The Role of Trade Costs in the Trade Collapse of 2008-2009

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The largest global trade bust in the last 150 years (outside of wartime) occurred between early 2008 and mid-2009. The decline in trade was larger than during any one year in the Great Depression.

The unique size of the trade collapse suggests that the structure of global trade has been significantly altered over recent years so as to render trade more sensitive to changes in the cost of international trade. The research of Kei-Mu Yi (forthcoming) emphasizes that international supply chains or production sharing can magnify the sensitivity of trade to a given rise in trade costs.

Indeed, our evidence suggests that larger collapses occurred where such production sharing was more prevalent. In this essay, we pair state-of-the-art theoretical and empirical economic models of bilateral trade with cross-country comparative data to gain perspective on this issue and to shed light on the diversity of experiences in response to the global shock.

The worst trade collapse in 150 years?

Between the second quarter of 2008 and the first quarter of 2009, the nominal value of world exports plummeted by some 50 percent. Even after accounting for the massive decline in commodity prices, deflationary tendencies and seasonal variation, world trade has suffered an enormous blow that is unprecedented in peacetime history. The data show that real, seasonally adjusted aggregate bilateral exports for a sample of 16 countries have fallen some 20 percent on average in less than a year.[1] This far outpaces the average decline in real GDP over the same period, which was roughly 4 percent. By way of comparison to the Great Depression, the only quantitatively comparable shock in modern times, Eichengreen and O'Rourke (2009) report a 10 percent decline of world trade from June 1929 to June 1930 and a roughly 20 percent decline in world industrial output. The discerning feature this time around is that trade has fallen much faster than output.

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[1] The average is a weighted average using total pair real GDP as weights. We include 16 countries for which the International Monetary Fund's International Financial Statistics provide real GDP and export deflators. We use the latter (at the country level) to deflate bilateral exports. We use seasonally adjusted quarterly data. The countries include the United States, Japan, Germany, Korea, the United Kingdom, New Zealand, Greece, Switzerland, Finland, Poland, Denmark, Sweden, Mauritius, Australia, Colombia, and Austria. We have also generated results using nominal data on a much broader sample. These results run qualitatively parallel to those presented here.

For the Great Depression, a large percentage of the trade decline has been attributed to commercial policy (Madsen, 2001). Fortunately, lessons were learned from the past and policy makers have avoided large and ostentatious rises in tariffs.[2] Still, the rapid transformation of global trade to heavy reliance on cross-border supply chains leads to the possibility that even small changes to trade policy can have a large impact on trade flows. This feature of the new global economy has sharpened the focus on trade costs more generally. These include tariff and non-tariff commercial policy but also a myriad of other frictions such as trade credit, transportation costs and so forth.

Possible reasons for the trade slump

Various potential explanations for the trade decline have been put forward. Freund (2009) has suggested that world trade has become more sensitive over time to output movements although theory lags behind this empirical observation. One possible mechanism is related to the types of goods that are most heavily traded. A significant share of trade amongst the largest economies consists of consumer durables and investment goods. These components of aggregate demand are more volatile than total output so that international trade may suffer disproportionately in times of economic crisis. The fact that major exporters of these goods such as Germany and Japan have seen some of the sharpest falls in exports appears consistent with the phenomenon that Freund has highlighted.

At the same time, Yi (2009) suggests that with the rise of cross-border supply chains or *vertical specialization* in recent decades, trade has become increasingly sensitive to changes in the costs of international trade. These costs are broadly defined and include transportation costs, commercial policy variables, insurance costs, financing costs and a range of other frictions. Incipient protectionism and the drying up of trade credit associated with the financial meltdown could have triggered a magnified fall in trade even if they imply seemingly small rises in the relative costs of trade (Eichengreen and Irwin, 2009; Baldwin and Evenett, 2009).

The steep decline in nominal trade has also been attributed to a collapse in the prices of heavily traded commodities as emphasized by Francois and Woerz (2009). Indeed, the U.S. import price deflator index dropped 21 percent from Q3:2008 to Q1:2009—a drop which is mild compared to the 36 percent fall of the price of Japanese imports. The list of suspects for the recent trade bust is long.

The gravity of the situation

In recent research we explore a structural model of bilateral trade (Jacks, Meissner and Novy, 2009) that is consistent with the leading trade theories in the literature. This model suggests a precise way to measure the relative contribution of declining output and increasing trade costs to the trade bust. Bilateral trade (measured as the product of

[2] However, as the Global Trade Alert initiative reminds us, commercial policy has become stiffer, non-tariff measures have cropped up and government bailouts have enacted stimulus plans which typically favor domestic goods and services and have thus cut the wind from the sails of international trade.

exports in both directions) is a function of country-pair GDP, bilateral trade costs or frictions and factors affecting all the trade partners of the two countries in the pair. Trade costs are unobservable, but theory yields a measure of the tariff equivalent of these costs as the deviation of total bilateral trade from what economic size alone—that is, frictionless trade—would predict. Our theory is valid for any supply side structure and all models of trade that predict specialization in production.

Trade costs include tariffs, international shipping costs, non-tariff barriers, trade finance costs and many other such frictions both observable and unobservable. For instance, they can also be interpreted as the ***interaction of vertical specialization forces and rising trade costs*** so long as the elasticity of trade with respect to GDP itself is constant.[3] Our measure is also a relative cost measure. It measures the relative cost of international versus domestic trade. Below, we analyze the correlation between our measure of trade costs and observable proxies for the frictions described here to make our key point. The equation for the (bilateral geometric average) of tariff equivalent of trade costs is given by

$$\tau_{ijt} = \left(\frac{x_{iit} x_{jjt}}{x_{ijt} x_{jit}} \right)^{\frac{1}{2(1-\sigma)}} - 1 \qquad \textbf{(1)}$$

where x_{iit} is a proxy for domestic trade given by GPP less total exports for country i and other variables are described in footnote 4..

Trade costs have risen

First, we focus on the evolution of average aggregate bilateral trade and average GDP in our sample of countries. These are the key components of the trade cost measure. All data are measured in constant 2005 U.S. dollars and trade flows are deflated using aggregate country level export deflators. All series are also seasonally adjusted. The vertical scales of Figure 1 show that trade has grown roughly twice as fast as average bilateral GDP between 2001 and 2008.[4] There are two exceptions. Trade grew much faster than output

[3] In fact, trade models based on homothetic preferences, as is most frequently the case in the literature, yield GDP elasticities of one, but the unit elasticity is not a necessary condition for our methodology.

[4] Specifically the standard gravity equation for the product of exports between countries i and j in period t is $x_{ijt} x_{jit} = \left(\frac{y_{it} y_{jt}}{y^{Wt}} \right)^2 \left(\frac{t_{ijt} t_{jit}}{\Pi_{it} \Pi_{jt} P_{it} P_{jt}} \right)^{1-\sigma}$ where x_{ijt} denotes exports from country i to country j at time t and y_{it} denotes GDP in country i at time t, $\Pi_{it} \Pi_{jt} P_{it} P_{jt}$ includes factors affecting trade between all partners of i and j, and t_{ijt} represents total bilateral trade costs between i and j. Finally, σ measures the elasticity of substitution between goods from any two countries, which we assume to be eight although our results are not very sensitive to this parameter choice. See Jacks, Meissner and Novy (2008 and 2009) for details. In a regression of the log of trade flows on the log of pair GDP and pair intercepts, the coefficient on the GDP term is 2.38 (t-statistic = 45.08). Divergence from 2 is likely due to the fact that there is no control for the bilateral trade costs.

movements would have predicted between 2003 and 2005, and during the recent trade bust trade has declined roughly six times faster than real output.

[*Figure 1 about here*]

Table 1 uses an accounting decomposition as in Jacks, Meissner and Novy (2009) to see how much of the trade fall can be accounted for by declines in output. For the entire sample, the fall in output can explain on average 15 percent of the fall in trade. The exercise reveals similar numbers for the U.S. and Germany, a slightly lower number for the UK (11 percent), while about a quarter of Japan's trade bust can be accounted for by the fall in output.

[*Table 1 about here*]

The rest of the fall in trade is by construction chalked up to trade costs broadly defined since output declines cannot account for it.[5] For example, a possible mechanism could be that consumer durables and investment goods were particularly hard hit by evaporating credit, and since trade disproportionately consists of such goods, this adverse shock most clearly manifests itself in the trade data. We next explore the magnitude of the tariff equivalent of these frictions and then look at some possible determinants.

A closer look at trade costs

Figures 2-4 track indices of the tariff equivalent of trade costs for the U.S., Japan and Germany using equation (1) with key trading partners.[6] We also include the average trade cost index for our sample. Altogether we have 3,531 observations on 107 unique country pairs representing 16 separate countries with data spanning 33 quarters (Q1:2001 to Q1:2009).[7] The following observations can be made:

- The large drop in world trade has been accompanied by a historically unprecedented rise in the tariff equivalent of aggregate trade costs across nearly all trade partners.
- Average bilateral trade costs (weighted by pair GDP) rose by an approximate 11 percent cumulatively from the end of the second quarter of 2008 to the end of the first quarter of 2009. The standard deviation was 9 percent with the 5th percentile being a rise of 2.5 percent and 95th percentile 25 percent.
- Certain pairs have seen sharper rises than others. Notably, pairs involving the UK in our figures show much larger increases.

[5] Technically multilateral considerations come into play here which we ignore. Still these appear as significant forces for maintaining trade. Basically, the shock to trade costs has been common, simply deflecting demand towards domestic consumption. The fact that total GDP has not fallen as fast as trade keeps international demand higher than it have been had GDP fallen as fast as total exports.

[6] Deflators for recent quarters for China were unavailable in the IMF's International Financial Statistics. As these become available we will incorporate this important country.

[7] 13 possible pairs for the 16 countries have some missing data during the period and hence are not included. This would have yielded another 429 pair observations. Our trade cost measure captures bilateral relative to domestic trade costs. The finding that trade costs between the U.S. and Japan have increased over the period means that their bilateral trade costs dropped less than their domestic trade costs.

- Similar methods reveal a rise in the tariff equivalent of barriers to trade of 5 percent to 6 percent between 1929 and 1930 in the Great Depression (based on annual data).

[*Figures 2-4 about here*]

These figures indicate many possibilities about the trade collapse. Perhaps a sizeable fraction of the trade drop is due to non-tariff trade policy and other trade frictions, e.g., evaporating trade credit, and home bias in purchases associated with government stimulus plans in the larger countries.

The best evidence available on policy induced trade barriers, the Global Trade Alert initiative (GTA), suggests much activity but no rise in measured protectionism anywhere near that observed in the 1930s. One possibility is that these measures are interfering with trade in combination with a lack of trade credit and uncertainty about the future. Another possibility is that small trade cost rises due to the above factors are interacting with the back and forth trade characteristic of vertical specialization patterns.

A first look at the determinants of trade costs: A role for the international fragmentation of the supply chain?

We have examined the relative impact of three possible determinants of the change in our measure of bilateral trade costs. These touch on several of the leading hypotheses that have been emphasized in recent analysis.

The first variable attempts to see to what extent vertical specialization is related to our measure of trade costs. To be clear we are not assessing whether vertical specialization has driven trade costs upwards or whether countries engaged in vertical specialization have seen higher rises in tariffs etc. Rather think of this as a test for whether a common trade cost shock (trade financing, incipient "murky" protectionism) made a larger impact in pairs where vertical specialization is more prevalent.

We use the data presented in a recent paper by Johnson and Noguera (2009) who provide country level ratios of value-added in exports relative to exports (traditionally measured as total value). The ratio is often below one for many countries due to the fact that countries import unfinished intermediates and then re-export these after processing. Traditional accounting methods count gross value every time merchandise shipments cross a border and therefore exaggerate the amount of world trade when production in vertical specialization networks is important. The lower the Johnson and Noguera ratio, the more a country is involved in such production networks. We use the product of the ratio for each country in the pair.

The second variable uses information from the GTA data base. This is the log product of one plus the number of 'red' trade measures undertaken at the bilateral level.[8] The third variable uses calculations by Engel and Wang (2009) on the share of trade accounted for

[8] 'Red' measures are trade policies that have been implemented and which 'almost certainly discriminate against a country's interest.'

by durables and investment goods. This is the geometric average of the share of imports and exports for each partner accounted for by durables excluding materials and energy.

We ran GDP-weighted regressions of the percentage change (Q2:2008 to Q1:2009) in the tariff equivalent of trade costs on these three variables and have found that only one variable stands out. The Johnson and Noguera measure of the domestic content of total trade is negatively related to the rise in trade costs and it alone is statistically significant.

This implies that the lower the domestic value-added of the pair's trade flows, or the greater the involvement in vertical specialization, the higher the associated rise in trade costs. Figure 5 displays a scatter plot of this relationship and the regression line when only the Johnson and Noguera variable is included in the regression. The bottom line is that trade has collapsed faster than economic size would predict in pairs where back and forth trade is more prevalent. Although theory lags here too, this is some evidence of Yi's magnification effect.

[*Figure 5 about here*]

In terms of the other variables, we found that the GTA measure of trade measures was positively related to trade cost rises but not statistically significant. The share of durables in imports was not significant, even when included by itself, and it always has the 'wrong' negative sign.

Conclusions

Our results suggest that an increase in trade costs has played an important role in the recent trade collapse. We find that trade costs ***broadly defined*** increased on average by around 11 percent between the second quarter of 2008 and the first quarter of 2009.

Furthermore, we present evidence that might help identify a particular mechanism of how the economic crisis translated into such a tremendous trade collapse. In particular, we find that the country pairs hit hardest are those whose production networks engage in greater levels of vertical specialization and cross-country shipping of intermediate goods. This finding suggests that the slicing up of the production chain into international stages magnifies the impact of the hard-to-quantify trade cost rises associated with evaporating credit, non-tariff barriers and home bias in government stimulus plans that have been widely discussed in anecdotal accounts of the trade collapse.

The magnification effect can also work in the opposite direction. Once the adverse conditions surrounding international trade ease back, we expect international trade to rise strongly, and especially in those industries characterized by vertical specialization.

In future research, we will aim to assess how much of the rise in trade costs between 2008 and 2009 was due to commercial policy changes, financial frictions, and other observable barriers to trade. We also aim to improve our understanding of the interaction between these trade costs and international production sharing. Such information should

be valuable for those seeking to understand how to revive global trade and how to avoid yet another trade bust in the future.

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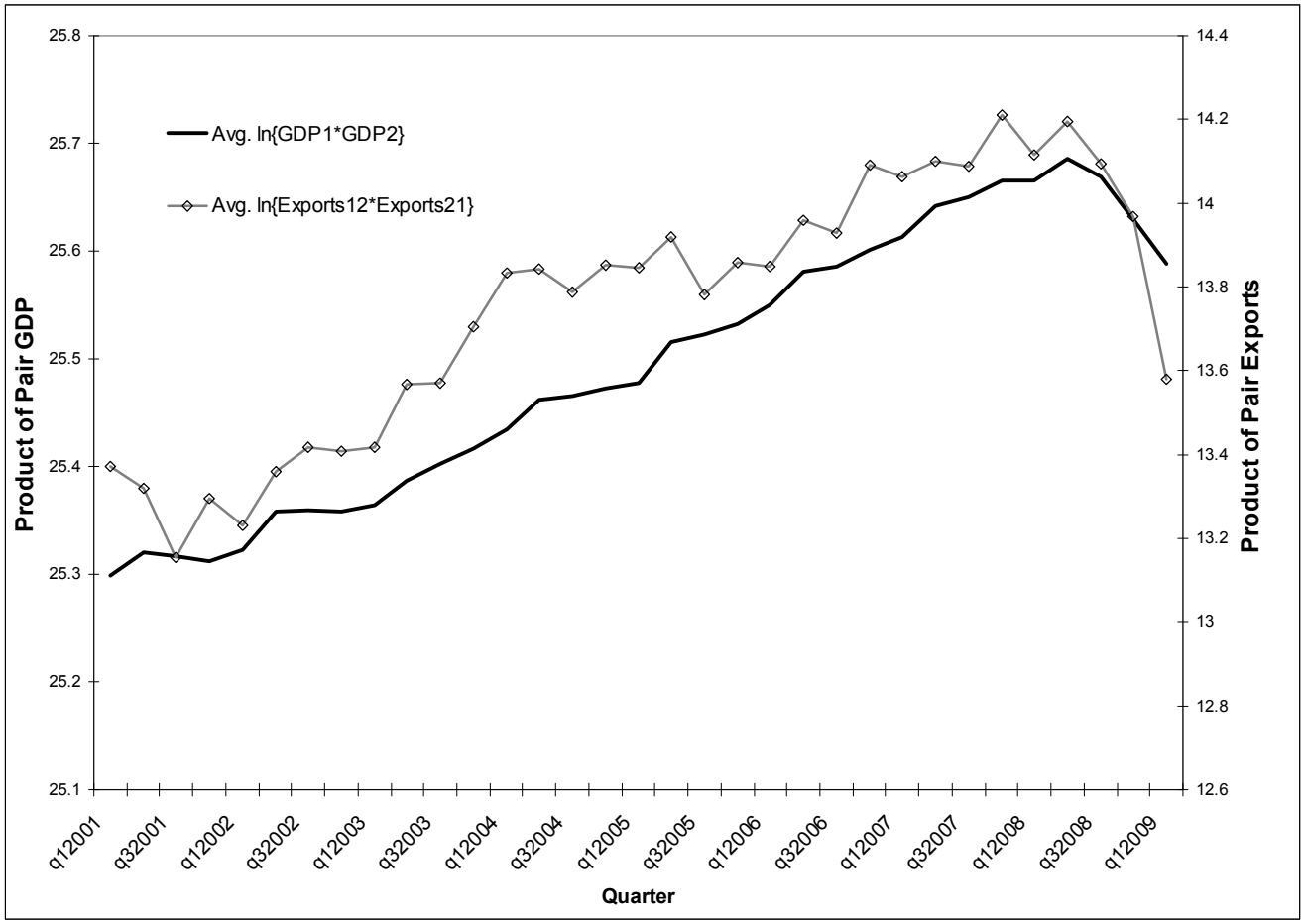
***Figure 1**: Bilateral Trade and GDP, Q1:2001-Q1:2009.*



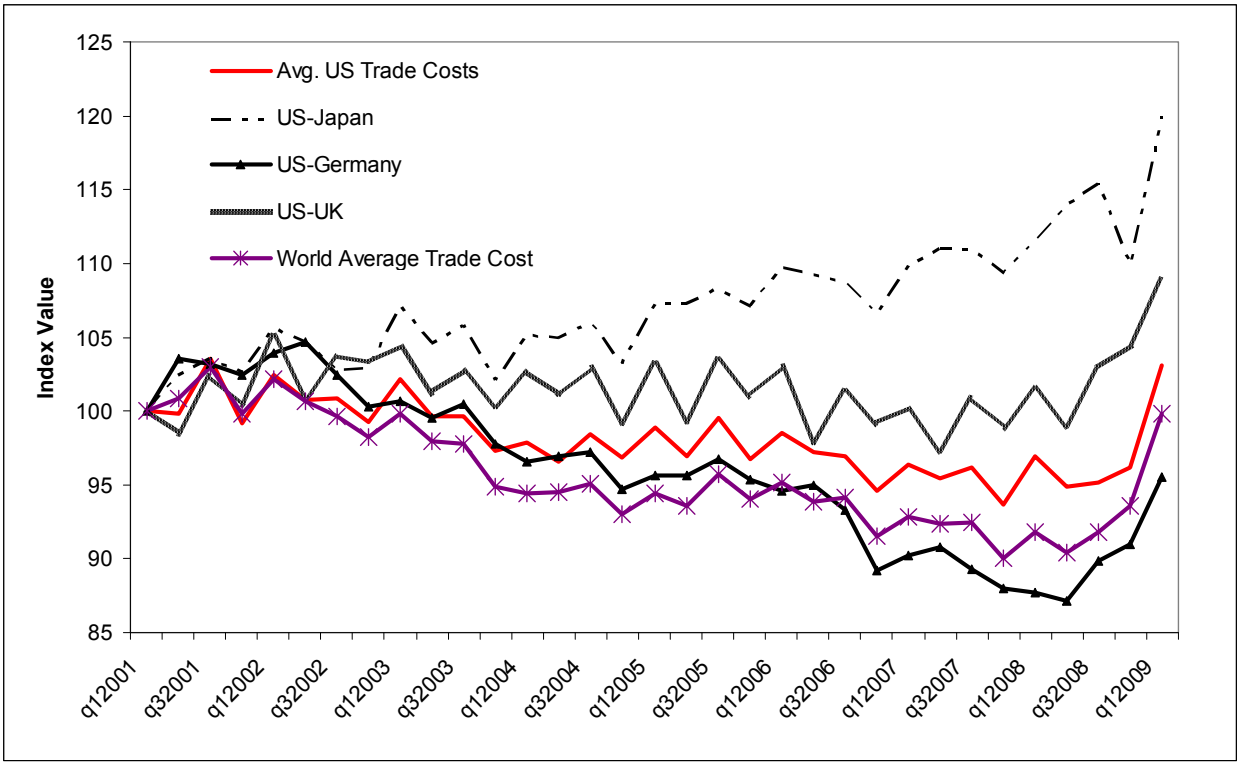
Notes: Authors' calculations based on data from the International Monetary Fund's (IMF) Direction of Trade Statistics and International Financial Statistics. Averages are weighted averages using the sum of country pair GDP as weights. All data are in real 2005 U.S. dollars and are seasonally adjusted.

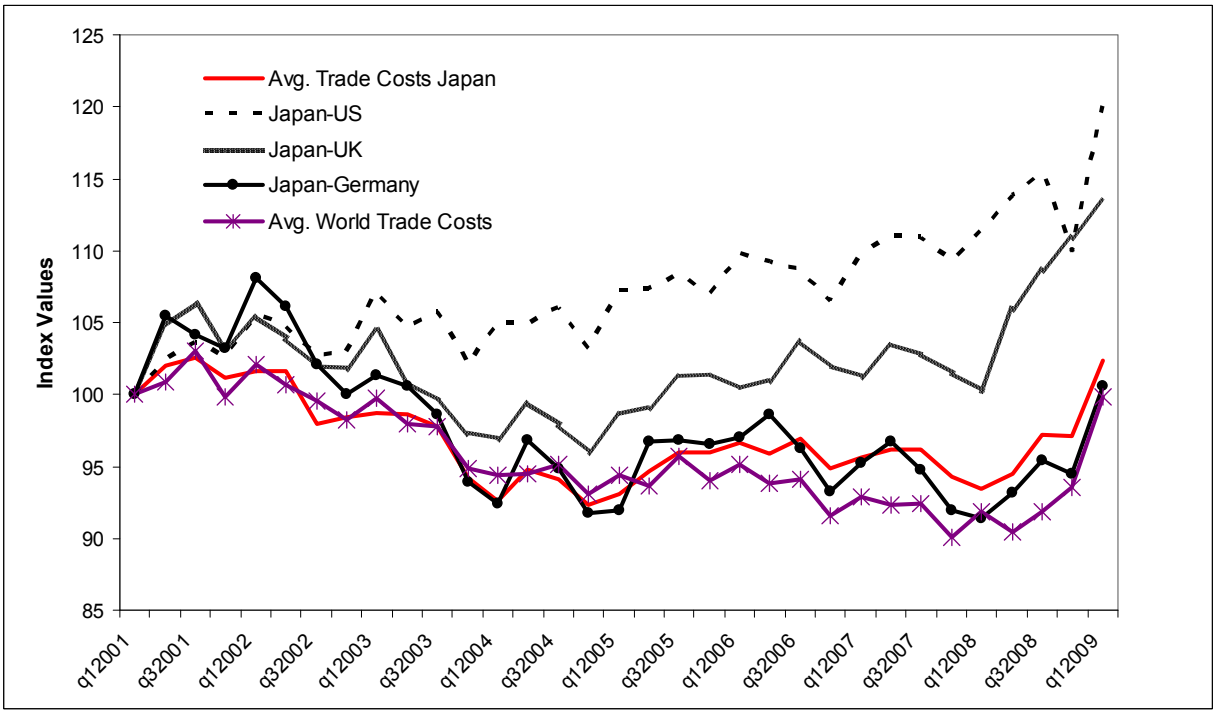
***Table 1**: The Role of Output Declines in the Recent Trade Bust, Sample Average and Selected Countries.*

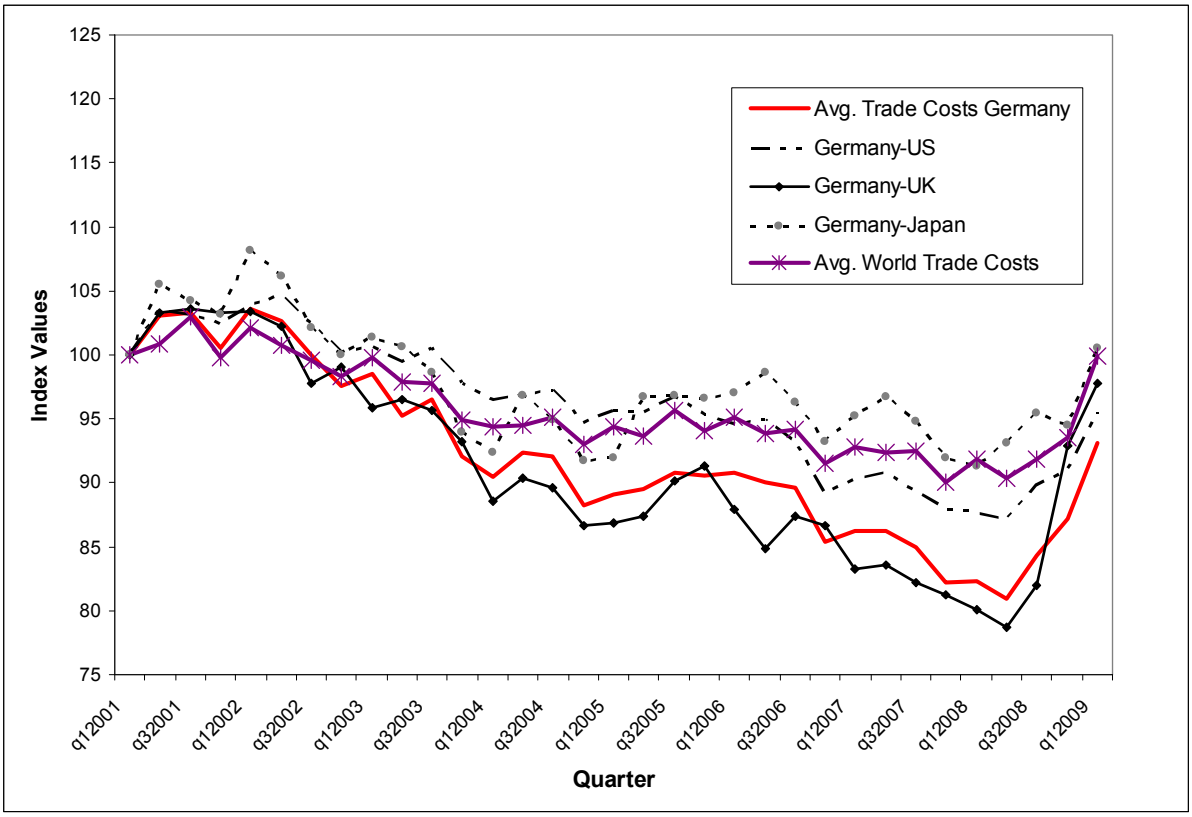
	Sample Average	USA	Japan	Germany	UK
Percentage of trade bust explained by decline in the product of pair output	15.62	16.97	26.40	17.44	11.92

Notes: Authors' calculations. The sample includes 16 countries and 107 bilateral pairs as stated in the text. The sample average is a weighted average, and for each country a pair weighted average across all trade partners is given.

***Figures 2-4**: The Evolution of Trade Costs, Q1:2001-Q1:2009: Global Averages and Averages for Three Countries with Selected Trade Partners.*

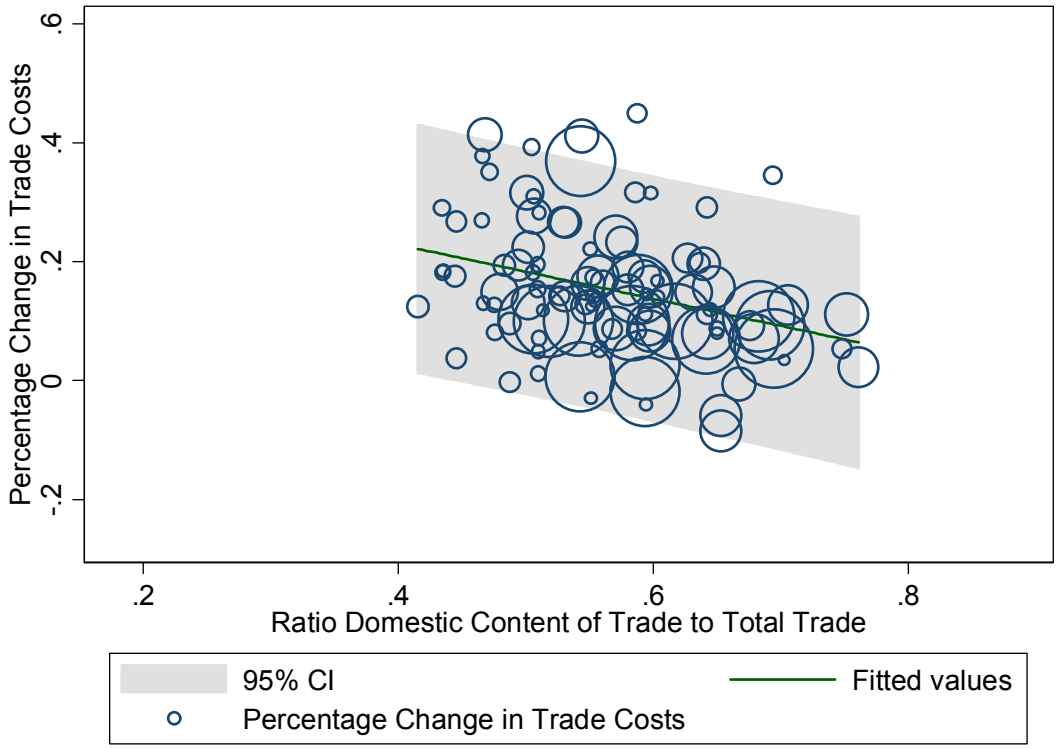






Source: Authors' calculations.

***Figure 5**: Vertical Specialization Amplifies the Measured Trade Cost Shock*



Notes: The ratio of domestic content of trade to total trade is the product of the ratio of value-added exports to total exports for each country in a pair as calculated and reported by Johnson and Noguera (2009). The regression line in a least squares weighted regression of the percentage rise in trade costs on this variable has a coefficient of -0.53 (robust t-statistic = -3.69). Circle size is related to the size of the sum of bilateral GDP.