications of importance in our baseline results. Second, there is a scarcity of right-hand side variables that would be relevant for product-level trade data, particularly for a global sample such as ours. Table 3 therefore narrowly focuses on three robustness checks to baseline specifications 3 and 6: (i) addition of protectionist dummies for export measures, (ii) dependent variable defined as changes in trade volume, instead of trade value, and (iii) protectionist dummies coded as 0-1, instead of the 0-1-2-… coding in the baseline.

- **Adding dummies for protectionist export measures.** In our baseline regressions, we excluded protectionist dummies for export measures, for two reasons illustrated in our robustness Table 3. First, the inclusion of export measures does not change the coefficients for import restrictions. Second, neither export restrictions nor export support measures, such as export subsidies, significantly affected trade flows during the crisis. For export support, the reason may be that these measures were taken in favor of exporting industries that were fragile to start with and therefore not capable of increasing exports relative to competing countries, even with the additional assistance. Finally, neither export support nor export restrictive measures were very prominent in our sample period, with less than 20 of each registered. In light of the high volatility of product-level trade data, export coefficients' low statistical significance may be partly attributable to this.

- **Using changes in trade volumes as the dependent variable.** When changes in trade volumes are used as the dependent variable, the results are weakened somewhat compared to the baseline, with regards to both the magnitude of coefficients and to their statistical significance. Surprisingly, however, the main results still broadly hold, even though the GTIS trade volume data tend to be of considerably lower quality than value data.[39] In our preferred TV product and country-pair FE specification, border import restrictions still significantly discourage trade, although the estimated reduction is now 2.5 percent (compared to 5 percent in the baseline). Behind-the-border measures also still carry the expected negative sign, but lose statistical significance.

- **Alternative definition of protectionist dummies.** Restricting the protectionist dummy variables to take only values of 0 or 1 leaves baseline results almost unchanged. This is not surprising, since very few observations are subject to more than one new measure (see footnote 28).

[39] Some 4-digit volume flows are obtained by adding volumes at more disaggregate levels, but these may be expressed in different units of measurement (e.g., tons and liters), which is not taken into account in the addition.

**Table 3. Robustness**

| Estimation of product-level trade impact 1/ | | | | | | |
|---|---|---|---|---|---|---|
| | Includes regressors for export measures | | YoY Volume change as dependent variable | | Protectionist dummies take only values of 0 or 1 | |
| Time-varying fixed effects | Product & Countrypair | Imp.-Prod. & Exp.-Prod. | Product & Countrypair | Imp.-Prod. & Exp.-Prod. | Product & Countrypair | Imp.-Prod. & Exp.-Prod. |
| Regression # | A1 | A2 | A3 | A4 | A5 | A6 |
| **Import Restrictions** | -0.051 *** | -0.083 *** | -0.028 ** | -0.035 | -0.053 *** | -0.071 ** |
| | (-4.77) | (-2.70) | (-2.08) | (-1.04) | (-4.57) | (-2.06) |
| **Behind-the-border measures (impact on imports)** | -0.074 *** | -0.008 | -0.036 | -0.050 | -0.070 *** | 0.000 |
| | (-4.56) | (-0.07) | (-1.62) | (-0.35) | (-4.28) | (0.00) |
| **Export Restrictions** | 0.017 | -0.007 | | | | |
| | (0.46) | (-0.06) | | | | |
| **Export Support** | -0.016 | -0.032 | | | | |
| | (-1.30) | (-0.87) | | | | |
| **Behind-the-border measures (impact on exports)** | -0.026 | 0.066 | | | | |
| | (-1.56) | (1.43) | | | | |
| F-Statistic vs. regression # | 3 | 6 | | | | |
| F-Statistic | 2.77 | 2.04 | | | | |
| Prob>F: | 0.040 | 0.107 | | | | |
| Number of Time-varying fixed effects | 128,833 | 3,819,552 | 128,833 | 3,819,552 | 128,833 | 3,819,552 |
| Number of Observations | 9,878,481 | 9,878,481 | 9,878,481 | 9,878,481 | 9,878,481 | 9,878,481 |
| Adj. R-Squared (percent) | 3.12 | 8.97 | 1.96 | 5.42 | 3.12 | 8.97 |

| Calculation of aggregate trade impact 3/ 6/ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | No. of meas. 4/ | Affec-ted obs. 5/ | Affected quarterly trade 6/ | A1 | A2 | A3 | A4 | A5 | A6 |
| **Import Restrictions** | 239 | | $ 42,722 | -$2,105 | -$3,416 | -$1,162 | -$1,481 | -$2,224 | -$2,933 |
| | | 1.11% | 1.97% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| **Behind-the-border measures** | 40 | | $ 34,946 | -$2,480 | -$290 | -$1,224 | -$1,712 | -$2,365 | $12 |
| **(impact on imports)** | | 0.54% | 1.61% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| **Export Restrictions** | 19 | | $ 34,438 | $582 | -$226 | | | | |
| | | 0.03% | 1.59% | 0.00% | 0.00% | | | | |
| **Export Support** | 16 | | $ 4,860 | -$76 | -$153 | | | | |
| | | 0.31% | 0.22% | 0.00% | 0.00% | | | | |
| **Behind-the-border measures** | 40 | | $ 15,766 | -$398 | $1,081 | | | | |
| **(impact on exports)** | | 0.48% | 0.73% | 0.00% | 0.00% | | | | |

1/ 3/ 4/ 5/ 6/ Please see notes in Table 2.

## B. Effects by measure types

39. **Interesting insights can be gained by disaggregating the protectionist dummies by types of measures, region, sector, and time periods.** In presenting all of these more detailed results in the following subsections, we focus on our preferred TV product & country-pair FE specification for space reasons. Results obtained using other specifications are broadly similar.[40] We also omit reiterating the above robustness checks for these detailed specifications, because, as in the baseline, they generally leave results unchanged.

[40] As discussed in section V.A for the baseline, multicollinearity with importer-product FEs also renders the coefficients of behind-the-border measures statistically insignificant in the detailed regressions using these types of FEs.

**Table 4. Detailed results, by type of measure**

| Estimation of product-level trade impact 1/ | | | | Calculation of aggregate trade impact 3/ 6/ | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Time-varying fixed effects | Product & Countrypair | Product & Countrypair | Product & Countrypair | Agg. quarterly trade impact implied by regression #: | | | No. of meas. | Affec-ted obs. | Affected quarterly trade |
| Regression # | 3 | 7 | 8 | 3 | 7 | 8 | 4/ | 5/ | 6/ |
| **Total** | | | | **-$4,568** | **-$4,352** | **-$4,134** | **279** | | **$77,668** |
| | | | | **-0.21%** | **-0.20%** | **-0.19%** | | **1.65%** | **3.58%** |
| **Import Restrictions** | **-0.051 ***** | | | **-$2,105** | **-$1,908** | **-$1,672** | **239** | | **$42,722** |
| | **(-4.77)** | | | **-0.10%** | **-0.09%** | **-0.08%** | | **1.11%** | **1.97%** |
| Tariff and Import Bans | | -0.030 | | | -$788 | -$408 | 99 | | $26,859 |
| | | (-1.58) | | | -0.04% | -0.02% | | 0.48% | 1.24% |
| Tariff | | | -0.012 | | | -$322 | 67 | | $26,204 |
| | | | (-0.64) | | | -0.01% | | 0.44% | 1.21% |
| Quota | | | -0.270 * | | | -$18 | 5 | | $75 |
| | | | (-1.84) | | | 0.00% | | 0.01% | 0.00% |
| Import ban | | | -0.145 * | | | -$14 | 23 | | $100 |
| | | | (-1.67) | | | 0.00% | | 0.01% | 0.00% |
| Competitive Devaluation | | | -0.120 | | | -$54 | 4 | | $480 |
| | | | (-1.48) | | | 0.00% | | 0.02% | 0.02% |
| Trade Defense Measures | | -0.170 *** | -0.169 *** | | -$291 | -$290 | 102 | | $1,861 |
| | | (-2.83) | (-2.82) | | -0.01% | -0.01% | | 0.02% | 0.09% |
| Non-tariff Barriers | | -0.098 *** | | | -$77 | -$71 | 16 | | $828 |
| | | (-3.44) | | | 0.00% | 0.00% | | 0.18% | 0.04% |
| Licensing requirements | | | -0.092 *** | | | -$67 | 11 | | $764 |
| | | | (-3.44) | | | 0.00% | | 0.17% | 0.04% |
| Sanitary and Phytosanitary | | | -0.605 | | | $0 | 1 | | $0 |
| | | | (-1.14) | | | 0.00% | | 0.00% | 0.00% |
| Other NTBs | | | -0.044 | | | -$4 | 4 | | $88 |
| | | | (-0.61) | | | 0.00% | | 0.02% | 0.00% |
| Discriminatory Purchasing | | -0.046 *** | | | -$751 | -$903 | 22 | | $16,661 |
| | | (-3.02) | | | -0.03% | -0.04% | | 0.49% | 0.77% |
| Local Content | | | -0.068 ** | | | -$360 | 5 | | $5,506 |
| | | | (-2.01) | | | -0.02% | | 0.12% | 0.25% |
| Public Procurement | | | 0.027 | | | $110 | 9 | | $4,070 |
| | | | (0.88) | | | 0.01% | | 0.12% | 0.19% |
| Consumption Subsidies | | | -0.092 *** | | | -$653 | 8 | | $7,428 |
| | | | (-4.46) | | | -0.03% | | 0.26% | 0.34% |
| **Behind-the-border measures 2/** | **-0.073 ***** | | | **-$2,462** | **-$2,444** | **-$2,463** | **40** | | **$34,946** |
| | **(-4.53)** | | | **-0.11%** | **-0.11%** | **-0.11%** | | **0.54%** | **1.61%** |
| Bailouts | | -0.072 *** | -0.072 *** | | -$1,885 | -$1,893 | 27 | | $27,204 |
| | | (-2.51) | (-2.52) | | -0.09% | -0.09% | | 0.19% | 1.25% |
| Domestic Subsidies | | -0.076 *** | -0.078 *** | | -$559 | -$569 | 7 | | $7,633 |
| | | (-4.06) | (-4.13) | | -0.03% | -0.03% | | 0.34% | 0.35% |
| Investment Subsidies | | -0.030 | -0.031 | | $0 | $0 | 6 | | $1 |
| | | (-0.44) | (-0.45) | | 0.00% | 0.00% | | 0.00% | 0.00% |
| F-Statistic vs. regression # | | 3 | 3 | | | | | | |
| F-Statistic | | 2.32 | 4.63 | | | | | | |
| Prob>F: | | 0.041 | 0.000 | | | | | | |
| No. of Time-varying fixed effects | 128,833 | 128,833 | 128,833 | | | | | | |
| No. of Observations (thousands) | 9,878 | 9,878 | 9,878 | | | | | | |
| Adj. R-Squared (percent) | 3.12 | 3.12 | 3.12 | | | | | | |

Source: Authors' estimates.

1/ 2/ 3/ 4/ 5/ 6/ Please see notes in Table 2.

40. **We first disaggregate the protectionist dummies by measure types** (Table 4). Regression 7 categorizes import border measures into: (i) tariffs and import bans; (ii) trade defense measures; (iii) non-tariff barriers (NTBs), mainly made up of licensing requirements and sanitary and phytosanitary restrictions; and (iv) discriminatory purchasing measures, including local content provisions, public procurement, and consumption subsidies. Local content provisions cover measures requiring that certain goods and services sold to anyone domestically contain a specified amount of local content. Public procurement measures are more specific in the sense that they just impose this requirement on public sector purchasers. Finally, consumption subsidies are benefits paid to consumers tied to the purchase of a domestic product. Behind-the-border measures are disaggregated into: (v) bailouts, (vi) domestic subsidies, and (vii) investment subsidies. Bailouts are distinguished from domestic subsidies by the former being directed to specific firm(s), while the latter apply to an entire sector. Investment subsidies provide investment incentives to domestic firms in a discriminatory fashion. Regression 8 further disaggregates categories (i), (iii), and (iv). Moreover, the results of our preferred baseline regression 3 are repeated in Table 4 for convenient comparison

41. **Traditional trade barriers such as tariffs were not the most harmful in deterring trade.** This seems to support the consensus emerging in recent literature focusing on non-traditional barriers as main retardants of trade (Minor and Tsigas, 2008). Tariff measures' impact is statistically insignificant, potentially because tariff increases on average were not large enough for our dummy variable approach to reveal an impact. Correspondingly, they contribute little to the overall impact, although the number of implemented tariff measures (67) is high relative to total measures taken. In contrast, those traditional trade measures which by design should be more restrictive, such as quotas and import bans, showed this also in the data, decreasing trade in affected products by 24 and 13 percent, respectively. Their coefficients are borderline statistically significant, but their contribution to the overall protectionist impact is low given the narrow targeting of these measures. Kee et al. (2010) examine changes in countries' tariff schedules and their use of antidumping (AD) measures between 2008 and 2009. They conclude that developments in these specific areas resulted in only modest increases in countries' overall levels of protection.

42. **Non-traditional border measures were most harmful to product-level trade, when narrowly focused, and most harmful to aggregate trade when diffuse.** These measures include nontariff barriers (NTBs) as well as trade defense and discriminatory purchasing measures. Trade defense measures, by their nature, were very narrowly focused on specific trade partners in specific products and therefore could not have a large aggregate impact, despite the high number of different duties imposed (102). However, trade in those *4-digit* products that were affected decreased by 16 percent, implying that trade in the sub-4-digit products actually affected likely experienced a collapse. Within NTBs, new licensing requirements drove the impact, with a 9 percent trade decrease at the product-level, but again narrow application forestalled a large aggregate impact. Of all border measures, discriminatory purchasing provisions generally reduced aggregate imports the most.[41] Among

[41] In regression 7, the aggregate impact of tariffs and import bans is slightly higher, but it results from a statistically insignificant product-level coefficient.

discriminatory purchasing provisions, consumption subsidies caused the largest import decreases both at the product level (-9 percent) as well as in reducing global trade (-0.03 percent). Local content requirements covering the entire domestic market were similarly harmful. In contrast, and despite the large attention received by public procurement measures during the crisis, our analysis does not point to a trade impact. Bown (2010) reviews developments in the use of antidumping, safeguards, and countervailing duties (temporary trade barriers, TTBs). He notes that the use of TTBs rose by ¼ in 2008-09 as measured by the coverage of product lines by major users, driven mainly by developing economy users.

43. **Among behind-the-border measures, bailouts and domestic subsidies were equally harmful.** Both of these measures decreased trade in affected products by around 7 percent. Therefore, whether discriminatory aid was directed to specific firms or entire sectors of the economy did not make a difference with regards to deterring imports. Consequently, impacts on aggregate trade reflect closely the amount of trade covered by these measures. With bailouts more prominent in our sample, their aggregate impact (-0.09 percent) outstripped that of domestic subsidies (-0.03 percent). Discriminatory subsidies encouraging investment by domestic firms only are not found to have caused a contemporaneous statistically significant trade reduction. This, however, does not preclude that they may reduce imports in the future as investment projects are finalized and new domestic production capacity comes on stream.

44. **Estimates of the overall protectionist impact are hardly changed by disaggregation.** Disaggregate regressions 7 and 8 yield alternative estimates of reductions in aggregate world trade of 0.20 and 0.19 percent, respectively—very much in line with the baseline estimate of 0.21 percent. When evaluating this across all our different disaggregations, we find that estimates indeed tend to cluster in a relatively tight interval around the 0.21 percent baseline estimate.

### C. Effects by country group

45. **We now adopt a geographic perspective to identify both (i) which country groups' measures have done the most harm and (ii) which country groups were most affected.** We disaggregate our import restrictions and behind-the-border measures in two ways according to whether they were implemented by advanced or developing countries (Table 5) and by region (Table 6). Tables 7 and 8 present analog results showing which country groups' exports have been most affected by these new measures.

**Table 5. Detailed results, by implementing country grouping**

| Estimation of product-level trade impact 1/ | | | Calculation of aggregate trade impact 3/ 6/ | | | | |
|---|---|---|---|---|---|---|---|
| Time-varying fixed effects | Product & Countrypair | Product & Countrypair | Agg. qtrly trade impact; reg. #: | | No. of meas. | Affec-ted | Affected quarterly |
| Regression # | 9 | 10 | 9 | 10 | 4/ | obs. 5/ | trade 6/ |
| **Total** | | | **-$4,552** | **-$4,536** | **279** | **1.65%** | **$77,668** |
| | | | **-0.21%** | **-0.21%** | | | **3.58%** |
| **Import restrictions implemented in:** | | | **-$2,531** | **-$2,508** | **239** | **1.11%** | **$42,722** |
| | | | **-0.12%** | **-0.12%** | | | **1.97%** |
| Advanced/High-income Countries 7/ | -0.081 *** | -0.083 *** | -$1,833 | -$1,877 | 42 | 0.33% | $23,654 |
| | (-4.71) | (-4.85) | -0.08% | -0.09% | | | 1.09% |
| Developing Countries | -0.037 *** | | -$698 | -$630 | 197 | 0.78% | $19,068 |
| | (-2.85) | | -0.03% | -0.03% | | | 0.88% |
| Upper Middle Income | | -0.041 ** | | -$257 | 108 | 0.36% | $6,378 |
| | | (-2.25) | | -0.01% | | | 0.29% |
| Lower Middle Income | | -0.029 | | -$355 | 77 | 0.42% | $12,600 |
| | | (-1.53) | | -0.02% | | | 0.58% |
| Low Income | | -0.237 | | -$19 | 12 | 0.00% | $89 |
| | | (-1.56) | | 0.00% | | | 0.00% |
| **Behind-the-border Measures implemented in 2/:** | | | **-$2,021** | **-$2,028** | **40** | **0.54%** | **$34,946** |
| | | | **-0.09%** | **-0.09%** | | | **1.61%** |
| Advanced/High-income Countries 7/ | -0.048 *** | -0.044 ** | -$1,265 | -$1,157 | 19 | 0.24% | $26,829 |
| | (-2.39) | (-2.23) | -0.06% | -0.05% | | | 1.24% |
| Developing Countries | -0.098 *** | | -$756 | -$871 | 21 | 0.30% | $8,117 |
| | (-4.11) | | -0.03% | -0.04% | | | 0.37% |
| Upper Middle Income | | -0.119 *** | | -$884 | 14 | 0.27% | $7,884 |
| | | (-4.93) | | -0.04% | | | 0.36% |
| Lower Middle Income | | 0.053 | | $13 | 7 | 0.02% | $233 |
| | | (0.64) | | 0.00% | | | 0.01% |
| Low Income | | 0.000 | | $0 | 0 | 0.00% | $0 |
| | | (0.00) | | 0.00% | | | 0.00% |
| F-Statistic vs. regression # | 3 | 3 | | | | | |
| F-Statistic | 6.23 | 5.86 | | | | | |
| Prob>F: | 0.002 | 0.000 | | | | | |
| No. of Time-varying fixed effects | 128,833 | 128,833 | | | | | |
| No. of Observations (thousands) | 9,878 | 9,878 | | | | | |
| Adj. R-Squared (percent) | 3.12 | 3.12 | | | | | |

Source: Authors' estimates.
1/ 2/ 3/ 4/ 5/ 6/ Please see notes in Table 2.
7/ To conserve space, advanced and high-income country results are reported on the same line. Advanced countries (Reg. 9) and high-income countries (Reg. 10) are defined according to the IMF WEO and World Bank classifications, respectively.

46. **Advanced countries' border measures distorted world trade more than those of developing countries, both because they were more restrictive and they covered more trade flows.** Affected imports at the product level decreased by 8 percent in response to border measures implemented by advanced countries, but only by half of that for those implemented by developing countries (Table 5). Developing nations' impact in turn was largely driven by middle income countries, as low income countries took only few and narrowly-targeted measures. Not only were advanced countries' measures more trade restrictive, but they also affected larger trade flows. Consequently, these countries account for about ¾ of the aggregate trade distortion implied by border measures. Table 6 shows that

**Table 6. Detailed results, by implementing region**

| Estimation of product-level trade impact 1/ | | | Calculation of aggregate trade impact 3/ 6/ | | | | |
|---|---|---|---|---|---|---|---|
| Time-varying fixed effects | Product & Countrypair | Product & Countrypair | Agg. qtrly trade impact; reg. #: | | No. of meas. | Affec-ted | Affected quarterly |
| Regression # | 11 | 12 | 11 | 12 | 4/ | obs. 5/ | trade 6/ |
| **Total** | | | **-$2,773** | **-$2,730** | **279** | **1.65%** | **$77,668** |
| | | | **-0.13%** | **-0.13%** | | | **3.58%** |
| **Import restrictions implemented in:** | | | **-$1,405** | **-$1,449** | **239** | **1.11%** | **$42,722** |
| | | | **-0.06%** | **-0.07%** | | | **1.97%** |
| Africa | -0.038 | | -$63 | -$4 | 42 | 0.04% | $1,704 |
| | (-0.48) | | 0.00% | 0.00% | | | 0.08% |
| Middle East & North Africa | | 0.087 | | $105 | 19 | 0.02% | $1,166 |
| | | (0.80) | | 0.00% | | | 0.05% |
| Sub-saharan Africa | | -0.228 ** | | -$110 | 23 | 0.02% | $538 |
| | | (-2.26) | | -0.01% | | | 0.02% |
| Asia | -0.018 | | -$548 | -$652 | 96 | 0.58% | $31,221 |
| | (-1.10) | | -0.03% | -0.03% | | | 1.44% |
| East Asia | | -0.027 | | -$710 | 40 | 0.37% | $26,587 |
| | | (-1.36) | | -0.03% | | | 1.23% |
| Central Asia | | -0.002 | | -$9 | 33 | 0.20% | $4,169 |
| | | (-0.08) | | 0.00% | | | 0.19% |
| South Asia | | 0.136 | | $68 | 23 | 0.01% | $465 |
| | | (1.31) | | 0.00% | | | 0.02% |
| Europe | -0.044 | | -$33 | -$32 | 24 | 0.05% | $763 |
| | (-1.29) | | 0.00% | 0.00% | | | 0.04% |
| Western Europe | | -0.047 | | -$29 | 9 | 0.04% | $625 |
| | | (-1.31) | | 0.00% | | | 0.03% |
| Central and Eastern Europe | | -0.024 | | -$3 | 15 | 0.01% | $138 |
| | | (-0.23) | | 0.00% | | | 0.01% |
| Latin America and Caribbean | -0.090 *** | -0.090 *** | -$109 | -$109 | 65 | 0.18% | $1,268 |
| | (-4.07) | (-4.07) | -0.01% | -0.01% | | | 0.06% |
| North America | -0.088 *** | -0.088 *** | -$653 | -$652 | 12 | 0.25% | $7,765 |
| | (-4.19) | (-4.18) | -0.03% | -0.03% | | | 0.36% |
| **Behind-the-border Measures implemented in:** 2/ | | | **-$1,368** | **-$1,281** | **40** | **0.54%** | **$34,946** |
| | | | **-0.06%** | **-0.06%** | | | **1.61%** |
| Africa | 0.204 * | | $0 | $0 | 2 | 0.00% | $0 |
| | (1.72) | | 0.00% | 0.00% | | | 0.00% |
| Middle East & North Africa | | 0.000 | | $0 | 0 | 0.00% | $0 |
| | | (0.00) | | 0.00% | | | 0.00% |
| Sub-saharan Africa | | 0.201 * | | $0 | 2 | 0.00% | $0 |
| | | (1.70) | | 0.00% | | | 0.00% |
| Asia | -0.132 *** | | -$1,364 | -$1,315 | 16 | 0.30% | $11,049 |
| | (-5.94) | | -0.06% | -0.06% | | | 0.51% |
| East Asia | | -0.101 * | | -$355 | 4 | 0.04% | $3,700 |
| | | (-1.81) | | -0.02% | | | 0.17% |
| Central Asia | | -0.140 *** | | -$957 | 11 | 0.26% | $7,341 |
| | | (-5.79) | | -0.04% | | | 0.34% |
| South Asia | | -0.471 | | -$3 | 1 | 0.00% | $8 |
| | | (-1.64) | | 0.00% | | | 0.00% |
| Europe | -0.019 | | -$115 | -$77 | 18 | 0.22% | $6,143 |
| | (-0.89) | | -0.01% | 0.00% | | | 0.28% |
| Western Europe | | -0.029 | | -$160 | 15 | 0.21% | $5,530 |
| | | (-1.38) | | -0.01% | | | 0.25% |
| Central and Eastern Europe | | 0.127 | | $83 | 3 | 0.01% | $612 |
| | | (1.32) | | 0.00% | | | 0.03% |
| Latin America and Caribbean | 0.186 | 0.186 | $111 | $111 | 3 | 0.01% | $543 |
| | (1.40) | (1.40) | 0.01% | 0.01% | | | 0.03% |
| North America 7/ | -0.492 *** | -0.492 *** | -$6,693 | -$6,691 | 1 | 0.00% | $17,212 |
| | (-3.15) | (-3.15) | -0.31% | -0.31% | | | 0.79% |
| F-Statistic vs. regression # | 3 | 3 | | | | | |
| F-Statistic | 9.21 | 6.63 | | | | | |
| Prob>F: | 0.000 | 0.000 | | | | | |
| F-Statistic vs. regression # | | 9 | | | | | |
| F-Statistic | | 3.68 | | | | | |
| Prob>F: | | 0.001 | | | | | |
| No. of Time-varying fixed effects | 128,833 | 128,833 | | | | | |
| No. of Observations (thousands) | 9,878 | 9,878 | | | | | |
| Adj. R-Squared (percent) | 3.12 | 3.12 | | | | | |

Source: Authors' estimates.
1/ 2/ 3/ 4/ 5/ 6/ Please see notes in Table 2.
7/ This outlier coefficient is excluded in the calculation of aggregate trade impacts.
Note: Central Asia includes Russia. Latin America and Caribbean includes Mexico.

these advanced country results are largely driven by North America. On the developing country side, Latin American border measures significantly reduced imports in affected products (-9 percent) and, though numerous, affected only a relatively small amount of trade. Border measures taken by East Asian nations show the highest impact on aggregate world trade, although the corresponding product-level coefficient is small and statistically insignificant.

47. **Developing countries' behind-the-border measures were more trade restrictive, but advanced countries' measures were more harmful on aggregate.** In the product-level coefficients, the pattern is reversed from that of border measures, with developing countries' measures now twice as restrictive (-9 percent), again mainly driven by upper middle income countries. Our regional analysis, in turn, shows that the main culprits were mainly those countries located in Central and East Asia. Yet, advanced countries' aggregate impact was larger, as actions targeted larger import flows, oftentimes those from other advanced nations.[42] The regressions here suggest that a substantial part of this impact originates in North America, but despite statistical significance of the relevant coefficient estimate, we caution from over interpretation. The estimate is likely strongly affected by omitted variable bias, because estimation is based on a single measure. With this measure affecting only North American automobile imports, the estimate can be expected to partly reflect a particularly large crisis-induced reduction in vehicle purchases by American consumers compared to the rest of the world. This protectionism-unrelated factor will bias the coefficient downwards, i.e. make it more negative. A protectionist impact may still exist, but scarcity of measures makes it unidentifiable.[43]

48. **Developing country exports were hurt somewhat more by border measures.** Each developed and developing country exports were reduced by about 0.05 percent (of world trade) on aggregate. With developing country exports still making up less than half of world exports, this shock was relatively more accentuated for developing countries. Also, the average border measure applied to developing country exports was more trade deterring at the product level. Within developing countries, exports of the relatively poorer nations seem to be the most deterred: We find the impact on lower middle income countries to be considerably higher than that on their upper middle income country counterparts.[44] This result may partly be caused by poor countries' export structure with intra-regional trade among countries in poor regions generally being very small. Thereby the relative importance of exports to advanced countries is highest for the poorest nations, so that they suffer particularly from the high restrictiveness of advanced country border measures. The result is

[42] See Table 7.

[43] In results not reported here, we added instead TVIMP and TVEXP effects to regression 12. As expected, the North America behind-the-border measures coefficient is reduced to a statistically insignificant value of -0.028. Complete results are available from the authors upon request.

[44] Exports of low income countries (LICs) are estimated to have fallen by even more, but the respective coefficient remains statistically insignificant, potentially because LICs were affected by a much smaller number of measures.

**Table 7. Detailed results, by affected country grouping**

| Estimation of product-level trade impact 1/ | | | Calculation of aggregate trade impact 3/ 6/ | | | | |
|---|---|---|---|---|---|---|---|
| Time-varying fixed effects | Product & Countrypair | Product & Countrypair | Agg. qtrly trade impact; reg. #: | | No. of meas. | Affec-ted obs. | Affected quarterly |
| Regression # | 13 | 14 | 13 | 14 | 4/ | 5/ | trade 6/ |
| **Total** | | | **-$4,707** | **-$4,749** | | **1.65%** | **$77,668** |
| | | | **-0.22%** | **-0.22%** | | | **3.58%** |
| **Import Restrictions affecting exports of:** | | | **-$2,071** | **-$2,180** | | **1.11%** | **$42,722** |
| | | | **-0.10%** | **-0.10%** | | | **1.97%** |
| Advanced/High-income Countries 7/ | -0.044 *** | -0.037 *** | -$1,110 | -$934 | 146 | 0.66% | $25,886 |
| | (-3.25) | (-2.78) | -0.05% | -0.04% | | | 1.19% |
| Developing Countries | -0.059 *** | | -$961 | -$1,246 | 224 | 0.44% | $16,836 |
| | (-3.54) | | -0.04% | -0.06% | | | 0.78% |
| Upper Middle Income | | -0.055 ** | | -$315 | 134 | 0.21% | $5,862 |
| | | (-2.11) | | -0.01% | | | 0.27% |
| Lower Middle Income | | -0.087 *** | | -$855 | 189 | 0.21% | $10,257 |
| | | (-3.73) | | -0.04% | | | 0.47% |
| Low Income | | -0.111 | | -$76 | 35 | 0.02% | $717 |
| | | (-1.54) | | 0.00% | | | 0.03% |
| **Behind-the-border measures affecting exports of:** 2/ | | | **-$2,636** | **-$2,570** | | **0.54%** | **$34,946** |
| | | | **-0.12%** | **-0.12%** | | | **1.61%** |
| Advanced/High-income Countries 7/ | -0.083 *** | -0.079 *** | -$2,290 | -$2,192 | 39 | 0.40% | $28,852 |
| | (-4.27) | (-4.32) | -0.11% | -0.10% | | | 1.33% |
| Developing Countries | -0.058 ** | | -$346 | -$377 | 40 | 0.14% | $6,095 |
| | (-2.15) | | -0.02% | -0.02% | | | 0.28% |
| Upper Middle Income | | -0.102 ** | | -$341 | 39 | 0.07% | $3,515 |
| | | (-1.96) | | -0.02% | | | 0.16% |
| Lower Middle Income | | -0.014 | | -$36 | 38 | 0.07% | $2,572 |
| | | (-0.34) | | 0.00% | | | 0.12% |
| Low Income | | -0.123 | | -$1 | 19 | 0.00% | $8 |
| | | (-0.67) | | 0.00% | | | 0.00% |
| F-Statistic vs. regression # | 3 | 3 | | | | | |
| F-Statistic | 1.10 | 2.25 | | | | | |
| Prob>F: | 0.332 | 0.036 | | | | | |
| No. of Time-varying fixed effects | 128,833 | 128,833 | | | | | |
| No. of Observations (thousands) | 9,878 | 9,878 | | | | | |
| Adj. R-Squared (percent) | 3.12 | 3.12 | | | | | |

Source: Authors' estimates.
1/ 2/ 3/ 4/ 5/ 6/ Please see notes in Table 2.
7/ To conserve space, advanced and high-income country results are reported on the same line. Advanced countries (Reg. 13) and high-income countries (Reg. 14) are defined according to the IMF WEO and World Bank classifications, respectively.

confirmed by the regional estimates, which show exports from our Africa grouping (which we define to include both MENA and SSA countries) to face the most restrictive border measures, although exports of all countries are significantly reduced by these new barriers.[45] On the advanced country side, North America faces the more restrictive measures, but Western Europe suffers the larger aggregate impact.[46]

[45] Our regional country groupings are mostly based on World Bank country classifications. Appendix Table A2 provides exact detail.

[46] Cernat and Sousa (2010) identify the latter to be the counterpart to new *border* measures implemented by EU trade partners in Central Asia, but our results in Table 6 cannot confirm this result.

**Table 8. Detailed results, by affected region**

| Estimation of product-level trade impact 1/ | | | Calculation of aggregate trade impact 3/ 6/ | | | | |
|---|---|---|---|---|---|---|---|
| Time-varying fixed effects | Product & Countrypair | Product & Countrypair | Agg. qtrly trade impact; reg. #: | | No. of meas. | Affec-ted obs. | Affected quarterly |
| Regression # | 15 | 16 | 15 | 16 | 4/ | 5/ | trade 6/ |
| **Total** | | | **-$5,734** | **-$5,469** | | **1.65%** | **$77,668** |
| | | | **-0.26%** | **-0.25%** | | | **3.58%** |
| **Import restrictions affecting exports of:** | | | **-$2,771** | **-$2,571** | | **1.11%** | **$42,722** |
| | | | **-0.13%** | **-0.12%** | | | **1.97%** |
| Africa | -0.105 ** | | -$1,383 | -$1,237 | 86 | 0.06% | $13,924 |
| | (-2.15) | | -0.06% | -0.06% | | | 0.64% |
| Middle East & North Africa | | -0.093 | | -$1,206 | 75 | 0.03% | $13,652 |
| | | (-1.50) | | -0.06% | | | 0.63% |
| Sub-saharan Africa | | -0.121 | | -$31 | 52 | 0.03% | $271 |
| | | (-1.53) | | 0.00% | | | 0.01% |
| Asia | -0.053 *** | | -$692 | -$613 | 205 | 0.34% | $13,424 |
| | (-2.61) | | -0.03% | -0.03% | | | 0.62% |
| East Asia | | -0.050 ** | | -$539 | 195 | 0.28% | $11,142 |
| | | (-2.21) | | -0.02% | | | 0.51% |
| Central Asia | | 0.00 | | $2 | 58 | 0.02% | $1,514 |
| | | (0.01) | | 0.00% | | | 0.07% |
| South Asia | | -0.104 * | | -$76 | 68 | 0.04% | $768 |
| | | (-1.91) | | 0.00% | | | 0.04% |
| Europe | -0.037 *** | | -$393 | -$417 | 135 | 0.53% | $10,948 |
| | (-2.52) | | -0.02% | -0.02% | | | 0.50% |
| Western Europe | | -0.045 *** | | -$410 | 121 | 0.41% | $9,350 |
| | | (-2.98) | | -0.02% | | | 0.43% |
| Central and Eastern Europe | | -0.004 | | -$7 | 93 | 0.13% | $1,598 |
| | | (-0.11) | | 0.00% | | | 0.07% |
| Latin America and Caribbean | -0.064 * | -0.064 * | -$184 | -$184 | 93 | 0.11% | $2,992 |
| | (-1.90) | (-1.90) | -0.01% | -0.01% | | | 0.14% |
| North America | -0.087 *** | -0.087 *** | -$119 | -$119 | 100 | 0.06% | $1,434 |
| | (-2.36) | (-2.36) | -0.01% | -0.01% | | | 0.07% |
| **Behind-the-border Measures affecting exports of:** 2/ | | | **-$2,963** | **-$2,898** | | **0.54%** | **$34,946** |
| | | | **-0.14%** | **-0.13%** | | | **1.61%** |
| Africa | -0.035 | | -$11 | $7 | 35 | 0.02% | $332 |
| | (-0.43) | | 0.00% | 0.00% | | | 0.02% |
| Middle East & North Africa | | 0.000 | | $0 | 31 | 0.02% | $132 |
| | | (0.00) | | 0.00% | | | 0.01% |
| Sub-saharan Africa | | 0.035 | | $7 | 25 | 0.01% | $200 |
| | | (0.30) | | 0.00% | | | 0.01% |
| Asia | 0.008 | | $39 | -$21 | 38 | 0.10% | $4,768 |
| | (0.22) | | 0.00% | 0.00% | | | 0.22% |
| East Asia | | -0.008 | | -$38 | 34 | 0.09% | $4,560 |
| | | (-0.21) | | 0.00% | | | 0.21% |
| Central Asia | | 0.132 | | $14 | 24 | 0.01% | $100 |
| | | (1.00) | | 0.00% | | | 0.00% |
| South Asia | | 0.021 | | $2 | 22 | 0.01% | $108 |
| | | (0.27) | | 0.00% | | | 0.00% |
| Europe | -0.094 *** | | -$1,599 | -$1,491 | 39 | 0.36% | $17,878 |
| | (-5.04) | | -0.07% | -0.07% | | | 0.82% |
| Western Europe | | -0.082 *** | | -$1,259 | 38 | 0.27% | $15,942 |
| | | (-3.97) | | -0.06% | | | 0.74% |
| Central and Eastern Europe | | -0.128 *** | | -$232 | 39 | 0.09% | $1,936 |
| | | (-3.26) | | -0.01% | | | 0.09% |
| Latin America and Caribbean | -0.153 ** | -0.153 ** | -$418 | -$418 | 29 | 0.02% | $2,952 |
| | (-1.98) | (-1.98) | -0.02% | -0.02% | | | 0.14% |
| North America | -0.114 | -0.114 | -$974 | -$974 | 37 | 0.03% | $9,016 |
| | (-1.62) | (-1.62) | -0.04% | -0.04% | | | 0.42% |
| F-Statistic vs. regression # | 3 | 3 | | | | | |
| F-Statistic | 2.89 | 2.33 | | | | | |
| Prob>F: | 0.003 | 0.002 | | | | | |
| F-Statistic vs. regression # | | 9 | | | | | |
| F-Statistic | | 1.70 | | | | | |
| Prob>F: | | 0.104 | | | | | |
| No. of Time-varying fixed effects | 128,833 | 128,833 | | | | | |
| No. of Observations (thousands) | 9,878 | 9,878 | | | | | |
| Adj. R-Squared (percent) | 3.12 | 3.12 | | | | | |

Source: Authors' estimates.
1/ 2/ 3/ 4/ 5/ 6/ Please see notes in Table 2.
Note: Central Asia includes Russia. Latin America and Caribbean includes Mexico.

49. **On the other hand, damage from behind-the-border measures remained largely within advanced countries.** Behind-the-border measures faced by advanced country exports were more restrictive with an 8 percent product-level trade reduction. With more than ¾ of exports affected by behind-the-border measures coming from advanced countries, they also bore more than 85 percent of the aggregate impact. Much of the impact was concentrated in advanced as well as emerging Europe. We suppose this to be the reflection of highly trade-restrictive behind-the-border measures implemented in Central Asia, given gravity considerations such as the regions' proximity to each other. Latin America faced the highest product-level impact from new behind-the-border measures with a 14 percent reduction in affected exports. Africa and Asia, however, were seemingly unscathed by these measures.

## D. Effects by sector

50. **New measures in the textiles, machinery, and transportation equipment sectors had the largest impact** (Table 9). To obtain these results, we first assigned each product category to one of nine broad sectors.[47] Among border measures, those that showed statistically significant reductions in affected imports were those in the textile and machinery industries, with estimates of -7 and -5 percent, respectively. Despite its lower product-level coefficient, the machinery sector accounts for more than half of the reduction in world imports, because affected trade flows are higher than those in textiles. Behind-the-border measures mainly obstructed imports of machinery and transport equipment, reducing affected flows by 12 percent on average. The larger size of trade flows in the transport sector results in it accounting for the lion's share of the aggregate impact, which we tally at a -0.14 percent reduction in world trade. Appendix Table A3 analyzes the sectoral impact from a different angle by classifying imported products by import demand elasticities. With Broda et al.'s (2006) classification attributing medium and high income elasticities to most machinery and transport equipment products, the conclusions that emerge are broadly similar to those of Table 9.

[47] HS 2-digit product lines (in parentheses) were assigned to our broad sectors as follows: Agriculture (01-15), Processed Food (16-24), Minerals (25-27), Metals (68-83), Wood (44-49, 92, 94, 97), Chemicals (28-40), Textiles (41-42, 50-67), Machinery (84, 85, 90, 91, 93, 95, 96), Transportation (86-89).

**Table 9. Detailed results, by sector**

| Estimation of product-level trade impact 1/ | | | Calculation of aggregate trade impact 3/ 6/ | | | |
|---|---|---|---|---|---|---|
| Time-varying fixed effects | Product & Countrypair | | Agg. qtrly trade impact, reg. #: | No. of meas. | Affec-ted obs. | Affected quarterly trade 6/ |
| Regression # | 17 | | 17 | 4/ | 5/ | |
| **Total** | | | **-$4,627** | **359** | **1.65%** | **$77,668** |
| | | | **-0.21%** | | | **3.58%** |
| **Import restrictions targeting the sector of:** | | | **-$1,039** | **312** | **1.11%** | **$42,722** |
| | | | **-0.05%** | | | **1.97%** |
| Agriculture | 0.006 | | $9 | 53 | 0.10% | $1,536 |
| | (0.15) | | 0.00% | | | 0.07% |
| Processed food | -0.042 | | -$45 | 20 | 0.08% | $1,100 |
| | (-1.09) | | 0.00% | | | 0.05% |
| Minerals | 0.023 | | $330 | 13 | 0.00% | $14,337 |
| | (0.21) | | 0.02% | | | 0.66% |
| Metals | -0.037 | | -$116 | 67 | 0.17% | $3,224 |
| | (-1.38) | | -0.01% | | | 0.15% |
| Wood | -0.141 | * | -$22 | 16 | 0.02% | $171 |
| | (-1.78) | | 0.00% | | | 0.01% |
| Chemicals | 0.004 | | $7 | 48 | 0.06% | $1,636 |
| | (0.12) | | 0.00% | | | 0.08% |
| Textiles | -0.076 | *** | -$463 | 30 | 0.32% | $6,326 |
| | (-3.94) | | -0.02% | | | 0.29% |
| Machinery | -0.049 | *** | -$627 | 43 | 0.34% | $13,155 |
| | (-2.68) | | -0.03% | | | 0.61% |
| Transportation | -0.095 | | -$112 | 22 | 0.02% | $1,237 |
| | (-1.52) | | -0.01% | | | 0.06% |
| **Behind-the-border Measures targeting the sector of:** 2/ | | | **-$3,588** | **47** | **0.54%** | **$34,946** |
| | | | **-0.17%** | | | **1.61%** |
| Agriculture | 0.010 | | $19 | 9 | 0.08% | $1,881 |
| | (0.26) | | 0.00% | | | 0.09% |
| Processed food | 0.402 | ** | $48 | 4 | 0.01% | $98 |
| | (2.32) | | 0.00% | | | 0.00% |
| Minerals | 0.237 | | $1 | 1 | 0.00% | $4 |
| | (1.32) | | 0.00% | | | 0.00% |
| Metals | -0.005 | | -$6 | 4 | 0.12% | $1,181 |
| | (-0.18) | | 0.00% | | | 0.05% |
| Wood | -0.121 | | -$1 | 1 | 0.00% | $13 |
| | (-0.80) | | 0.00% | | | 0.00% |
| Chemicals | 0.141 | | $43 | 4 | 0.01% | $287 |
| | (1.40) | | 0.00% | | | 0.01% |
| Textiles | -0.120 | | -$2 | 3 | 0.01% | $22 |
| | (-1.33) | | 0.00% | | | 0.00% |
| Machinery | -0.125 | *** | -$656 | 7 | 0.22% | $5,591 |
| | (-5.43) | | -0.03% | | | 0.26% |
| Transportation | -0.125 | *** | -$3,033 | 14 | 0.10% | $25,870 |
| | (-3.32) | | -0.14% | | | 1.19% |
| F-Statistic vs. regression # | 3 | | | | | |
| F-Statistic | 4.56 | | | | | |
| Prob>F: | 0.000 | | | | | |
| No. of Time-varying fixed effects | 128,833 | | | | | |
| No. of Observations (thousands) | 9,878,481 | | | | | |
| Adj. R-Squared (percent) | 3.12 | | | | | |

Source: Authors' estimates.
1/ 2/ 3/ 4/ 5/ 6/ Please see notes in Table 2.

## E. Effects by time periods

51. **We ask two questions to investigate during which stage of the global crisis measures did the most damage.** The first question asks whether measures implemented in the immediate aftermath of the Lehman collapse were more harmful than those implemented at a later stage. We disaggregate our protectionist dummies according to the period in which measures were implemented. The second question asks whether the damage done by measures increased or decreased as the crisis subsided. We allow the disaggregate protectionist dummies to cover all measures in effect in a given period, no matter when they were implemented. In each of the tables we split the dummies into three periods according to the trend in global trade flows: (i) the trade collapse (up to January 2009), (ii) the trade stabilization (February-May 2009), and (iii) the trade recovery (from June 2009 onwards).

52. **Measures taken during the first nine months after the Lehman collapse in September 2008 were particularly harmful** (Table 10). Border measures implemented before the trade recovery started in June 2009 are estimated to have decreased affected trade flows by 5-6 percent on average. The most and broadest measures were implemented during the phase when trade stabilized after its collapse. These measures accounted for almost the entire aggregate impact for both border and behind-the-border measures, reducing world trade by roughly 0.1 percent each. Behind-the-border measures implemented during this period were also particularly damaging at the product level, reducing trade flows by 8 percent on average. Meanwhile, we cannot identify a statistically significant effect of

**Table 10. Detailed results, by time of implementation**

| Estimation of product-level trade impact 1/ | | Calculation of aggregate trade impact 3/ 6/ | | | |
|---|---|---|---|---|---|
| Time-varying fixed effects | Product & Countrypair | Agg. qtrly trade impact, reg. #: | No. of meas. | Affec-ted obs. | Affected quarterly |
| Regression # | 20 | 20 | 4/ | 5/ | trade 6/ |
| **Total** | | **-$4,859** | **279** | **1.73%** | **$82,358** |
| | | **-0.22%** | | | **3.80%** |
| **Import restrictions** | | **-$2,278** | **239** | **1.20%** | **$47,521** |
| | | **-0.11%** | | | **2.19%** |
| the trade collapse (before Jan 2009) | -0.054 *** | -$270 | 26 | 0.33% | $5,182 |
| | (-3.08) | -0.01% | | | 0.24% |
| the trade stabilization (Feb 2009-May 2009) | -0.063 *** | -$1,914 | 67 | 0.59% | $31,215 |
| | (-4.10) | -0.09% | | | 1.44% |
| the trade recovery (after June 2009) | -0.008 | -$93 | 146 | 0.27% | $11,123 |
| | (-0.34) | 0.00% | | | 0.51% |
| **Behind-the-border measures:** 2/ | | **-$2,581** | **40** | **0.54%** | **$34,838** |
| | | **-0.12%** | | | **1.61%** |
| the trade collapse (before Jan 2009) | -0.057 | -$212 | 7 | 0.05% | $3,808 |
| | (-1.09) | -0.01% | | | 0.18% |
| the trade stabilization (Feb 2009-May 2009) | -0.086 *** | -$2,094 | 9 | 0.33% | $25,402 |
| | (-4.53) | -0.10% | | | 1.17% |
| the trade recovery (after June 2009) | -0.050 | -$274 | 24 | 0.16% | $5,628 |
| | (-1.63) | -0.01% | | | 0.26% |
| F-Statistic vs. regression # | 3 | | | | |
| F-Statistic | 1.46 | | | | |
| Prob>F: | 0.213 | | | | |
| No. of Time-varying fixed effects | 128,833 | | | | |
| No. of Observations (thousands) | 9,878 | | | | |
| Adj. R-Squared (percent) | 3.12 | | | | |

Source: Authors' estimates.
1/ 2/ 3/ 4/ 5/ 6/ Please see notes in Table 2.

measures implemented after trade was already recovering.[48]

53. **These early measures, if not removed, will continue to constitute a drag on trade.** Table 11 includes dummies to capture all measures that were in effect during the respective time period, no matter when they were implemented. The table illustrates that measures in effect during the trade recovery—which also include those implemented during the trade collapse and stabilization and not yet reversed—were still harming trade significantly. Estimated product-level reductions were 4 percent for border and 6 percent for behind-the-border measures. Coefficient magnitudes are somewhat smaller than those during the trade stabilization, but this comes mainly from early measures' impact being diluted by the less harmful measures taken during the trade recovery phase. Our results thus provide clear evidence that removal of crisis measures still in effect could boost global trade by at least 0.2 percent. While not huge, it is a benefit worth reaping—year after year.

**Table 11. Detailed results, by time of impact**

| Estimation of product-level trade impact 1/ | | | Calculation of aggregate trade impact 3/ 6/ | | | |
|---|---|---|---|---|---|---|
| Time-varying fixed effects | Product & Countrypair | | Agg. qtrly trade impact, reg. #: | No. of meas. | Affec-ted obs. | Affected quarterly trade 6/ |
| Regression # | 19 | | 19 | 4/ | 5/ | |
| **Total** | | | **-$3,922** | **279** | **1.65%** | **$77,668** |
| | | | **-0.24%** | | | **3.58%** |
| **Import restrictions' impact during:** | | | **-$1,855** | **239** | **1.11%** | **$42,722** |
| | | | **-0.11%** | | | **1.97%** |
| the trade collapse (before Jan 2009) | -0.170 | *** | -$72 | 26 | 0.06% | $463 |
| | (-3.10) | | 0.00% | | | 0.02% |
| the trade stabilization (Feb 2009-May 2009) | -0.062 | *** | -$480 | 93 | 0.27% | $7,943 |
| | (-3.07) | | -0.02% | | | 0.37% |
| the trade recovery (after June 2009) | -0.044 | *** | -$1,855 | 239 | 1.11% | $42,722 |
| | (-3.93) | | -0.09% | | | 1.97% |
| **Behind-the-border measures' impact during:** 2/ | | | **-$2,066** | **40** | **0.54%** | **$34,946** |
| | | | **-0.13%** | | | **1.61%** |
| the trade collapse (before Jan 2009) | 0.033 | | $24 | 7 | 0.01% | $716 |
| | (0.28) | | 0.00% | | | 0.03% |
| the trade stabilization (Feb 2009-May 2009) | -0.149 | *** | -$850 | 16 | 0.13% | $6,138 |
| | (-4.28) | | -0.04% | | | 0.28% |
| the trade recovery (after June 2009) | -0.061 | *** | -$2,066 | 40 | 0.54% | $34,946 |
| | (-3.39) | | -0.10% | | | 1.61% |
| F-Statistic vs. regression # | 3 | | | | | |
| F-Statistic | 4.26 | | | | | |
| Prob>F: | 0.002 | | | | | |
| No. of Time-varying fixed effects | 128,833 | | | | | |
| No. of Observations (thousands) | 9,878 | | | | | |
| Adj. R-Squared (percent) | 3.12 | | | | | |

Source: Authors' estimates.
1/ 2/ 3/ 4/ 5/ 6/ Please see notes in Table 2.

[48] It is worthwhile to point out that our sample does not include a full 12 month period after implementation for measures implemented during the trade recovery, i.e. after June 2009. As a result an insufficient number of observations may be a reason behind our inability to identify a statistically significant trade-distorting effect of measures implemented in the trade recovery. For the same reason, higher numbers of observations imply that earlier measures are attributed a higher weight in determining our baseline coefficients.

## VI. CONCLUSION

54. **The present paper fills a gap in the literature by quantifying the trade impact of a broad set of crisis protectionist measures.** Given the many different types of trade restrictions implemented in the wake of the global crisis, a comprehensive approach is very informative. With crisis protectionism only affecting a few percent of global trade flows, our econometric estimation relies on product-level trade data. In absence of control variables unrelated to protectionism at the product level, our approach explores extensive fixed effect specifications to disentangle the protectionist impact from that of other factors. In a second step, impacts on aggregate global trade are derived indirectly by multiplying product-level coefficients by the amount of trade affected by measures. To achieve a comprehensive coverage of protectionist actions, we use a dummy variable approach.

55. **Our results provide strong evidence that crisis import restrictions significantly decreased trade in affected products.** Estimates show that affected trade flows fell by 5 percent in response to border measures and 7 percent in response to behind-the-border measures, with these impacts possibly being somewhat underestimated.[49] Traditional trade measures, most notably tariffs, hardly had an impact, while antidumping duties and other unconventional types of protectionism such as non-tariff barriers, discriminatory purchasing policies, bailouts, and domestic subsidies substantially reduced affected trade flows. It has been documented elsewhere that unconventional measures have been an important feature of the trade policy response to the crisis, but our data and method have allowed the first comprehensive assessment of their impact on trade flows. Protectionism was very harmful for exports of developing countries, and our evidence suggests that poorer nations may have been hit harder. Interestingly, it was the damage done by border restrictions that most hurt the developing world. In contrast, developing country exports were little affected by trade partners' bailouts, which distorted affected trade less than those of developing countries. To the contrary, damage from advanced countries' behind-the-border measures seemingly affected mostly their peers.

56. **The crisis protectionism measures included in our study are estimated to be reducing global trade by at least $30-35 billion or 0.2 percent annually.** The fact that this figure is not much larger is due to the restraint that countries have shown—since the measures themselves have had strong and harmful effects at the product level. This implies that policymakers should remain attentive to protectionist pressures. The current global economic recovery could be aided by removing crisis protectionist measures so as to not perpetuate the associated trade losses.

[49] As described, underestimation could result from a mismatch between the disaggregation of the trade data (HS 4-digit) and the granularity of the trade flow to which the measure is actually applied.

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# Appendix

**Table A1. List of Global Trade Alert (GTA) "Red" Measures Used in the Study 1/**

| GTA Measure Number | Implementing Country | Classification 2/ | GTA Measure Number | Implementing Country | Classification 2/ | GTA Measure Number | Implementing Country | Classification 2/ | GTA Measure Number | Implementing Country | Classification 2/ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 53 | Zambia | Tariff | 451 | South Africa | Trade DM | 785 | Russia | Trade DM | 1168 | Morocco | Tariff |
| 92 | Argentina | License | 457 | China | Trade DM | 786 | Russia | Trade DM | 1169 | Argentina | Trade DM |
| 95 | Ukraine | Tariff | 462 | Canada | Trade DM | 790 | Russia | Tariff | 1170 | Argentina | Trade DM |
| 100 | Russia | Tariff | 464 | European Union | Trade DM | 793 | Belarus | Ex. Sup. | 1171 | Argentina | Cons. Sub. |
| 101 | Argentina | License | 465 | India | Trade DM | 794 | Russia | Tariff | 1173 | Russia | Trade DM |
| 110 | European Union | Ex. Sup. | 466 | Argentina | Trade DM | 797 | China | Trade DM | 1175 | Indonesia | Bailout |
| 118 | Indonesia | Ex. Res. | 468 | Argentina | Trade DM | 798 | Argentina | Trade DM | 1182 | Turkey | Trade DM |
| 119 | Japan | Trade DM | 471 | European Union | Trade DM | 801 | European Union | Trade DM | 1201 | Algeria | License |
| 122 | Philippines | Trade DM | 482 | India | Trade DM | 802 | European Union | Trade DM | 1207 | Argentina | Trade DM |
| 123 | Ukraine | Tariff | 485 | Turkey | Trade DM | 804 | India | Trade DM | 1215 | India | Trade DM |
| 125 | Vietnam | Tariff | 489 | Australia | Trade DM | 826 | Switzerland | Bailout | 1220 | India | Trade DM |
| 127 | Vietnam | Tariff | 490 | Argentina | Trade DM | 827 | Indonesia | Tariff | 1222 | Argentina | Trade DM |
| 128 | Russia | Import Ban | 491 | India | Trade DM | 844 | Argentina | Inv. Sub. | 1224 | Brazil | Tariff |
| 129 | Brazil | Tariff | 494 | India | Trade DM | 857 | France | Bailout | 1226 | China | Tariff |
| 139 | Ecuador | Tariff | 495 | India | Trade DM | 863 | Argentina | Trade DM | 1228 | Russia | Tariff |
| 142 | United States | Trade DM | 501 | China | Trade DM | 864 | Argentina | Trade DM | 1229 | Russia | Ex. Res. |
| 145 | United States | Ex. Sup. | 505 | Colombia | Trade DM | 865 | Argentina | Trade DM | 1235 | India | License |
| 147 | Iraq | Import Ban | 512 | India | Trade DM | 874 | Canada | Local | 1236 | India | Inv. Sub. |
| 152 | Korea, South | Tariff | 513 | India | Trade DM | 879 | Angola | Import Ban | 1237 | Turkey | Tariff |
| 157 | India | Ex. Sup. | 521 | China | Trade DM | 881 | Uganda | Tariff | 1242 | Thailand | Trade DM |
| 159 | United States | Import Ban | 522 | Pakistan | Trade DM | 884 | Brazil | Tariff | 1250 | Argentina | Cons. Sub. |
| 165 | United States | Cons. Sub. | 523 | China | Trade DM | 885 | Brazil | Tariff | 1253 | Argentina | Trade DM |
| 166 | Indonesia | License | 526 | Canada | Trade DM | 890 | Egypt | Ex. Res. | 1258 | Russia | Ex. Res. |
| 167 | Indonesia | License | 541 | Canada | Trade DM | 897 | South Africa | Tariff | 1264 | India | Local |
| 172 | Indonesia | Ex. Res. | 543 | India | Trade DM | 898 | South Africa | Trade DM | 1266 | Belgium | Inv. Sub. |
| 174 | Belarus | Ex. Res. | 545 | Turkey | Trade DM | 899 | Kazakhstan | Ex. Res. | 1268 | Greece | Bailout |
| 176 | Russia | Tariff | 550 | Canada | Trade DM | 901 | Kazakhstan | Ex. Res. | 1271 | Netherlands | Inv. Sub. |
| 177 | Russia | Tariff | 565 | India | Trade DM | 907 | Ukraine | Bailout | 1276 | Brazil | Tariff |
| 178 | Indonesia | Tariff | 567 | Jordan | Trade DM | 908 | Russia | Dom. Sub. | 1278 | Brazil | Tariff |
| 200 | Saudi Arabia | Import Ban | 576 | Argentina | Tariff | 909 | Russia | Bailout | 1279 | Brazil | Tariff |
| 217 | Switzerland | Ex. Sup. | 579 | Germany | Bailout | 912 | Kazakhstan | Quota | 1283 | India | Ex. Res. |
| 219 | Kuwait | Import Ban | 586 | Poland | Bailout | 916 | Russia | Tariff | 1285 | Saudi Arabia | Tariff |
| 234 | Belarus | Quota | 588 | Italy | Bailout | 918 | Ukraine | Cons. Sub. | 1286 | United Arab Emirates | Tariff |
| 239 | Russia | Tariff | 592 | Germany | Dom. Sub. | 920 | Russia | Bailout | 1292 | Indonesia | Ex. Res. |
| 255 | Ghana | Tariff | 602 | Argentina | License | 921 | Nigeria | Import Ban | 1293 | Indonesia | Ex. Res. |
| 258 | China | Local | 604 | Spain | Dom. Sub. | 922 | Russia | Bailout | 1299 | United States | Import Ban |
| 266 | Saudi Arabia | Import Ban | 605 | Paraguay | Tariff | 923 | Russia | Bailout | 1301 | Uganda | Import Ban |
| 268 | Sudan | Import Ban | 606 | Paraguay | Pub. Proc. | 924 | Australia | Trade DM | 1305 | China | Trade DM |
| 272 | Russia | Cons. Sub. | 607 | Chile | Trade DM | 931 | Russia | Bailout | 1310 | Sierra Leone | Tariff |
| 274 | United States | Bailout | 609 | Italy | Dom. Sub. | 932 | Israel | Trade DM | 1313 | Nigeria | Local |
| 278 | Indonesia | Bailout | 611 | Poland | Bailout | 935 | Ecuador | Other NTBs | 1314 | Kenya | Ex. Res. |
| 279 | Indonesia | Bailout | 614 | India | Ex. Sup. | 936 | Kazakhstan | Trade DM | 1316 | Nigeria | Comp. Dev. |
| 280 | Mexico | Tariff | 618 | China | Trade DM | 941 | Russia | Tariff | 1317 | Ethiopia | Comp. Dev. |
| 285 | Mexico | SPS | 625 | Australia | Bailout | 944 | Peru | Trade DM | 1318 | Nigeria | Pub. Proc. |
| 286 | Japan | Trade DM | 631 | India | Ex. Sup. | 945 | Russia | Bailout | 1336 | Argentina | Ex. Res. |
| 289 | Egypt | Ex. Res. | 632 | India | Ex. Sup. | 951 | Russia | Bailout | 1341 | Togo | License |
| 293 | Saudi Arabia | Import Ban | 636 | India | Tariff | 962 | Ukraine | Trade DM | 1343 | India | Trade DM |
| 297 | Russia | Import Ban | 638 | China | Tariff | 965 | Turkey | Trade DM | 1345 | Mauritania | Import Ban |
| 298 | Belarus | Tariff | 639 | India | Tariff | 968 | Argentina | Trade DM | 1347 | Bangladesh | Tariff |
| 299 | Japan | Trade DM | 641 | China | Trade DM | 969 | Argentina | Trade DM | 1349 | Bolivia | Tariff |
| 301 | Japan | Trade DM | 643 | India | Trade DM | 970 | Egypt | Cons. Sub. | 1358 | Paraguay | Other NTBs |
| 302 | Japan | Trade DM | 646 | European Union | Trade DM | 982 | Mexico | Quota | 1361 | Iran | Pub. Proc. |
| 305 | Japan | Trade DM | 648 | European Union | Trade DM | 985 | Argentina | Other NTBs | 1373 | Pakistan | Tariff |
| 311 | Switzerland | Ex. Sup. | 653 | European Union | Ex. Sup. | 986 | Argentina | Tariff | 1374 | Israel | License |
| 315 | Mongolia | Tariff | 671 | Russia | Tariff | 991 | Algeria | Import Ban | 1376 | Kazakhstan | Local |
| 316 | Russia | Trade DM | 675 | United States | Trade DM | 997 | Russia | Bailout | 1392 | India | Trade DM |
| 318 | Saudi Arabia | Import Ban | 679 | Russia | Tariff | 1000 | Russia | Bailout | 1393 | Venezuela | Import Ban |
| 319 | Kazakhstan | Comp. Dev. | 681 | Russia | Tariff | 1006 | Austria | Bailout | 1395 | Venezuela | Comp. Dev. |
| 327 | France | Ex. Sup. | 682 | Russia | Tariff | 1008 | Finland | Dom. Sub. | 1404 | Bolivia | Import Ban |
| 331 | Indonesia | Import Ban | 683 | Russia | Tariff | 1033 | Sudan | Tariff | 1406 | Trinidad & Tobago | Tariff |
| 333 | Ecuador | Trade DM | 684 | Russia | Tariff | 1034 | Brazil | Tariff | 1415 | Argentina | Trade DM |
| 335 | Canada | Ex. Sup. | 687 | Russia | Pub. Proc. | 1035 | Brazil | Tariff | 1416 | Russia | Trade DM |
| 339 | Brazil | Tariff | 688 | Argentina | Trade DM | 1056 | Mexico | Trade DM | 1417 | South Africa | Import Ban |
| 342 | United States | Trade DM | 690 | India | Trade DM | 1057 | Mexico | Trade DM | 1421 | Russia | Bailout |
| 345 | Russia | Tariff | 693 | Argentina | Trade DM | 1068 | Iran | Import Ban | 1424 | Russia | Pub. Proc. |
| 346 | Russia | Tariff | 695 | Russia | Tariff | 1069 | Iran | Tariff | 1433 | Gambia | License |
| 347 | Belarus | Cons. Sub. | 699 | United Kingdom | Dom. Sub. | 1093 | United Kingdom | Bailout | 1435 | Kazakhstan | Ex. Res. |
| 360 | Ukraine | Cons. Sub. | 701 | China | Trade DM | 1101 | Argentina | Dom. Sub. | 1439 | Argentina | Trade DM |
| 365 | Syria | Import Ban | 702 | New Zealand | Trade DM | 1103 | Sierra Leone | Ex. Res. | 636 | India | Ex. Res. |
| 371 | France | Bailout | 754 | Argentina | Trade DM | 1111 | China | Pub. Proc. | 1316 | Nigeria | Ex. Sup. |
| 373 | Tanzania | Other NTBs | 755 | Argentina | Trade DM | 1112 | Nigeria | Inv. Sub. | 1317 | Ethiopia | Ex. Sup. |
| 379 | Brazil | Quota | 756 | Argentina | Trade DM | 1122 | Cameroon | Inv. Sub. | 1395 | Venezuela | Ex. Sup. |
| 382 | France | Pub. Proc. | 757 | Argentina | Trade DM | 1123 | Argentina | Bailout | 319 | Kazakhstan | Ex. Sup. |
| 389 | Spain | Pub. Proc. | 759 | Brazil | Trade DM | 1126 | Zimbabwe | Import Ban | 172 | Malaysia | Ex. Res. |
| 391 | Spain | Pub. Proc. | 760 | Brazil | Trade DM | 1130 | Indonesia | Ex. Res. | 172 | Thailand | Ex. Res. |
| 418 | Korea, South | Tariff | 763 | Brazil | Trade DM | 1136 | Indonesia | License | 174 | Russia | Ex. Res. |
| 420 | Vietnam | Tariff | 766 | United States | Tariff | 1137 | Indonesia | Ex. Res. | 234 | Russia | Quota |
| 423 | Vietnam | Tariff | 769 | Vietnam | Tariff | 1142 | China | Trade DM | | | |
| 435 | Argentina | Trade DM | 770 | Mexico | Trade DM | 1147 | China | Trade DM | | | |
| 448 | Turkey | Trade DM | 779 | Nigeria | Tariff | 1149 | Turkey | Trade DM | | | |

1/ Classification in this study. Further details are available in Excel format upon request to the authors. For detailed descriptions of measures refer to www.globaltradealert.org.
2/ The following abbreviations have been used: Comp. Dev. (competitive devaluation), Trade DM (trade defense measures), License (licensing requirements), SPS (sanitary and phytosanitary), Local (local content), Pub. Proc. (public procurement), Cons. Sub. (consumption subsidy), Dom. Sub. (domestic subsidy), Inv. Sub. (investment subsidy), Ex. Res. (export restriction), Ex. Sup. (export support measure).

**Table A2. Regional Country Classification**

| Regional grouping | Included Countries |
|---|---|
| Africa | |
| Middle East & North Africa | Algeria; Bahrain; Djibouti; Egypt, Arab Rep.; Iran, Islamic Rep.; Iraq; Israel; Jordan; Kuwait; Lebanon; Libya; Morocco; Oman; Qatar; Saudi Arabia; Syrian Arab Republic; Tunisia; United Arab Emirates; West Bank and Gaza; Yemen, Rep. |
| Sub-Saharan Africa | Angola; Benin; Botswana; Burkina Faso; Burundi; Cameroon; Cape Verde; Central African Republic; Chad; Comoros; Congo, Dem. Rep.; Congo, Rep.; Côte d'Ivoire; Eritrea; Ethiopia; Gabon; Gambia, The; Ghana; Guinea; Guinea-Bissau; Kenya; Lesotho; Liberia; Madagascar; Malawi; Mali; Mauritania; Mauritius; Mozambique; Namibia; Niger; Nigeria; Rwanda; São Tomé and Principe; Senegal; Seychelles; Sierra Leone; Somalia; South Africa; Sudan; Swaziland; Tanzania; Togo; Uganda; Zambia; Zimbabwe |
| Asia | |
| East Asia & Pacific | American Samoa; Australia; Brunei Darussalam; Cambodia; China; Fiji; French Polynesia; Hong Kong SAR, China; Indonesia; Japan; Kiribati; Korea, Dem. Rep.; Korea, Rep.; Lao PDR; Macao SAR, China; Malaysia; Marshall Islands; Micronesia, Fed. Sts.; Mongolia; Myanmar; New Caledonia; New Zealand; Palau; Papua New Guinea; Philippines; Samoa; Singapore; Solomon Islands; Thailand; Tonga; Tuvalu; Vanuatu; Vietnam |
| Central Asia | Azerbaijan; Georgia; Kazakhstan; Kyrgyz Republic; Russian Federation; Tajikistan; Turkmenistan; Uzbekistan |
| South Asia | Afghanistan; Bangladesh; Bhutan; India; Maldives; Nepal; Pakistan; Sri Lanka |
| Europe | |
| Western Europe | Andorra; Austria; Belgium; Cyprus; Denmark; Finland; France; Germany; Gibraltar; Greece; Greenland; Hungary; Iceland; Ireland; Italy; Liechtenstein; Luxembourg; Malta; Monaco; Netherlands; Norway; Portugal; San Marino; Spain; Sweden; Switzerland; United Kingdom |
| Central and Eastern Europe | Albania; Armenia; Belarus; Bosnia and Herzegovina; Bulgaria; Croatia; Czech Republic; Estonia; Latvia; Lithuania; Macedonia, FYR; Moldova; Montenegro; Poland; Romania; Serbia; Slovak Republic; Slovenia; Turkey; Ukraine |
| Latin America & Caribbean | Antigua and Barbuda; Argentina; Aruba; Barbados; Belize; Bermuda; Bolivia; Brazil; Cayman Islands; Chile; Colombia; Costa Rica; Cuba; Dominica; Dominican Republic; Ecuador; El Salvador; Equatorial Guinea; Grenada; Guatemala; Guyana; Haiti; Honduras; Jamaica; Mexico; Netherlands Antilles; Nicaragua; Panama; Paraguay; Peru; Puerto Rico; St. Kitts and Nevis; St. Lucia; St. Vincent and the Grenadines; Suriname; Trinidad and Tobago; Turks and Caicos Islands; Uruguay; Venezuela, Bolivaran Rep. |
| North America | Bahamas, The; Canada; United States; Virgin Islands (U.S.) |

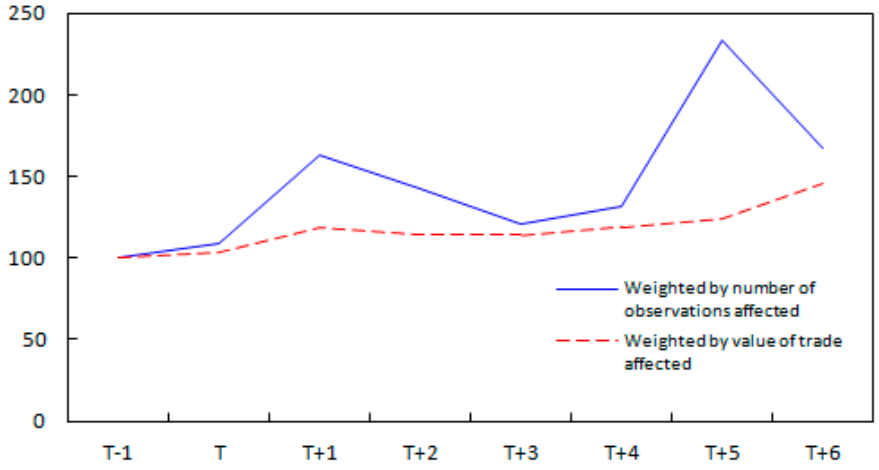
Sources: Authors based on World Bank country classification.

**Table A3. Detailed results, by product's import-demand elasticity**

| Estimation of product-level trade impact 1/ | | Calculation of aggregate trade impact 3/ 6/ | | | |
|---|---|---|---|---|---|
| Time-varying fixed effects | Product & Countrypair | Agg. qtrly trade impact, reg. #: | No. of meas. | Affec-ted obs. | Affected quarterly |
| Regression # | 18 | 18 | 4/ | 5/ | trade 6/ |
| **Total** | | **-$3,870** | **396** | **1.65%** | **$77,668** |
| | | **-0.18%** | | | **3.58%** |
| **Import restrictions affecting products with:** | | **-$1,563** | **332** | **1.11%** | **$42,722** |
| | | **-0.07%** | | | **1.97%** |
| Low elasticity of substitution | -0.051 *** | -$523 | 118 | 0.36% | $10,524 |
| | (-2.89) | -0.02% | | | 0.49% |
| Medium elasticity of substitution | -0.010 | -$228 | 93 | 0.34% | $22,143 |
| | (-0.63) | -0.01% | | | 1.02% |
| High elasticity of substitution | -0.084 *** | -$813 | 121 | 0.40% | $10,055 |
| | (-4.86) | -0.04% | | | 0.46% |
| **Behind-the-border Measures affecting products with:** 2/ | | **-$2,306** | **64** | **0.54%** | **$34,946** |
| | | **-0.11%** | | | **1.61%** |
| Low elasticity of substitution | -0.019 | -$79 | 16 | 0.18% | $4,214 |
| | (-0.82) | 0.00% | | | 0.19% |
| Medium elasticity of substitution | -0.130 *** | -$369 | 20 | 0.18% | $3,027 |
| | (-4.69) | -0.02% | | | 0.14% |
| High elasticity of substitution | -0.069 *** | -$1,858 | 28 | 0.18% | $27,706 |
| | (-2.57) | -0.09% | | | 1.28% |
| No. of Time-varying fixed effects | 128,833 | | | | |
| No. of Observations (thousands) | 9,691,785 | | | | |
| Adj. R-Squared (percent) | 3.10 | | | | |

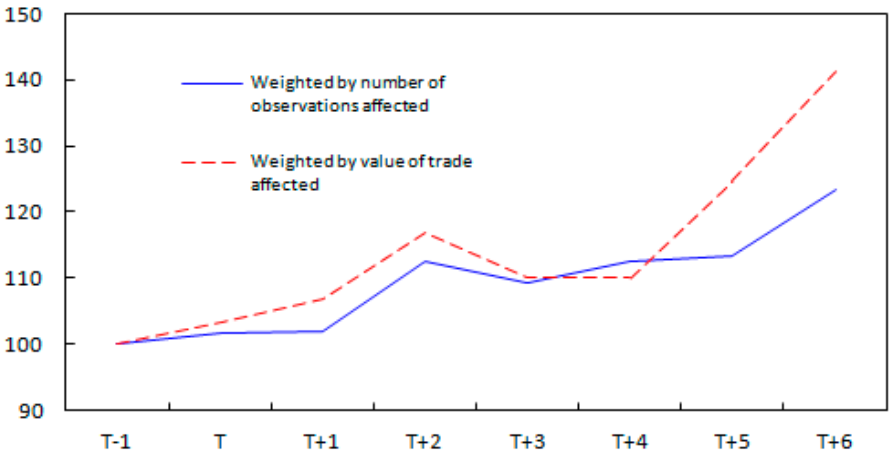
Source: Authors' estimates.
1/ 2/ 3/ 4/ 5/ 6/ Please see notes in Table 2.
Note: 3-digit HS product were classified into low/medium/high import demand elasticities based on the results for the U.S. in Broda, Greenfield and Weinstein (2006). Given that not all observations could be assigned an elasticity, no F-statistic compared to the analog model in Table 2 could be computed.

**Figure A1. Average performance of trade affected by export restrictions**
(averages over implementation months) 1/




Source: Authors' calculations.
1/ The graph shows different weighted averages (over implementation months). Index is normalized at 100 for the month before implementation T-1. Measures included in this graph (implemented up to July 2009) cover more than 80 percent of trade affected by measures in the study.

**Figure A2. Average performance of trade affected by export support measures**
(averages over implementation months) 1/




Source: Authors' calculations.
1/ The graph shows different weighted averages (over implementation months). Index is normalized at 100 for the month before implementation T-1. Measures included in this graph (implemented up to July 2009) cover more than 95 percent of trade affected by measures in the study.