Trade Prices and the Global Trade Collapse of 2008–2009*

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Abstract

We document the behavior of trade prices during the Great Trade Collapse of 2008-2009 using transaction-level data from the U.S. Bureau of Labor Statistics. First, we find that differentiated manufactures exhibited marked stability in their trade prices during the large decline in their trade volumes. Prices of non-differentiated manufactures, by contrast, declined sharply. Second, while the trade collapse was much steeper among differentiated durable manufacturers than among non-durables, prices in both categories barely changed. Third, despite this lack of movement in average price levels, the frequency and magnitude of price adjustments at the product level noticeably changed with the onset of the crisis.

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1 Introduction

The financial crisis and global recession of 2008-2009 was associated with a dramatic collapse in world international trade, in excess of the fall in production and significantly larger than the fall in GDP. The empirical literature has primarily focused on trade values—the product of prices and quantities—and therefore is consistent with large declines in prices, quantities, or both. The details of whether adjustment came about through prices or quantities matter not only in order to better understand the large trade collapse but also because they may improve our understanding of the sources of the recession.[1] To address this we use highly disaggregated data on U.S. import and export prices during the great recession from the U.S. Bureau of Labor Statistics (BLS) and compare them to the behavior of U.S. trade values over that period.

We emphasize three findings for the peak period of the trade collapse, which for concreteness we consider here to be the period from September 2008 to March 2009. First, while the dollar price of non-differentiated goods declined by 17 percent for both exports and imports, the price of differentiated goods declined only by around 1 percent for imports and 0.5 percent for exports. The 30 percent decline in the trade value of differentiated goods therefore was almost entirely a quantity phenomenon.

Second, though durable differentiated manufactures experienced a significantly larger decline in trade values than non-durables, the average magnitude of price changes on differentiated durables was 1 percent or less, effectively the same as for non-durables. The only categories that experienced large declines in prices were non-manufactures, consumer non-durables, and durable intermediates, presumably sectors that include a lot of commodities or goods with large commodity content. The contrasting behavior of differentiated versus non-differentiated goods carries through for different end-uses and different source and destination countries.

Third, there were changes in the frequency and size of price adjustment, even for differentiated goods, that coincided closely with the start of the crisis. In particular, the absolute size

[1] A number of theories explaining the large disruption in trade have been put forth. Alessandria, Kaboski, and Midrigan (2010b) calibrate a model in which imported inventories decline more than domestic inventories due to fixed costs of trade. Eaton, Kortum, Neiman, and Romalis (2010) use a gravity model with a global input-output structure to attribute the bulk of the decline to a collapse in the share of spending on durables. Chor and Manova (2011) covary changes in U.S. imports by country and sector with measures of the cost and intensity of credit and conclude that difficulties in financing international trade were important. These and other explanations often have different predictions for the behavior of prices.

of price adjustment and the fraction of changing prices in a given month increased during the period of trade collapse. Furthermore, the fraction of price increases out of all price changes decreased, while the fraction of price decreases rose. Although noticeable, these differences in price-setting behavior were not quantitatively large enough to result in considerable price declines for differentiated goods, consistent with the first observation above.

There are a few previous papers that also study trade prices during the recent global recession. Levchenko, Lewis, and Tesar (2010) show the real and nominal declines in U.S. imports and exports for 10 to 15 end-use industries. Outside of commodity sectors (and sectors intensive in the use of commodities as inputs), they find prices to have been relatively stable. Haddad, Harrison, and Hausman (2010) look at the movement in unit values which they calculate at the 6-digit level. For differentiated goods imported into the United States, they find that prices slightly increased. Behrens, Corcos, and Mion (2011) look at unit values for trades with Belgium and find that price declines played a moderate role in the overall decline in Belgian trade. They consider differences in the decline of trade values for differentiated and non-differentiated goods, but do not consider the differential behavior of prices across those categories. Ahn, Amiti, and Weinstein (2011) show that the price of manufacturing exports during the crisis increased relative to the price of domestic manufacturing sales.

Our departure from these papers is that we use BLS good-level price data as compared to unit values or aggregated price indices. We can therefore distinguish between market and intra-firm transactions, better observe differences in the prices charged for differentiated and non-differentiated goods, and speak to the frequency of price adjustment and behavior of prices when conditioned on a price change. By observing price series for particular goods we can isolate price changes from shifts in quality or composition within each sector.[2]

The next section includes a description of our data set and documents average changes in import and export prices at the sector, aggregate, and country levels. We compare these changes with key macroeconomic variables, such as exchange rates, commodity prices, and producer prices, paying particular attention to differences between differentiated and non-differentiated goods and between durable and non-durable goods. We document differences in price responses between arm's length and related party transactions. Next, we study the mechanics behind movements in these average prices, including the frequency of price increases and decreases and the magnitude of the typical price change. Finally, we con-

[2]Levchenko, Lewis, and Tesar (2011) examine whether the trade crisis brought a change in the quality of goods imported into the U.S.

sider alternative margins of adjustment, including substitutions or terminations of existing products.

2 Data on Trade Prices and Trade Volumes

This paper merges transaction-level micro data on trade prices obtained from surveys administered by analysts in the BLS' International Pricing Program from 1993 to 2009 with sector-level data on trade volumes publicly available from the U.S. International Trade Commission (ITC). For more details on the characteristics of the BLS data, see Gopinath and Rigobon (2008). Figure 1 depicts our construction of the import and export price index and compares it to the corresponding BLS indices.[3] Our data on trade values from the ITC exclude services and are not seasonally adjusted.[4]

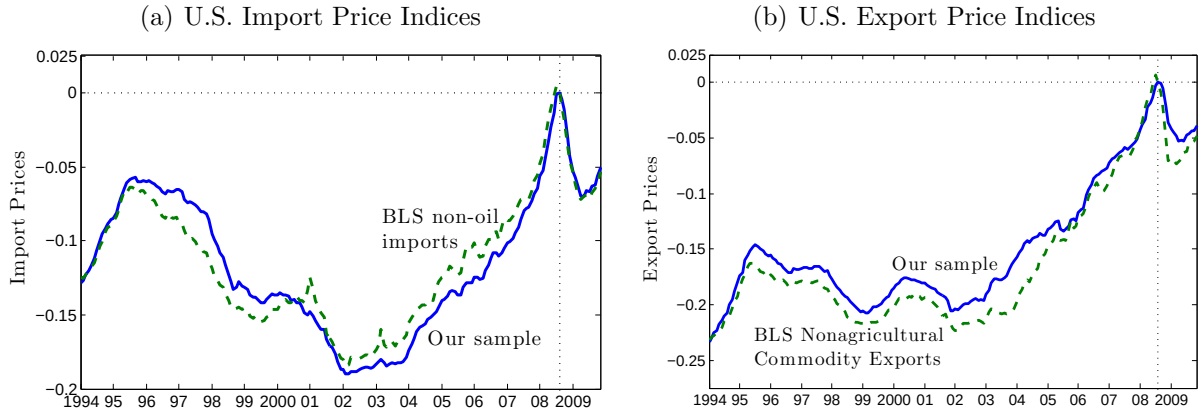


Figure 1: Comparison of GIN and BLS Trade Price Indices

Notes: Log of import and export price indices in U.S. Dollars; August 2008 values normalized to zero.

For various analyses, we divide imports and exports into differentiated and non-differentiated goods using the 2007 version of the Rauch (1999) classification, downloaded from Jon Haveman's International Trade Data web page.[5] We additionally use the concordance from Eaton, Kortum, Neiman, and Romalis (2010) to classify goods as non-manufacturers, durable manufactures, and non-durable manufactures, as well as to distinguish among these manufactures

[3] We constructed the trade price indices used in these plots and elsewhere in this paper using an unweighted average of price changes in market transactions, excluding outliers. While this methodology does not conform exactly with that used in the BLS' aggregated price indices, Figure 1 demonstrates the close fit of our constructed indices with their "non-oil import" and "nonagricultural commodity export" price series.

[4] Seasonally adjusted data are not available at the disaggregated level used for these categories.

[5] Goods traded on an "Organized Exchange" or with "Reference Prices" are considered non-differentiated.

those that are capital, intermediate, or consumer goods. The concordance for these definitions is available at the 2-digit HTS level and indicates what fraction of the sub-sectors in each 2-digit sector falls into each category. We label any given good as belonging to a category if the concordance suggests the label at the 2-digit level applies to more than 70 percent of the sub-sectors. If no category captures more than 70 percent of the 2-digit aggregate, we leave that sector unmarked. Therefore, for all our analyses, the combination of subcategories need not total the full set of prices. For example, some goods are labeled as neither differentiated nor non-differentiated, and the decline in "all" prices need not always lie between the declines in differentiated and non-differentiated good prices.

3 The Behavior of Export and Import Prices

We start by examining import and export price indices, which are impacted by the joint behavior of price stickiness (i.e. whether a price changes or not) and the distribution of price changes conditional on a change. One feature of the data is the large and highly correlated swing in both export and import prices. Figure 2 plots the log of U.S. import and export price indices, measured in U.S. dollars and normalized to zero in August 2008, along with indices capturing the price of oil, the U.S. dollar's trade-weighted exchange rate, and U.S. manufacturing producer prices (PPI). Starting in 2002, the dynamics of all these indices are very closely correlated. After a long period of increase (alongside with U.S. dollar depreciation), they all peaked in July or August 2008, and then sharply declined during the following six months. For example, import and export prices were growing at an annual rate of about 2.5 percent from 2002 to July 2008, then decreased a bit more than 5 percent between September 2008 and March 2009, and finally quickly regained about half of this decline by the end of 2009. The 11 percent decline in the manufacturing U.S. PPI during the corresponding crisis months was twice as large. The swing in oil prices (plotted against the right y-axis) was largest, with prices during the crisis dipping to a level 66 percent below their peak.

These large swings in import and export prices are closely correlated with movements of the U.S. trade-weighted exchange rate, which steadily depreciated between 2002 and July 2008 at an annual rate of 4.5 percent and then appreciated sharply by 15 percent between August 2008 and March 2009. This was followed by a rapid depreciation, although the U.S.

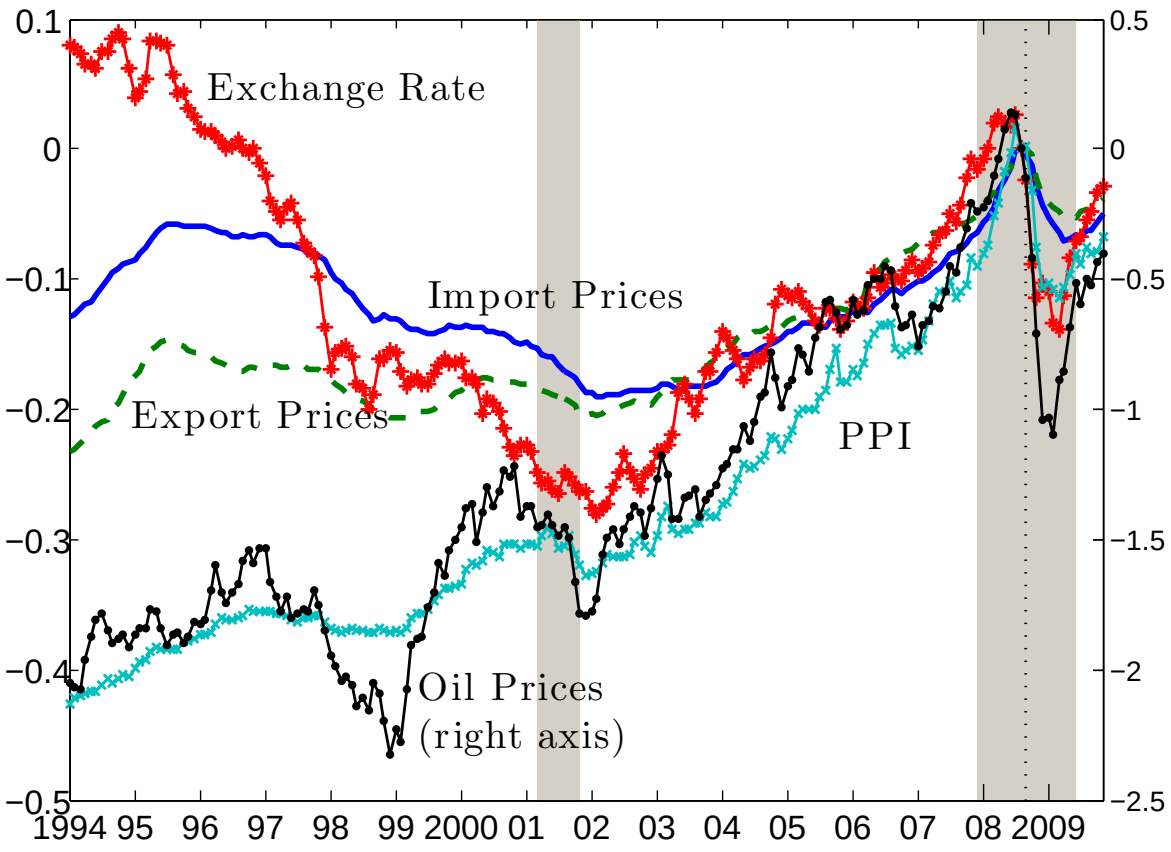


Figure 2: Trade Prices, Producer Prices, Oil Prices, and the Exchange Rate

Notes: Dashed areas mark NBER recession dates; Log index series with August 2008 value normalized to zero; Exchange Rate is broad trade-weighted exchange rate index from FRED; Oil Prices are spot WTI crude oil prices.

trade-weighted exchange rate remained by the end of 2009 more than 5 percent above its July 2008 level. This pattern is representative of most U.S. bilateral exchange rates with the exception of the Japanese Yen, which appreciated 4.6 percent against the dollar in the months of crisis, and the Chinese Yuan, which remained stable relative to the dollar.

3.1 Differentiated and non-differentiated goods

The movement in aggregate price indices masks the very different behavior of prices for differentiated compared with non-differentiated goods. The solid lines in Figure 3(a) plot indices capturing changes in the dollar value of total U.S. imports (M) and the price of those imports (P_M), and the solid lines in Figure 3(b) plot the equivalent for exports. The value

of imports and exports both decline nearly 40 percent in the global recession of 2008-2009, the rightmost shaded region of the plots. Overall import and export prices show a modest decline during this period.

(a) U.S. Import Prices and Values

(b) U.S. Export Prices and Values

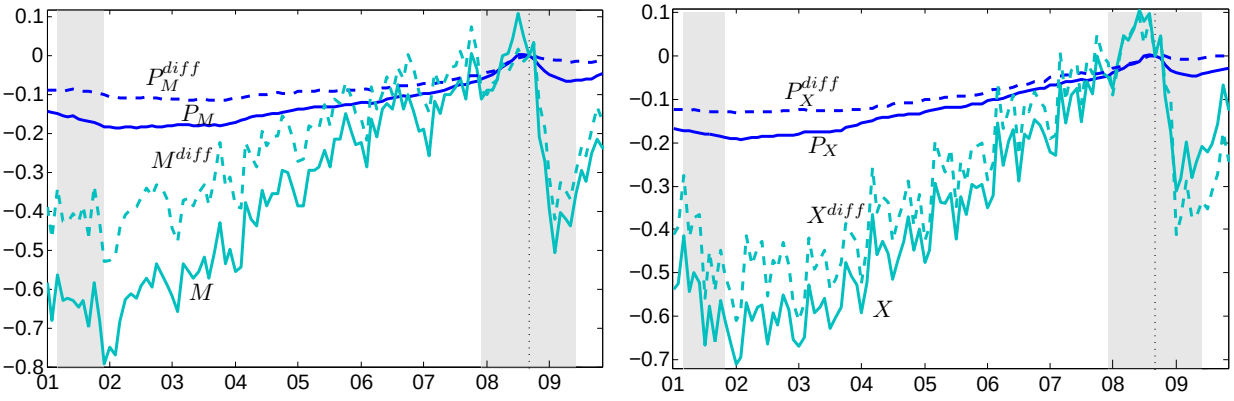


Figure 3: U.S. Trade Prices and Values

Notes: Log index series with August 2008 value normalized to zero.

The picture changes when we strip out differentiated goods using the Rauch (1999) classification and plot these indices using the dashed lines labeled with superscript "diff". The decline in trade values for differentiated goods move largely with the aggregate figures. Differentiated good trade prices, however, do not exhibit the decline witnessed in the aggregated price indices, implying the bulk of price adjustment is due to larger declines in more commodity-like goods traded with reference prices or on organized exchanges. These same patterns hold for the smaller price decline observed in the earlier shaded region identifying the 2001 recession.

Zooming in on the recent recession reinforces this point. Figure 4 shows that declines in the average price of imports and exports are almost entirely driven by price changes among non-differentiated goods. In fact, non-differentiated goods prices declined by about 16 percent for both imports and exports, hence contributing significantly to the overall decrease in trade values for non-differentiated goods. In contrast, the trivial decline by about 1 percent in the prices of differentiated goods contributes almost nothing to the very large declines in the values of trade for these goods, which by implication comes almost entirely from the decline in trade volumes. Table 1 further summarizes the price movements for all traded goods, as well as differentiated and non-differentiated subsamples during the months of the crisis.

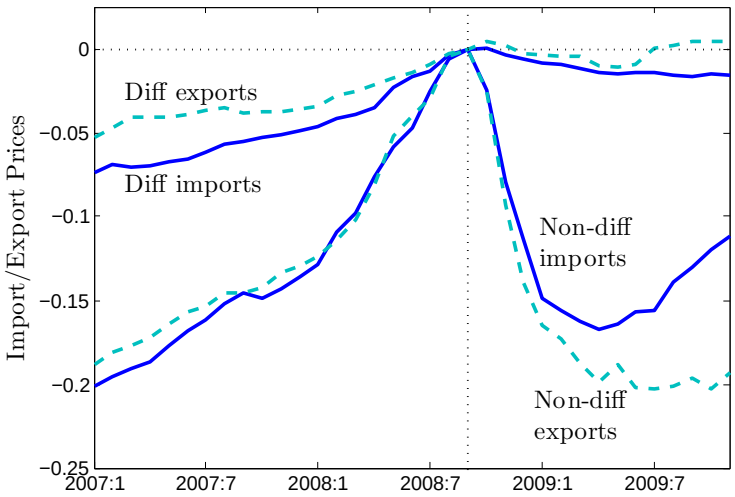


Figure 4: Trade Prices for Differentiated and Non-Differentiated Goods, 2007-2009

Notes: Log index series with August 2008 value normalized to zero.

Table 1: Import and Export Price Changes (%) During Trade Collapse

	2008m9	2008m9 to 2008m11	2008m9 to 2009m2	2008m9 to 2009m3	2008m9 to 2009m11
			IMPORTS		
All	-0.5	-2.9	-5.5	-6.3	-4.9
Non-Diff	-1.3	-8.8	-15.5	-16.1	-11.7
Diff	0.1	-0.3	-0.9	-1.1	-1.5
			EXPORTS		
All	-0.2	-2.1	-4.1	-4.4	-2.9
Non-Diff	-0.6	-8.0	-14.6	-15.7	-12.8
Diff	0.1	0.1	-0.5	-0.6	0.2

3.2 Arm's length and related party transactions

Our analyses thus far only use pricing data from market-based trade transactions. It is well-known, however, that transactions between related parties, or intra-firm trades, account for a large share of total import and export values.[6] Table 2 compares the behavior of market and related party transactions by reporting the price changes between August 2008 and March 2009. Related party prices declined by significantly less than did market transaction prices, but the vast majority of this difference was driven by the smaller decline in intra-firm non-differentiated goods prices. The prices of differentiated goods, whether traded by

[6]See Neiman (2010) for a detailed comparison of arm's length and intra-firm prices in BLS data.

related parties or at arm's length moved by little. For the remainder of the paper, as with the analyses proceeding this subsection, we only use data on market transactions.

Table 2: Changes in Market and Related Party Transaction Prices (%), 2008m9 to 2009m3

	Imports			Exports		
	All	Non-Diff	Diff	All	Non-Diff	Diff
All	-4.4	-13.3	-0.7	-3.8	-13.9	-1.0
Mkt	-6.3	-16.1	-1.1	-4.4	-15.7	-0.6
RP	-2.2	-7.5	-0.3	-2.4	-7.8	-1.7

3.3 Durable and non-durable goods

As emphasized in Eaton, Kortum, Neiman, and Romalis (2010), Levchenko, Lewis, and Tesar (2010), and Alessandria, Kaboski, and Midrigan (2010a), reduced trade values in durable and storable goods played a prominent role in generating the recent global trade collapse.[7] We now look at the changes in trade prices and values of durable versus non-durable goods, both for non-differentiated and differentiated goods. We report changes in trade prices for the period September 2008 to March 2009, as in previous analyses. The trade values are reported from June 2008 to June 2009, however, because we do not want the comparison obscured by seasonality. The second panel of Table 3 divides imported goods into three categories: non-manufactures (S), non-durable manufactured goods (N), and durable manufactured goods (D). The left panel shows changes in import prices while the right panel shows changes in import values. We refer to the non-manufactured good category with an 'S' because it includes services, but we note that it also includes commodities such as oil products, which is why it features the largest price declines.

The value of trade in durable goods fell substantially more than did trade in non-durables for differentiated and non-differentiated goods alike. Within non-differentiated goods, durable prices dropped by significantly more than non-durables, and we suspect this reflects a large commodity content in non-differentiated durables. Once we focus on the sub-sample of differentiated goods, however, the price declines for both non-durable and durable goods are equally small.

[7] See Engel and Wang (2011) for an analysis of how the intensity of durables in international trade impacts the dynamic properties of trade values more generally.

Table 3: Changes in Import Prices and Values (%) by Type and End-Use

	Prices			Values		
	All	Non-Diff	Diff	All	Non-Diff	Diff
All	-6.3	-16.1	-1.1	-32.7	-48.0	-24.4
Non-manufactures (S)	-31.5	-15.5	-3.9	-49.8	-54.1	-21.3
Non-durables (N)	-3.8	-8.3	-0.3	-16.3	-19.7	-18.5
Durables (D)	-4.3	-36.1	-1.3	-29.5	-49.9	-26.4
Consumption-N	-2.6	-5.6	-0.2	-12.0	-15.2	-14.7
Intermediate-N	-1.1	-1.9	0.0	-19.9	-21.9	-8.1
Capital-D	-1.1	—	-0.7	-22.4	—	-23.1
Consumption-D	1.1	—	1.2	-24.3	—	-24.0
Intermediate-D	-18.4	-34.0	-9.6	-60.2	-64.7	-39.3

Table 4: Changes in Export Prices and Values (%) by Type and End-Use

	Prices			Values		
	All	Non-Diff	Diff	All	Non-Diff	Diff
All	-4.4	-15.7	-0.6	-26.8	-31.1	-34.7
Non-manufactures (S)	-14.4	-12.6	-17.9	-40.8	-30.7	-41.2
Non-durables (N)	-8.4	-11.7	-3.4	-14.5	-24.3	-15.9
Durables (D)	-2.0	-31.2	0.4	-28.8	-42.2	-38.3
Consumption-N	-9.2	-11.2	-8.4	-11.2	-18.9	-14.7
Intermediate-N	-0.2	-0.5	4.9	-14.1	-16.1	-3.5
Capital-D	-0.2	—	0.8	-23.5	—	-51.4
Consumption-D	0.0	—	0.3	-19.3	—	-19.6
Intermediate-D	-19.8	-33.7	-4.7	-42.8	-46.2	-26.4

Next, the lower panel of Table 3 splits all manufactured goods into five end-use categories. We divide the non-durable manufactures into consumer (Con-N) and intermediate (Int-N) goods categories and divide durables into capital (Cap-D), consumer (Con-D), and intermediate (Int-D) goods categories. Among capital and consumption durables there are no non-differentiated goods at all. The price changes for differentiated durables in these two categories are all less than 1.2 percent. The only category of differentiated durables which features a significant price decline is differentiated durable intermediates. These goods constitute a very small share of total differentiated durables and likely have a high commodity component in their cost structure as would be the case with, say, copper wire.[8]

Table 4 shows these same calculations for export prices and values. As with imports,

[8]Prior to the crisis, trade in intermediate goods represented only 5 percent of differentiated durable manufacturing imports and 2 percent of differentiated durable exports.

though trade value declines were large within all subsamples of manufactured goods, particularly durables, large manufacturing price declines were generally concentrated only in the non-differentiated goods. The behavior of durable and non-durable differentiated manufacturing import and export prices were hardly distinguishable from each other.

Table 5: Changes in Trade Prices (%) by Country, 2008m9 to 2009m3

	Imports			Exports		
	All	Non-Diff	Diff	All	Non-Diff	Diff
All	-6.3	-16.1	-1.1	-4.4	-15.7	-0.6
Canada	-23.3	-20.8	-7.5	-3.3	-10.9	-1.6
Mexico	-6.4	-6.2	0.1	-7.1	-13.3	-1.7
France	0.5	0.5	1.6	1.2	-15.5	3.3
Germany	-8.1	-7.7	-5.5	-2.9	-6.8	-2.0
Ireland	1.2	1.2	0.0	4.0	1.1	8.4
Italy	-3.9	-3.8	-5.5	-5.5	-9.6	0.0
Spain	-3.9	-3.8	-8.1	-4.1	-2.4	-0.6
Sweden	-2.1	-2.1	-3.0	-1.0	-0.9	-1.9
Switzerland	-6.2	-6.0	-5.0	0.3	-1.2	-3.0
U.K.	-9.0	-8.6	0.1	-0.3	-8.2	3.1
China	0.2	0.2	0.7	-17.1	-40.4	-2.0
Hong Kong	-0.8	-0.8	-0.2	-12.3	-18.4	-7.3
India	-3.1	-3.1	-1.2	-3.1	2.3	-0.7
Japan	2.8	2.9	3.0	1.3	-2.4	2.5
South Korea	-3.4	-3.4	-1.0	-5.7	-14.8	0.3
Taiwan	0.1	0.1	0.5	-4.1	-10.4	-0.2
Australia	-11.5	-10.9	-2.2	-2.9	-12.6	-3.1
Argentina	-17.9	-16.4	0.5	-0.2	-14.6	3.9
Brazil	-13.8	-12.9	3.6	-3.4	-6.4	6.6
Russia	-37.4	-31.2	2.8	-5.1	-6.9	-3.5
South Africa	-30.6	-26.4	0.0	2.2	12.5	2.4

3.4 Cross-country evidence

Finally, we consider the possibility of different pricing patters across source countries for U.S. imports and destination countries for U.S. exports. Table 5 provides evidence on trade prices for some of the largest U.S. trade partners, organized by geographic location. For all export destinations, differentiated good prices did not decrease much and in general do not show much variation. The price of differentiated imports from some European countries and Canada did have moderate decreases (of about 6 percent), but this decline still significantly

lags that in corresponding trade values. For the European source countries the decline in differentiated goods prices likely reflects relatively high pass-through of the depreciation of the Euro into U.S. Dollar import prices, while for Canada it likely reflects high content of commodity-intensive goods in their differentiated exports to the U.S. Notably, overall import price indices from many developing countries outside of Asia decreased substantially, but their import price indices for differentiated goods did not decline. All in all, differentiated good prices did not change significantly, regardless of their source or destination.

3.5 A look at the cross-section

Our initial look at the data suggests that there was a very limited trade price movement for both differentiated imports and exports, leaving the bulk of the differentiated trade value collapse due to reduced quantities. Non-differentiated trade value declines, by contrast, involved significant adjustment of prices. This characterization remains accurate and representative even when considering different relationship structures between trading parties, different end-uses of the goods, and different locations of the trading partners. We now merge our pricing data with trade value data at the 4-digit HTS sector level to further assess whether there is significant heterogeneity in price adjustment within differentiated and non-differentiated manufactures.

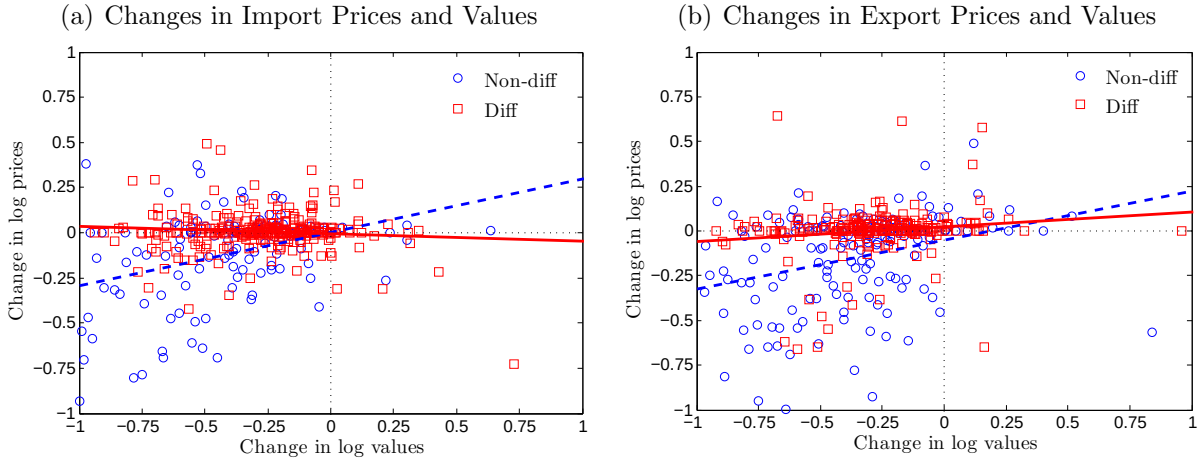


Figure 5: Trade Adjustment in Differentiated and Non-Differentiated Sectors

Notes: Sample is as described in the text; OLS regression lines.

Figure 5(a) is a scatter-plot of the changes in import prices and trade values from

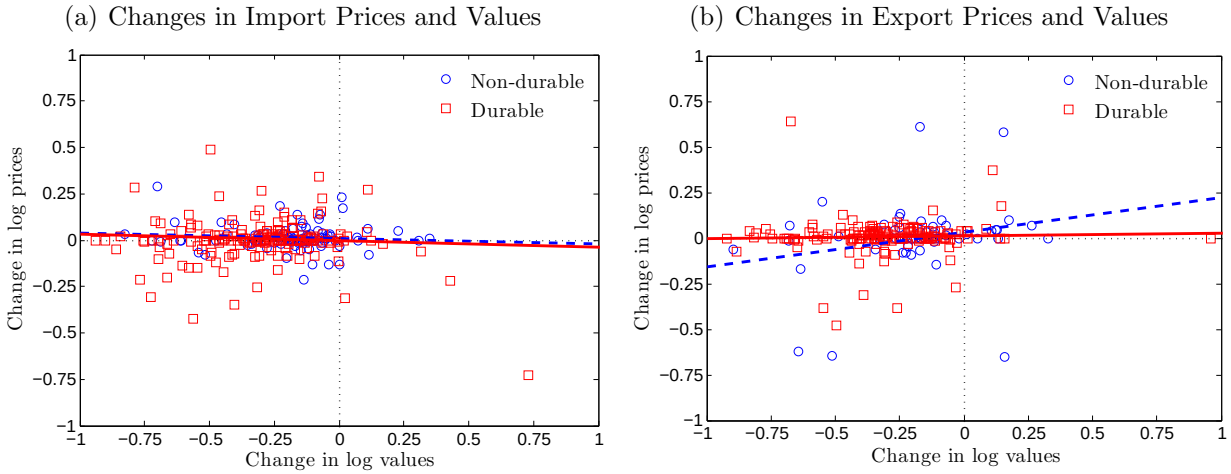


Figure 6: Trade Adjustment in Durable and Non-Durable Sectors

Notes: Differentiated sectors subsample; OLS regression lines.

July 2008 to June 2009, where blue circles correspond to 4-digit sectors that contain non-differentiated goods and red squares correspond to those containing differentiated goods.[9] Most squares and circles are located in the left half of the plot since most sectors exhibited large declines in trade values (the median declines in import values for differentiated and non-differentiated sectors were 22.1 and 39.9 percent). The two sectors clearly exhibit different pricing behavior, however, as can be seen in the differing slopes of the lines fitting the circles and the squares and reported in Table 6. Non-differentiated sectors experiencing larger declines typically also experienced larger price declines, while this relation is not found among differentiated goods. Figure 5(b) shows the same relationships for exports. Overall, heterogeneity in trade price changes can explain a sizable amount (about 30 percent, as reflected by the corresponding regression slopes) of the heterogeneity in trade value changes for non-differentiated goods, but zero of the heterogeneity in trade value changes for differentiated sectors.

Figure 6 considers the same analysis but now splits the differentiated good subsample into into durable (red squares) and non-durable (blue circles) sectors. Though the blue dotted line for non-durable exports is upward sloping, Table 6 shows that none of these four best

[9] Among the 1209 4-digit import sectors for which we have data on quantities, price data is available for 567 sectors. We further exclude a few price and quantity changes which exceed 2 log points. This constitutes our subsample. Within our subsample, 302 sectors are differentiated and 149 sectors are non-differentiated, while the remaining 116 sectors are unclassified. For 56 differentiated and 18 non-differentiated sectors the sectoral price change over the sample period is zero. Among the differentiated sectors, 179 are durable, 96 are non-durable, and 27 are unclassified. Similar patterns hold for exports.

Table 6: Regression Coefficient of Change in Prices on Change in Quantities

	Imports				Exports			
	Non-Diff	Diff			Non-Diff	Diff		
		All	Non-Dur	Durable		All	Non-Dur	Durable
OLS	0.29	−0.04	−0.03	−0.04	0.27	0.08	0.19	0.02
	(0.07)	(0.03)	(0.03)	(0.04)	(0.07)	(0.04)	(0.11)	(0.03)
OLS, no zeros		−0.05	−0.05	−0.05		0.12	0.22	0.03
Median	0.33	−0.00	−0.01	−0.00	0.23	−0.00	0.09	−0.01

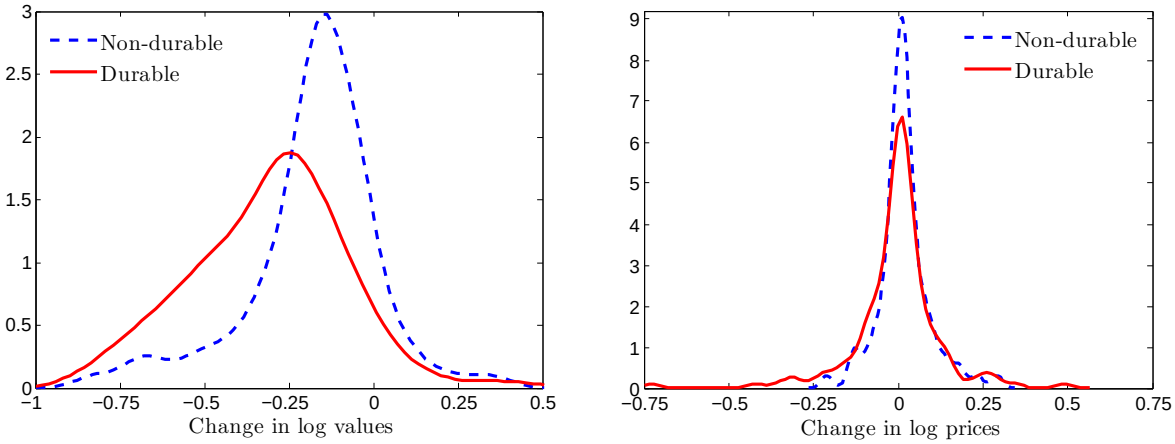
Notes: Sample is as described in the text; Standard errors for OLS specification in brackets; "No zeros" restricts the sample to sectors with a non-zero change in prices; "Median" is quantile median regression.

fit lines is statistically different from zero. This is unlike Figure 5, where both lines for the non-differentiated goods were statistically significant. Variation in prices across durable and non-durable manufactures does not systematically contribute to the differential decline in trade values across these two sectors.

Figure 7(a) plots the kernel densities of changes in import values and prices across durable and non-durable manufacturing sectors within the set of differentiated goods over the same period. Figure 7(b) plots these densities for exports. The distributions denoted with solid lines in the left panels are clearly shifted to the left of the dotted lines, indicating that durable sectors experienced significantly larger import value declines. Specifically, for differentiated imports, the median decline in sectoral trade values was 26.0 percent for durables and 14.7 percent for non-durables. The right panels, however, show price change distributions that are almost identical for the case of imports and equally centered at zero in the case of exports.

In sum, even when considering the significant heterogeneity present in levels of trade adjustment at the 4-digit HTS level, we find that distinguishing between differentiated and non-differentiated goods does a good job of characterizing the role played by price changes in declining trade values. Additional information, such as the durability of the good, gives information on the scale of the quantity decline, but not on the scale of the price decline.

(a) Imports: Values and Prices



(b) Exports: Values and Prices

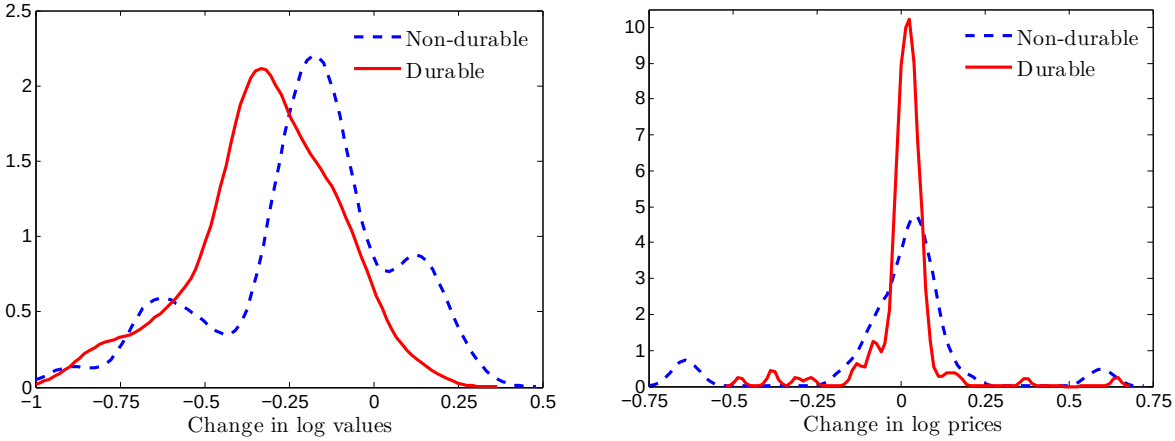


Figure 7: Kernel Densities of Adjustment in Durable and Non-Durables Sectors

Notes: Differentiated sectors with non-zero price changes.

4 The Mechanics of Price Adjustment

In this section, we make use of the micro data to understand how differences in stickiness or the scale of non-zero price changes produce the above movements in aggregated price indices.

4.1 Frequency and size of price adjustment

Figure 8 plots a 12-month moving average of the frequency of price adjustment, price increases, and price decreases in different subsamples: upper (lower) panels for imports (exports) and left (right) panels for all (differentiated) goods.[10] The solid blue line which

[10]Without smoothing, the series are too volatile and have very strong seasonality.

captures decreases, for example, is the percentage of total observed prices that are smaller than the previously observed price. The percentage of prices which do not change equals one minus the value of the solid black line (which itself equals to the sum of the other two lines).

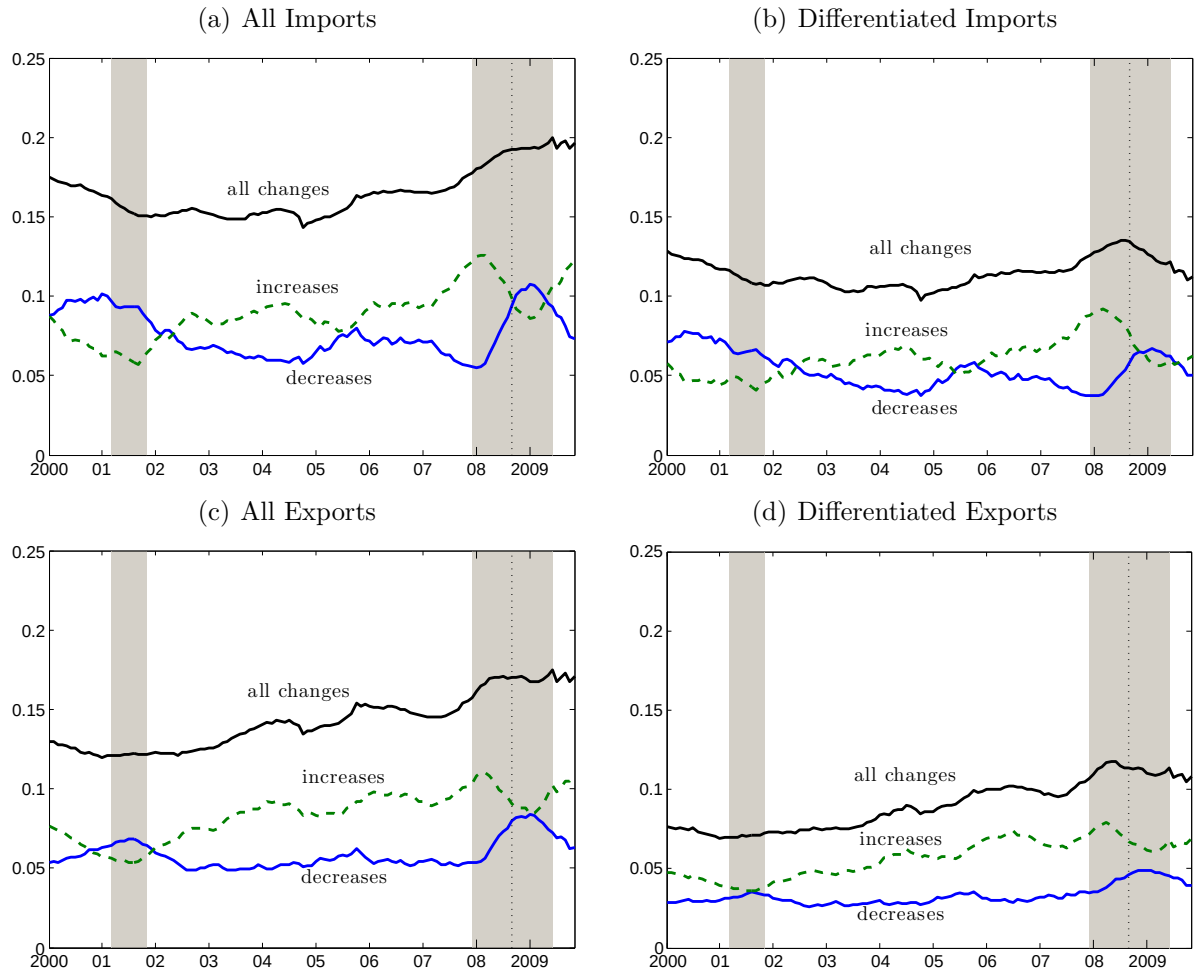


Figure 8: Price Adjustment Frequencies

Notes: 12-month moving average of monthly frequency of price adjustment.

The frequency of price changes increased in the months of the recent crisis for imports and exports, and this holds both for the set of all goods as well as for the set restricted to differentiated goods. This change is most apparent when looking at the increasing frequency of price decreases and the decreasing frequency of price increases. Quite surprisingly given our earlier results, these patterns are comparably strong for differentiated goods as in the full subsample, with the primary difference between the two being the lower average frequency

of price adjustment for differentiated goods.

The observed patterns favor a state-dependent view of price adjustment because the adjustment frequencies appear to respond endogenously to the underlying shocks. The patterns are also directionally consistent with a decline in the corresponding price indices. However, the scale of these movements is quite small and does not stand out relative to other high frequency swings in the series (such as seasonality in the raw series). For example, in the months of the crisis, the moving average of the frequency of decreases reached its peak at 10.7 percent while it pre-crisis low was 5.6 percent. Even the larger of the two frequencies suggests significant amounts of nominal rigidity, consistent with the stability of most trade prices during the trade crisis.

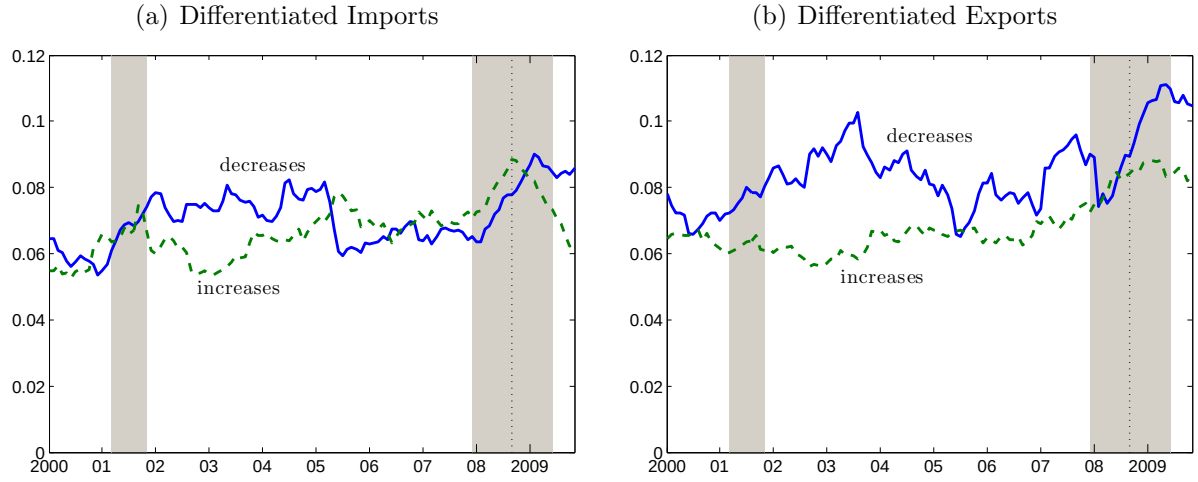


Figure 9: Price Adjustment Magnitudes for Differentiated Goods

Notes: 12-month moving average of average absolute size of log price changes.

Figure 9 plots a 12-month moving average of the average absolute size of price adjustment and separates this measure for price increases and decreases. The left panel shows the results for imports of differentiated goods, while the right panel covers differentiated goods exports. The patterns are similar qualitatively for the full sample and non-differentiated goods (not shown), but the magnitudes are significantly larger for non-differentiated goods.[11]

At the onset of recession, the absolute size of price adjustment increases for both price

[11]For example, the average absolute size of price decline for differentiated goods increases from 6.4 percent before the crisis to a peak of 9.0 percent in the months of the crisis, while in the full sample which incorporates both differentiated and non-differentiated the average absolute size of price declines increase from 7.2 percent to 11.7 percent. It appears that the very large size of price decreases was the key driver of sharp reduction in the price index of non-differentiated goods.

hikes and price cuts, perhaps implying that that there was an increase in the dispersion of cost shocks. Further into the recession, the average size of price decreases exceeds the average size of price increases, though the magnitudes for both types of price changes are not very large. Coupled with low frequency of price adjustment, this explains why there was only a muted decline in prices at the aggregate for differentiated goods.

Finally, we note that the patterns of frequency and size of price adjustment that we document for the current crisis were to some extent also observed during the 2001 recession (with the exception of the trending decline in frequency in the early 2000s). During the 2001 recession, prices decreased more often and increased less often, while the absolute size of price decreases (and increases in the case of imports) also went up.

4.2 Extensive Margin

As highlighted in Gopinath and Neiman (2011) and Bernard, Jensen, Redding, and Schott (2009), the bulk of high frequency trade adjustment takes place via the intensive margin. The economy as a whole typically does not quickly stop importing or exporting products which previously accounted for a large share of trade. The BLS data we use are not well equipped to evaluate the importance of the extensive margin for aggregate adjustment because it is sampled and constitutes only a small subset of total U.S. trade. Nonetheless, we now consider whether the churning of products with prices surveyed by the BLS changed at all during the recession.

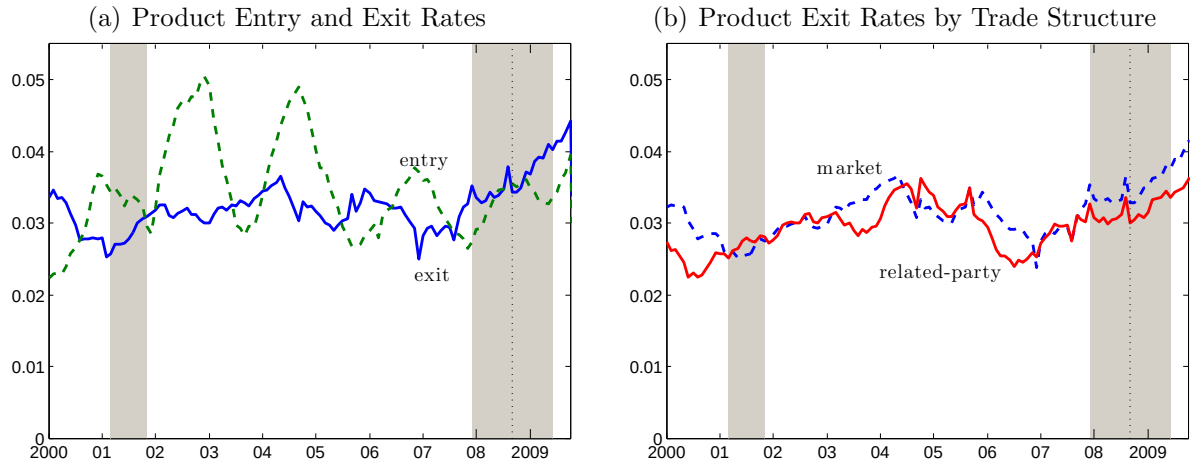


Figure 10: Product Extensive Margin for Differentiated Goods in BLS Data

Notes: 12-month moving average of product exit and entry to continuation ratios.

Figure 10(a) plots the 12-month moving average of the number of product entries and exits relative to the total number of products in the previous period. Both entry and exit rates are low, averaging 3-4 percent in any given month. There is some evidence of an increase in product churn during the recent recession, as both entry and exit rates increase by 1–2 percent, but this trend is not quantitatively very pronounced. The highest level of product exits in the recent recession still remained below levels seen in the late 1990s and the rate of product entry hovered near its sample average. Figure 10(b) disaggregates the differentiated good exit rate between arm's length and intrafirm trades. There is some evidence in other measures that intrafirm and arm's length trades responded somewhat differently to the crisis, but their patterns of differentiated product discontinuation appear highly similar. In sum, it appears unlikely that the conclusions we draw from comparisons of BLS prices, which would not capture extensive margin adjustment, with trade values obtained from U.S. customs data, which do reflect extensive margin adjustments, are impacted by firm or product churning during the recession.

5 Conclusion

Starting in the summer of 2008, the dollar value of international trade plunged relative to the scale of economic activity and was likely the biggest such decline since the Great Depression. A large literature has characterized this Great Trade Collapse of 2008-2009 and built models seeking to explain the decline and relate it to the broader global recession. Prior studies which approximate prices by measuring unit values at more aggregated levels may conflate price changes with changes in the composition or quality of traded goods. Relative to this literature, we offer new information on the behavior of U.S. trade prices, measured at the individual good level.

This micro-data allows us to focus on the difference between differentiated and non-differentiated goods, and we show that this distinction is crucial for understanding the extent to which price declines contributed to the decline in trade values. Though price declines contributed to the overall trade collapse, the sharp reduction in differentiated goods trade was entirely a quantity-driven phenomenon. The typical differentiated manufacturing good sector shipped 30 percent less physical goods across the U.S. border without any corresponding reduction in the price of those goods. This stability of trade prices was equally apparent

in differentiated durables and non-durables sectors, even though the decline in trade values was far more dramatic for durables. In contrast, differences in price changes can explain a moderate share of the different trade patterns in the non-differentiated sectors. Finally, we also document the mechanics of price changes such as the size of changes, their frequency, and the relative share of price increases and decreases, and show how these characteristics of pricing dynamics all changed with the onset of the trade crisis.

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