Export Responses to Real Exchange Rate Fluctuations: Development Status and Exported Good Effects*

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Abstract

Do exports expand after depreciations? If so, by how much? And do they react differently to such fluctuations depending on the development status of the traders or the type of the exported good? This paper estimates the export response to real fluctuations in exchange rates using a bilateral sample of 136 countries (34 high-income and 102 developing) for the period 1981-1997. Exploiting yearly country-pair variation of the real exchange rate and sectoral bilateral export flows, I estimate the distribution of real exchange rate elasticities of exports by exporter and by sector. The estimated exporter-level elasticities are broadly consistent with existing estimates of unity price elasticities for trade among high-income countries and well below unity for developing countries (from, e.g., Hooper and Marquez, 1995 and Reinhart, 1994). Notably, though, the elasticity for high-income countries (including export flows to the entire sample) is significantly lower than the consensus of one at only 0.13. Novel to the empirical literature, I find a sectoral differential in elasticities in which differentiated sectors have a larger elasticity than homogeneous sectors. The differential holds as long as high-income countries are included in the sample and is larger when high-income countries are exporters as opposed to importers in the sample. Export elasticities from this paper inform the current puzzle in international economics in which the trade literature supports high values and international macro supports low values of the substitution elasticity between domestic and foreign goods. Estimates from this exercise are at the low end of the range of estimated substitution elasticities. Lastly the evidence is consistent with credit constraints for developing countries and contradicts stylized theories of sectoral export behavior.

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1 Introduction

Despite the predictions of purchasing power parity theory, it is a well documented fact that the real exchange rate between countries fluctuates over time.[1] Real fluctuations in relative prices of countries have various impacts on their economies and their trade flows. Ex ante the overall effect of these fluctuations is not obvious, and the empirical literature is not conclusive on the overall impact of real exchange rate fluctuations. A positive effect of a real depreciation has been found at the firm and sectoral level but the effect at the aggregate level has been found to be positive and negative in different countries.[2]

In this paper we focus on the *export* response to real exchange rate fluctuations. The gravity model of trade frames this study and real exchange rate fluctuations are interpreted as changes in trade barriers between trading partners. In particular, I focus on the disaggregated export effect by development status of the trading partners and by type of sector involved in trade. Given the rise of some developing countries in world trade and the change in the composition of world trade during the last decades it is important to understand how export responses to shocks may vary by trading partners and by sectors to explain aggregate responses.[3] Moreover this exercise informs the existing debate on the substitution elasticity between domestic and foreign goods in international economics. Calibrations of international macroeconomic models that study real business cycles suggest that values of

[1] For comprehensive work on this matter see Rogoff (1996).

[2] For a sectoral level study see Krueger and Tornell (1999). For firm level studies see Aguiar (2005), Forbes (2002a, 2002b), and Desai, Foley, and Forbes (2004). For the aggregate effect on output see Agenor and Montiel (1996), Gupta, Mishra, and Sahay (2000), and Calvo and Reinhart (2000).

[3] For example Mann and Pluck (2007) point out that the share of US imports from China increased from 0 to 13 percent between 1980 and 2004. Krugman and Obstfeld (2005) illustrate how agricultural exports from developing countries decreased from 60 to 10 percent between 1960 and 2000 while manufactures increased from 10 to over 60 percent.

this elasticity between 1 and 2 are appropriate. Alternatively, trade models that study trade patterns and the impact of tariffs and trade liberalizations suggest that values of the elasticity of substitution between 10 and 15 are appropriate.[4] Lastly the disaggregated export responses will be used to inform which theories best capture the behavior of trading partners and sectors.

The estimates of the export response to fluctuations in real exchange rates use a sample of 136 countries (34 high-income and 102 developing) for the period 1981-1997 for 440 sectors. The long term panel allows for an identification strategy which exploits variation within country pairs in the real bilateral exchange rate and (sectoral) trade flows, beyond time and sector specific factors, over the sampled period. Four samples are studied, varying with the development status of the exporter and importer country: the "HI" sample includes exporter and importer countries from the high-income group, the "HI&MIX" sample includes exporters from the high-income group but importers from the high-income and developing country groups, and the "DC" and "DC&MIX" samples are built similarly for developing countries. Sectoral trade is classified in three main categories: homogeneous, reference-price and differentiated.[5]

For a sample of developed countries included in the HI&MIX sample, Hooper and Marquez (1995) present a comprehensive review of existing estimates from studies using a version of the imperfect-subsitutes model standard in this literature.[6] Overall, the consensus estimate of long-run price elasticities for exports and imports is around one for the US, Japan and Germany (see their Table 4.2 for details), with substantial variation across studies. Hooper and Marquez determine that certain characteristics within the US studies affect the estimates. The use of data for the pre-floating exchange rate period (before 1973) delivers larger elasticities, significant for imports and not for exports. Yearly versus semiannual or quarterly data deliver significantly larger elasticities for exports. The exclusion of lags delivers insignificantly larger export elasticities and significantly smaller import elasticities.

[4] I use the stated values for the elasticity puzzle that Ruhl (2008) offers.

[5] Section 4 describes this classification further.

[6] Note that I will mostly highlight estimates of price elasticities of exports from the literature, even though the literature also studies price elasticities for imports and income elasticities for exports and imports. The elasticities are presented here with positive signs to allow direct comparison with my estimates.

On the other hand, the use of OLS versus simultaneous equations that treat prices endogenously delivers similar results in the studies of the US price elasticities. Similarly, accounting for cointegration (like Clarida 1994) does not substantially change the estimates.

For a sample of developing countries included in the DC&MIX sample, Reinhart (1994) explains how literature from the 1970s and 1980s provided evidence that relative prices, affected by devaluations, have a significant impact on trade flows. This typically comes from static or long-run specifications where imports and exports are determined within an imperfect-substitutes model. Reinhart discusses how during the early 1990s time-series issues were considered, and studies found no significant effects of relative prices on trade balance or export growth. Reinhart herself, using a cointegration approach and an intertemporal optimizing version of a standard trade flow model, estimates mostly significant long-run price elasticities of imports and exports well below unity. Her findings seem to agree with the pessimistic view from the 1950s and 1960s on the export response of developing countries.[7]

Similar to our study in its bilateral nature, Bayoumi (1999) conducts a bilateral trade study using a reduced sample of 21 industrialized economies (included in our HI sample) for 1965-1992 and estimates significant export response elasticities ranging from 0.31 contemporaneously to 0.79 after four years. Closer to our study in sector and country grouping, Mann and Pluck (2007) perform a sectoral analysis of trade elasticities using US bilateral trade with 31 countries in four commodity groups (sectors) for 1980-2003. Different relative price elasticities for exports from the US to industrial countries (part of our HI sample) are found for the four sectors (between 0 and 1.6 in the long-run and between 0 and 0.9 in the short-run) while estimates for developing countries (part of our HI&MIX sample) are mostly close to zero and insignificant for all four sectors.[8]

[7] Ghei and Pritchett (1999) summarize the pessimistic view of the 1950s and 1960s. They explain how some economists, based on the work of Myrdal, Prebisch, and Singer, were pessimistic about the ability of changes in the real exchange rate to improve the trade balance. Orcutt (1950) surveys and critiques the estimation of the elasticities performed during the 1940s. He explains that the estimated price elasticities of exports were between zero and 0.5.

[8] Within the literature mentioned so far, most of the export elasticities are estimated with respect to relative price of exports, while this paper uses the real exchange rate. One advantage of using real exchange rate is its availability for the large sample of countries and years used in this study. Moreover the employed measure indicates the bilateral level of competitiveness between exporter and importer which I argue better

This study delivers two main findings. First, the export response to real exchange rate fluctuations of an average exporter in the HI sample is 0.67, in HI&MIX sample is 0.13, in DC sample is 0.18 and in DC&MIX sample is 0.15, all significantly different from zero. Findings are broadly consistent with existing estimates of elasticities of around one for high-income countries and well below unity for developing countries and further have the advantage of being derived under a uniform methodology for all four samples. Note though that our estimate for the HI&MIX sample is lower than estimates reported by Hooper and Marquez (1995) and is more aligned with estimates from Mann and Pluck (2007) who find nil responses of US exports going to developing countries.

Our second main finding relates to sectoral differences in export responses. Overall, exports of differentiated sectors are found to respond more to real exchange rate fluctuations than those of homogeneous sectors, with the differential between sectors varying by country group. For the HI sample the average differentiated sector export response elasticity is 0.56 while average homogeneous sector response is 0.02, and for the HI&MIX sample the respective responses are 0.20 and 0.05. Alternatively for the DC sample we find, respectively, 0.04 and 0.03, and for the DC&MIX sample we find 0.05 and 0.03. The export responses in differentiated sectors are significantly larger than those of homogeneous sectors in all samples except DC. In other words, as long as high-income countries are included in the sample, we observe a sectoral differential, which is larger when high-income countries are exporters as opposed to importers in the sample. While previous literature presents some evidence on sectoral trade responses, the sectoral classification in this paper is different and more detailed which makes comparisons difficult. Interestingly, both the literature and this study find large differences in export responses to real exchange rate fluctuations between sectors.

Export elasticities from this paper also inform the puzzle in international economics where the trade literature supports high values and international macro supports low values of the substitution elasticity between domestic and foreign goods.[9] Estimates from this

avoids endogeneity/simultaneity issues, in particular with respect to sectoral bilateral trade.

[9] See Ruhl (2008) for a detailed discussion of the puzzle and relevant cites.

exercise are at the low end of the range of estimated substitution elasticities. Elasticity estimates for the average exporter and the average sector in the studied samples are between zero and one.

2 Related Theories

The analysis in this paper provides empirical evidence for two groups of theories that offer predictions for export fluctuations. First, we focus on theories related to the development status of the trading partners, and second we focus on a theory with predictions on sectoral export responses. The literature on the importance of the development status of a country for export expansions discusses credit constraints of exporting developing countries. For example, Calvo and Reinhart (2000) propose a simple model where a devaluation in an emerging market implies limited international credit access, which can lead to a contraction in output rather than an export-led boom. Moreover, for an importer country, a story of credit constrains predicts that developing countries wouldn't be able to fully increase their imports when they experience bilateral appreciations. As developing countries are more vulnerable to credit constraints, they are expected to show a smaller export and import response than high-income countries.

Developing countries have larger fluctuations in bilateral real exchange rates than high-income countries. Orcutt (1950) argues that small fluctuations in real exchange rates may be ignored which implies that high-income countries should have smaller export responses than developing countries. Along similar lines, large real exchange rate fluctuations may be accompanied by large shocks that speed up the process of creative-destruction in the economy as described by Schumpeter (1942). Such shocks may push the economy to a higher production frontier as new technologies may be adopted (and old technologies may be scratched). Overall, contrary to the credit constraint story, this implies that developing countries should show a larger export response based on the larger fluctuations of real exchange rate that they face.

Second, regarding the literature on homogeneous and differentiated sectors, Krugman

(1980) develops a benchmark model where all firms are identical and every firm exports to every country as there is only a variable cost of trade. Given that consumers have a preference for variety, identical countries trade the differentiated goods (by country of origin) even though there are costs of trade. The implied gravity equation from this model is:

$$Exports_{ij} = \frac{Constant * GDP_i * GDP_j}{(tradebarriers_{ij})^{\sigma}} \tag{1}$$

where i represents the exporter country, j represents the importer country and σ is the elasticity of substitution between domestic and foreign goods. Krugman's model implies that the substitution elasticity can be recovered by the partial derivative of bilateral exports with respect to variable trade barriers:

$$\frac{-\partial \ln(Exports_{ij})}{\partial \ln(tradebarriers_{ij})} = \sigma \tag{2}$$

Within this model a higher σ implies a higher impact of trade barriers on bilateral exports. This prediction will be evaluated by using the real exchange rate to measure variable trade barriers. Krugman (1980) predicts that exports in more substitutable sectors (homogeneous) respond more than those in less substitutable sectors (differentiated) to changes in trade barriers.

3 Real Exchange Rate as a Measure of Trade Resistance

Tinbergen (1962) first estimated gravity equations of international bilateral trade flows, and since then the literature developed theoretical foundations and improved the estimation techniques of this model.[10] In essence the gravity formulation specifies that the volume of trade between two countries is proportional to their economic scale conditioning on measures of trade resistance between the countries. The equation for the bilateral trade flows T_{ijt}

[10] For some examples of these developments see Anderson (1979), Helpman and Krugman (1985), Helpman (1987), Feenstra (2002), Anderson and van Wincoop (2003), and Helpman, Melitz, and Rubinstein (2008).

delivers the estimating equation:

$$\ln(T_{ijt}) = \beta_1 \ln(Y_{jt}) + \beta_2 \ln(Y_{it}) + \gamma \ln(D_{ijt}) + \theta_{ij} + \tau_t + \varepsilon_{ijt} \quad (3)$$

where Y_{jt} is the GDP of the importer at time t, Y_{it} is the GDP of the exporter at time t, D_{ijt} is a time-variable measure of trade resistance or distance between the exporter and the importer, θ_{ij} represents country-pair specific measures of trade resistance that affect bilateral trade, τ_t represents a time specific effect on trade, and ε_{ijt} represents country-pair-year specific error. As additional measures of time-varying exporter and importer activity we add GDP per capita of the exporter and the importer represented as y_{it} and y_{jt}. As mentioned this paper interprets the real exchange rate between a pair of countries, RER_{ijt}, as a measure of trade resistance or distance between them.[11] Therefore the gravity equation becomes:

$$\begin{aligned} \ln(T_{ijt}) &= \beta_1 \ln(Y_{jt}) + \beta_2 \ln(Y_{it}) + \beta_3 \ln(y_{jt}) + \beta_4 \ln(y_{it}) \\ &\quad + \eta \ln(RER_{ijt}) + \mu \ln(d_{ijt}) + \theta_{ij} + \tau_t + \varepsilon_{ijt} \end{aligned} \quad (4)$$

where d_{ijt} measures the traditional forms of distance between exporter and importer such as the presence of a Free Trade Agreement (FTA).[12] η, the real exchange rate elasticity of exports, is the parameter of interest in our estimation which captures the export response (from country i to j) to fluctuations in the bilateral real exchange rate.

Alternatively, we may consider that the underlying data generating process may be dynamic, where current exports evolve depending on the difference between the equilibrium level of exports and their previous year's level. Such dynamic process calls for the lags of the dependent variable to be used as explanatory variables as well. Section 6 discusses the estimation of such model in this context and it shows that our coefficient of interest, η, is

[11] Bayoumi (1999) follows a similar procedure to obtain the real exchange rate elasticity. Feenstra (1989) finds supporting evidence for the symmetric pass-through of tariffs and exchange rates on US import prices of Japanese cars, trucks and motorcycles. Even though this paper looks into fluctuations in *real* exchange rates, Feenstra's study serves as a motivation for our interpretation of the real exchange rate as another measure of trade resistance.

[12] Note that for reasons of data availability we will not incorporate measures of d_{ijt} in the main empirical analysis. This is done for a smaller sample in robustness checks with trade regulation measures.

not significantly affected.

In addition to estimating the real exchange rate elasticity of exports at the country-pair level from (4), we exploit sector level data (4-digit SITC) as follows:

$$\begin{aligned} \ln(T_{sijt}) &= \beta_1 \ln(Y_{jt}) + \beta_2 \ln(Y_{it}) + \beta_3 \ln(y_{jt}) + \beta_4 \ln(y_{it}) \\ &\quad + \eta \ln(RER_{ijt}) + \mu \ln(d_{ijt}) + \theta_{sij} + \tau_{st} + \varepsilon_{sijt} \end{aligned} \quad (5)$$

where s indicates sectors (440 sectors)[13] and the country-pair and time fixed effects are sector specific (θ_{sij} and τ_{st}).[14] Note that the estimated η from equations (4) and (5) is a measure of σ under the Krugman (1980) model discussed in Section 2.[15] The trade variation used in the identification of η from (5) is coming from the yearly sector level fluctuations of exports within country pair, but beyond sector-year fixed effects. Potential endogeneity concerns of the real exchange rate are dissipated in such sector analysis as it is unlikely that omitted factors could systematically drive both sector level exports to importers and the overall bilateral real exchange rate. A biased estimate of η from (5) is possible when exports for a given country pair are highly concentrated in few sectors. On average, a country pair in the sample trades on 51.7 different sectors during one year and 50% of the country pairs trade on 12 different sectors or more per year.

4 Real Exchange Rate and Trade Data

Bilateral trade flows used are those compiled by Feenstra (2000).[16] Exchange rate data, income variables, and GDP deflators are obtained from the World Development Indicators (2001). Note that direct measures of real exchange rates are not widely available for the

[13] We are left with this number of sectors once we exclude those sectors for which the 4-digit code ends with X or A. As Feenstra (2000) explains the sector codes that end with an A are really 3-digit SITC codes or combinations of them. Those codes that end with X result from incomplete reporting at the 4, 3, or 2-digit level.

[14] The assumption of balanced trade built into the gravity formulation is less appealing at the sector level.

[15] Broda and Weinstein (2006) pursue an alternative identification strategy to uncover σ using prices and quantities for US imports between 1972 and 2001. The authors estimate a supply and demand system for US imports identifying σ with cross country variation in prices of 10-digit sector flows. They assume that each exporter of a given 10-digit sector sells a different variety of that good.

[16] The raw bilateral trade data is in thousands of US dollars. I obtain the 1995 dollar measure using the US GDP deflator.

sample of countries and years studied.[17] Therefore the real exchange rate is measured by the nominal exchange rate for each country in the pair and GDP deflators as follows:

$$\widehat{RER}_{ijt} = \frac{NominalE_{it}}{NominalE_{jt}} * \frac{GDP\ Deflator_{jt}}{GDP\ Deflator_{it}} \tag{6}$$

where i represents the exporter country in the pair, and j represents the importer country in the pair. $NominalE_{it}$ ($NominalE_{jt}$) is the nominal exchange rate for the exporter (importer) measured in local currency per US dollar.[18] An increase in $\widehat{RER}_{ijt}$ represents a real depreciation of the exporter country i with respect to the importer country j.

Noticeably the GDP deflators for the exporter and importer equal one hundred in 1995 for every country, as opposed to measuring actual price levels. Therefore we are *not* able to pin down the true real exchange rate (RER_{ijt}) and the obtained measure of the real exchange rate ($\widehat{RER}_{ijt}$) is incorrect up to a constant for each country pair. This constant, A_{ij}, is the price level ratio between importer and exporter in 1995 such that:

$$RER_{ijt} = \widehat{RER}_{ijt} * A_{ij} \tag{7}$$

By simply incorporating the natural logarithm of the price level ratio A_{ij} into the country-pair fixed effects we obtain the modified estimating equation (4) in terms of $\widehat{RER}_{ijt}$:

$$\begin{aligned} \ln(T_{ijt}) = {} & \beta_1 \ln(Y_{jt}) + \beta_2 \ln(Y_{it}) + \beta_3 \ln(y_{jt}) + \beta_4 \ln(y_{it}) \\ & + \eta \ln(\widehat{RER}_{ijt}) + \mu \ln(d_{ijt}) + \delta_{ij} + \tau_t + \varepsilon_{ijt} \end{aligned} \tag{2'}$$

where new country-pair fixed effects δ_{ij} capture $\eta \ln(A_{ij})$. Therefore η, the real exchange rate elasticity of exports, will be consistently estimated as long as we include a set of country-pair fixed effects in the econometric model.

A parallel modification to the sector analysis from equation (5) delivers the following

[17] Sectoral based RER will be used in a robustness check for a subsample.

[18] This is the year average official exchange rate reported in the World Development Indicators.

consistent estimating equation:

$$\ln(T_{sijt}) = \beta_1 \ln(Y_{jt}) + \beta_2 \ln(Y_{it}) + \beta_3 \ln(y_{jt}) + \beta_4 \ln(y_{it}) \\ + \eta \ln(\widehat{RER}_{ijt}) + \mu \ln(d_{ijt}) + \delta_{sij} + \tau_{st} + \varepsilon_{sijt} \tag{3'}$$

where sector-country-pair fixed effects δ_{sij} capture $\eta \ln(A_{ij})$.

4.1 Sample with Bilateral Volume of Exports: Overall and By Type of Good

We build a country-pair level sample including 136 countries for the period 1981-1997. The sample includes 13,917 country pairs and 140,627 bilateral-level observations.[19] Tables 1, 2, and 3 list the countries in the sample and indicate the number of times in which a country is an exporter and an importer in a country pair.[20] Table 4 provides summary statistics for bilateral trade flows and our measure of bilateral real exchange rate $\widehat{RER}_{ijt}$. Note that measured bilateral real exchange rate has higher variability than bilateral trade flows.

Table 5 presents summary statistics for bilateral trade flows classified by the type of exported goods following Rauch (1999). Rauch classifies export goods by the availability of information on their price: "Possession of a reference price distinguishes homogeneous from differentiated products. Homogeneous commodities can be further divided into those whose reference prices are quoted on organized exchanges and those whose reference prices are quoted only in trade publications." Therefore differentiated products are defined as those without a reference price or "branded" – i.e. their price can be quoted once mentioning the manufacturer. Homogeneous products are those traded on organized exchanges where reference prices are quoted (for example in the London Metal Exchange). Homogeneous products are not "branded" and they have specialized traders who centralize price information. Reference-price products are not "branded," have prices listed only in trade

[19] 55% of the trade flows for the country pairs formed by the 136 countries are equal to zero. (The total number of country-pair-years equals 136 x 135 x 17 years = 312,120.) On average, each country pair shows positive trade flows for 10.1 out of the 17 years in the sample.

[20] The observations with zero trade flows are not included as the estimating equations are specified in logs following standard practice in the trade literature. This omission could potentially bias the results as Santos Silva and Tenreyro (2006) argue.

publications, and may have specialized traders who centralize price information.

4.2 Sample with Bilateral Volume of Exports at the Sector Level

Using the aforementioned data from Feenstra (2000) and World Development Indicators (2001) we also build a sector-country-pair level sample including 136 countries and 440 sectors for the period 1981-1997. The sample includes 13,917 country-pairs and around 8 million observations at the sector level.[21] 20% of the 440 sectors are classified as homogeneous, 28% are reference-price, and 52% are differentiated sectors. Table 6 provides summary statistics for bilateral trade flows at the sector level.

4.3 High-Income and Developing Countries

Following the World Bank 2006 classification of countries based on 2004 GNI per capita, we classify 34 of our countries as high-income and 102 countries as developing countries. Table 7 lists the 34 high-income countries in the sample.[22]

The bilateral nature of this paper, requires that we specify the export destination countries for both groups of countries under study, high-income and developing. As explained, we use two alternative definitions for destination countries. First, we simply include in a given sample those country pairs formed by the exporter countries in the sample. This method delivers samples HI and DC. (For example, the HI sample includes high-income countries exporting to other high-income countries and it includes a maximum of 1,122 (=34*33) country pairs. 1,096 of those pairs have complete data for at least one year in the sample.) Second, we add to each sample country pairs formed by the countries in the sample exporting to countries in the other sample. (For example, for the high-income exporters we include 4,590 (=34*33+34*102) country pairs. 4,217 of those pairs have complete data for at least one year in the sample.) We denote HI&MIX the sample that incorporates export

[21] 94% of the sector trade flows for the country pairs formed by the 136 countries are equal to zero. (The total number of sector-country-pair-years equals 440 x 136 x 135 x 17 years = 137,332,800.)

[22] In our sample high income countries include 22 OECD countries and 12 non-OECD countries. Developing countries include 46 low income, 33 lower middle income, and 23 upper middle income countries. 2004 GNI per capita cutoffs for the four World Bank categories (low income, lower middle income, upper middle income, and high income) are 825US$, 3,255US$, and 10,065US$ respectively.

destinations outside the HI sample, and DC&MIX is the sample that incorporates export destinations outside the DC sample.

Table 8 summarizes bilateral trade flows and measured real exchange rate for the four defined samples. 90% of country-pair-years have positive trade and are included in HI while only 27% are included in the DC sample. Table 9 summarizes bilateral trade flows by type of good for the four defined samples. HI countries trade with each other (conditional on positive bilateral trade) on average only 13% of homogeneous goods while 50% of their trade is in differentiated goods. On the other hand DC countries trade with each other 39% in homogeneous goods and 26% in differentiated goods. HI&MIX sample exports 13% in homogeneous goods and 49% in differentiated goods. DC&MIX sample exports 39% in homogeneous goods and 31% in differentiated goods.[23] Lastly, Table 10 details the sector bilateral trade flows for different country groups and type of goods.

5 Empirical Results

5.1 World Patterns

As a benchmark we first present the bilateral export response to fluctuations in the real exchange rate for the world bilateral sample estimated with equation (2'). The variation used in the identification of η is that within country-pairs over time, beyond year specific factors and controlling for exporter and importer GDP measures. The first column of Table 11 shows a significant overall bilateral real exchange rate elasticity of exports of 0.055.[24] As a first cut into the data, we calculate the export response at the bilateral level by type of exported good. Columns two, three and four of Table 11 present these estimates where we observe that homogeneous bilateral exports respond less than non-homogeneous ones to fluctuations in the bilateral exchange rate.

[23] In order to calculate these proportions we take into account the fraction of country pairs with zero trade in exports for different types of sectors given that a country-pair has positive trade flow. For example, to calculate the percentage of trade in homogeneous goods for HI (conditional on positive trade for the country-pairs) the total number of observations for the estimated percentage is 17,252, reported in Table 8.

[24] Note that in this Table, as in the rest of the analysis, we use robust standard errors as data is clustered by country-pair.

Additionally we estimate equation (2') for each exporter i at a time. Such estimation by exporter allows for a more flexible specification with exporter-year fixed effects, τ_{it}, as opposed to year fixed effects. The estimation of these 136 regressions is summarized in the bottom panel of Figure 1, which presents the distribution of the 136 estimated η's with a mean of 0.22 (different from zero at 5% significance level). This exercise allows us to learn about the variation in the export response at the exporter level. Importantly, such estimation allows us to identify outlier countries and cross-country patterns. Outlier export responses η are defined as those below $(Q(25)-3*IQR)$ and those above $(Q(75)+3*IQR)$, where $Q(25)$ is the 25th percentile, $Q(75)$ is the 75th percentile, and IQR is the interquartile range $(Q(75)-Q(25))$ of the distribution of η.[25] Seven outliers are identified in the overall sample. Figure 2 and Table 12 present estimates and descriptive statistics of the 129 estimated η's (136 minus 7 outliers). The average export response excluding outliers is 0.14 (different from zero at 5% significance level).

5.2 High-Income and Developing Countries

Estimated export responses shown in Figure 2 and Table 12 correspond to samples HI&MIX and DC&MIX as they include as export destinations all the countries in the overall sample. Statistics indicate that the average export response for HI&MIX sample is 0.13 and for DC&MIX is 0.15, both different from zero at 5% significance level but not significantly different from each other.[26]

As export destinations can certainly affect export responses to bilateral real exchange rate fluctuations, we study next such responses in samples HI and DC. Remember that in these samples exporter and importer countries belong to the same country group. Figure 3 presents the distribution of the estimated η's for HI and DC samples obtained with the estimating equation (2') for each exporter i at a time.[27] Again, this estimation by exporter

[25] These outliers are labeled as "severe outliers" by Hamilton (1992), who points out that severe outliers comprise about .0002% of the normal population.

[26] If we do not exclude outliers the mean for DC&MIX is 0.25, significantly different from the mean for HI&MIX at the 10% significance level.

[27] Note that this Figure excludes severe outliers of HI and DC distributions identified with the Hamilton definition stated above.

allows for a more flexible specification with exporter-year fixed effects, τ_{it}, as opposed to year fixed effects. The histogram for DC countries presents the distribution of its 95 η's and the histogram for HI countries presents the distribution of its 34 η's. Table 13 shows descriptive statistics of these 129 estimated η's. The average response for an exporter is 0.67 for HI countries and 0.18 for DC countries (both different from zero at the 5% significance level). The mean for DC is significantly different from the mean for HI countries at the 1% significance level.[28]

Overall, results indicate that when developing countries are included in the sample, either as exporters or importers, the export response to real exchange rate fluctuations decreases from 0.67 to 0.13-0.18. Given that countries of different development status show different sectoral export compositions, we further investigate the difference in sectoral responses to real exchange rate fluctuations.

5.3 Export Response by Type of Good for High-Income Exporters

Figure 4 and the top panel of Table 14 present the histograms and statistics of export responses to real exchange rate fluctuations by sector for the sample HI&MIX. The sectoral export responses (η) are obtained from the estimation of equation (3') for each sector s, where 224 sectors are differentiated and 86 are homogeneous.[29] The average export response to real bilateral exchange rate movements is 0.20 for differentiated sectors and 0.05 for homogeneous sectors. Both responses are significantly different from zero at 5% significance level and significantly different from each other at 1% level.

Parallel results for the HI sample are included in Figure 5 and the bottom panel of Table 14 where stats are reported for 227 differentiated and 88 homogeneous sectors. In this sample of high-income countries we observe an even higher average response of differentiated sectors's exports than homogeneous sectors's exports, with average values of 0.56 and 0.02 respectively, significantly different from each other at 1% level (only 0.56 is significantly

[28] If we do not exclude outliers the mean for DC is 0.30, significantly different from the mean for HI countries at the 6% significance level.

[29] For clarity, in what follows, we exclude Reference Price sectors's results as they tend to lie in between the Homogeneous and Differentiated ones. Also, all Figures and Tables exclude severe outliers of Homogeneous and Differentiated distributions identified with the Hamilton definition stated above.

different from zero at the 5% level).

Therefore for high-income countries, exports of differentiated sectors respond more than those of homogeneous sectors to bilateral real exchange rate fluctuations. This finding is accentuated when we restrict export destinations to other high-income countries (0.20 versus 0.05 for HI&MIX and 0.56 versus 0.02 for HI).

5.4 Export Response by Type of Good for Developing Exporters

To study the behavior of developing countries, we focus on Figure 6 and the top panel of Table 15 which show histograms and statistics of export responses to real exchange rate fluctuations by sector for the sample DC&MIX. As for HI&MIX, the sectoral export responses (η) are obtained from the estimation of equation (3') for each sector s, where 221 sectors are differentiated and 87 are homogeneous. In this sample, the average export response to real bilateral exchange rate fluctuations is 0.05 for differentiated sectors and 0.03 for homogeneous sectors. The elasticities are significantly different from zero at 5% significance level and the response of differentiated sectors is significantly larger than that of homogeneous sectors, but only at 10% level.

Limiting export destinations of developing countries to other developing countries only delivers results for the DC sample in Figure 7 and the bottom panel of Table 15. In this sample of developing countries, where 220 sectors are differentiated and 81 are homogeneous, we observe a more even average response of differentiated sectors's exports and homogeneous sectors's exports with average values of 0.04 and 0.03 respectively, not significantly different from each other (only 0.04 is significantly different from zero at the 5% level).

Therefore for developing countries, exports of differentiated sectors seem to respond slightly more on average than those of homogeneous sectors to bilateral real exchange rate fluctuations. The larger response of differentiated over homogeneous sectors is only significantly so (at 10% level) in the DC&MIX sample and not in the DC sample.

Overall, the findings indicate that differentiated sectors respond more than homogeneous sectors, which explains part of the large overall response of high-income countries as they export proportionally more on differentiated sectors. Moreover for the samples that include developing countries this differentiated/homogeneous pattern is weaker (in particular when developing countries are included as exporters).

5.5 Interpretation of the Evidence in Light of the Theory

We relate the findings of Sections 5.2, 5.3 and 5.4 with theories from Section 2 as follows:

- Table 13 and Figure 3 show that the average export response to real exchange rate fluctuations of a high-income country in the HI sample is significantly larger than that of the average developing country in the DC sample (0.67 versus 0.18). Such estimates in the HI&MIX and DC&MIX sample are not significantly different from each other (0.13 versus 0.15) as Table 12 and Figure 2 show. Therefore, on average, exports of high-income countries respond more to real exchange rate fluctuations than those of developing countries, as long as high-income countries are not exporting to developing countries. This finding is consistent with the presence of *credit constraints for developing countries* both as exporters and importers. Note though that when we incorporate measures of credit constraints available for a subsample (shown in Section 6) we are unable to confirm their importance.

- The evidence provided is not consistent with theories of larger positive effects associated with large shocks to an economy. Developing countries are those facing larger real exchange rate shocks during the studied period and we observe that their elasticities are smaller than those of high-income countries.[30]

- The average export response to real exchange rate fluctuations of a differentiated sector is significantly larger than that of the average homogeneous sector as long as high-income countries are in the sample.[31] Table 14 and Figures 5 and 4 show results for HI and HI&MIX samples with respective elasticities of 0.56 versus 0.02 and 0.20 versus 0.05 for differentiated versus homogeneous sectors. Table 15 and Figures 7 and

[30] Moreover, the estimation of sectoral elasticities for the HI&MIX sample for the cases where the real exchange rate depreciated or appreciated more than 10% shows similar elasticities to those in the overall HI&MIX sample. This evidence further contradicts theories of larger effects associated with larger shocks.

[31] These differences are significant at the 1% level for the HI and HI&MIX samples, and at the 10% level for the DC&MIX sample.

6 show results for DC and DC&MIX samples with respective elasticities of 0.04 versus 0.03 and 0.05 versus 0.03 for differentiated versus homogeneous sectors. As shown, the sectoral differential of elasticities is pronounced when high-income countries are exporters in the sample. This evidence is not consistent with the trade theory of product differentiation and scale economies from Krugman (1980) which predicts that more substitutable sectors (homogeneous) should have a larger export response to changes in trade costs than less substitutable sectors (differentiated).

6 Robustness Checks

6.1 Persistent Estimates

Timing issues may be relevant in the estimation of the export responses to real exchange rate fluctuations. In particular, some fluctuations in the real exchange rate are sharp but quickly reversed and some are more stable. Both of these types of fluctuations may affect the dynamics of the export growth very differently. Moreover domestic producers may take several periods to adjust their production and exports when facing a favorable depreciation.

Some studies in the literature address the dynamics by including a number of lags in the exchange rate in the estimating equation. For example Bayoumi (1999) includes up to a fourth yearly lag in his estimations and describes the overall response of exports as the combined response over the specified lags. Alternatively in this paper we opt for a longer horizon specification for the estimating equation to obtain the overall persistent response of exports. In particular we collapse the data into four periods of time (as opposed to 17 years) to obtain persistent measures of real exchange rate and trade flows. We build averages of the variables in the estimating equations for the periods 1981-1982, 1983-1987, 1988-1992 and 1992-1997.[32] Below we present results for the collapsed estimation of estimating equation (2') at the bilateral level, and estimating equation (3') for each sector.

Table 16 presents the estimates of the elasticities η with the bilateral *collapsed* data for the world sample with estimating equation (2'). These results show slightly larger elasticities

[32] Note that we collapsed the data for every 5 years, except for the first collapsed period in which we use the first two years.

when compared with the yearly estimation results from Table 11. The first column of Table 16 shows a significant overall bilateral real exchange rate elasticity of exports of 0.072. Columns two, three and four of Table 16 show that homogeneous bilateral exports respond less than non-homogeneous ones to persistent fluctuations in the bilateral exchange rate, and again, these responses are slightly larger than those obtained with the yearly estimation.

When estimating persistent sectoral export responses for high-income countries we obtain very similar results to those estimated with yearly data. Table 17 presents the statistics of the estimates of η with *collapsed* data from equation (3') for each sector s. The average persistent export response for differentiated and homogeneous sectors is 0.17 and 0.05 for HI&MIX sample (and 0.56 and 0.002 for HI sample), both significantly different from each other at the 1% level. The study of the persistent sectoral export responses of developing countries also delivers similar results to the previous yearly estimates. Table 18 presents the statistics of the estimates of η with *collapsed* data from equation (3') for developing countries for each sector s. The average persistent export response for differentiated and homogeneous sectors is 0.08 and 0.05 for DC&MIX sample (and also 0.08 and 0.05 for DC sample), both significantly different from each other at the 5-6% level.

Therefore, persistent fluctuations in the real exchange rate, captured by the collapsed measures, have a slightly higher impact on bilateral exports than yearly fluctuations. In the sector level analysis results with yearly and collapsed data are very similar.

6.2 Estimating a Dynamic Panel

As mentioned in Section 3, we consider a dynamic panel model of exports, where the lag of the dependent variable is used as an explanatory variable to account for potential importance of past realizations of exports on current exports as follows:

$$\begin{aligned} \ln(T_{ijt}) &= \alpha \ln(T_{ijt-1}) + \beta_1 \ln(Y_{jt}) + \beta_2 \ln(Y_{it}) + \beta_3 \ln(y_{jt}) + \beta_4 \ln(y_{it}) \\ &\quad + \eta \ln(\widehat{RER}_{ijt}) + \mu \ln(d_{ijt}) + \delta_{ij} + \tau_t + \varepsilon_{ijt} \end{aligned} \tag{8}$$

The estimation of (8) delivers an estimated η of 0.040 significant at the 1% level (very similar to the 0.055 shown in Table 11 estimated with equation (2')).

As Roodman (2006) and others in the dynamic panel literature explain, the model from (8) suffers from "dynamic panel bias" as the lagged dependent variable, $\ln(T_{ijt-1})$, is correlated with the country-pair fixed effects. This correlation is a more relevant problem for the estimation when the number of years in the sample, P, is "small" (we have a maximum of 17 years of data for each country-pair).[33] To avoid this endogeneity we first-difference (8) to remove the country-pair fixed effects. The problem with such transformation is that it creates a correlation between the first-differenced lagged dependent variable and the first-differenced errors. To deal with this created endogeneity we apply the "Difference GMM" method suggested by Arellano and Bond (1991), where $(\ln(T_{ijt-1}) - \ln(T_{ijt-2}))$ is instrumented with lags of exports (starting with $\ln(T_{ijt-2})$) and with all other exogenous regressors.

When implementing "Difference GMM" we make several choices. In order to maximize sample size we use forward orthogonal deviations instead of first differences given that there are gaps in our panels. One-step estimation of variance is done with standard errors, robust to heteroskedasticity and arbitrary patterns of autocorrelation within country-pairs (note that the method imposes no correlation across country-pairs which is likely to hold true as we include time fixed effects). Given that we detect first order serial correlation in levels in the data with the Arellano-Bond test (and no serial correlation of higher order), we limit the use of instruments for the lagged dependent variable to those dated $t-2$ or earlier.

Our benchmark "Difference GMM" estimation uses 125 instruments and 105,360 observations in the transformed sample with 10,575 country-pairs. Our coefficient of interest, η, is 0.021 significant at the 1% level (of the same order of magnitude, but smaller, than the 0.055 estimated with (2') shown in Table 11). The validity of the estimates depends on the exogeneity of the instruments which is tested with the Sargan/Hansen tests. These tests for the benchmark specification indicate that the instruments are not exogenous. Additional

[33] Roodman (2006) cites work by Judson and Owen (1999) who, with simulations, find a bias of 20% in the coefficient of the lagged dependent variable even when P=30 in models with individual fixed-effects.

estimations were tried where extra regressors were instrumented with this method (those on Y_{jt}, Y_{it} and $\widehat{RER}_{ijt}$) but results still failed the exogeneity tests for instruments.

Overall the Arellano-Bond method of estimation underperforms in our framework and is therefore not further pursued.[34] Reassuringly however, the estimation of the dynamic panel model from (8) delivers similar results to those in our main specification in the paper.

6.3 Trade Regulation Measures

As explained in Section 3, measures of distance between the exporter and the importer country are important components of the gravity equation. So far we have accounted for such components by simply including country-pair fixed effects which capture time invariant factors specific to each country pair, like geographical distance or sharing a border. Complimentary, though, we are interested in accounting for the potential impact of country pair factors which typically vary over time such as trade regulation issues. One measure of such issues is obtained from Rose (2004) who compiled a yearly measure of the presence of a Regional Trade Agreement (RTA) between exporter and importer country in a pair. To further account for trade regulation issues we also collect GATT/WTO membership for exporter and importer from Rose (2004). These data are available for 12,845 (out of 13,917) country pairs in our bilateral dataset. Therefore by using these data we lose 6,738 bilateral observations.

Modified equation (2') is estimated by exporter to study if trade regulation issues affect results from Tables 12 and 13. For each $i = 1, 2, ...136$ we run:

$$\begin{aligned} \ln(T_{ijt}) &= \beta_1 \ln(Y_{jt}) + \beta_2 \ln(Y_{it}) + \beta_3 \ln(y_{jt}) + \beta_4 \ln(y_{it}) \\ &\quad + \eta \ln(\widehat{RER}_{ijt}) + \gamma_1 RTA_{ijt} + \gamma_2 WTO_{it} + \gamma_3 WTO_{jt} \\ &\quad + \delta_{ij} + \tau_{it} + \varepsilon_{ijt} \end{aligned} \tag{9}$$

[34] Mann and Pluck (2007) also report poor results with this method and opt for a fixed-effects estimation of their dynamic specification.

where RTA_{ijt} is a dummy variable which indicates the presence of a regional trade agreement for the ij country pair in year t, and WTO_{it} and WTO_{jt} are indicators of memberships to the GATT or WTO of the exporter and importer country in year t.

A similar modification to the sector equation (3') is estimated to determine if trade regulation issues affect our sector level results from Tables 14 and 15. For each $s = 1, 2, ...440$ we run:

$$\begin{aligned}\ln(T_{sijt}) &= \beta_1 \ln(Y_{jt}) + \beta_2 \ln(Y_{it}) + \beta_3 \ln(y_{jt}) + \beta_4 \ln(y_{it}) \\ &\quad + \eta \ln(\widehat{RER}_{ijt}) + \gamma_1 RTA_{ijt} + \gamma_2 WTO_{it} + \gamma_3 WTO_{jt} \\ &\quad + \delta_{sij} + \tau_{st} + \varepsilon_{sijt}\end{aligned} \tag{10}$$

Results on the bilateral real exchange rate elasticity of exports η for all country samples and sectors, not reported for brevity, are not significantly affected by the inclusion of the trade regulation measures. Therefore, this evidence suggests that the reported elasticity differential between country samples and sectors can not be attributed to omitted trade regulations issues.

6.4 Sectoral Based RER and Trade Weighted RER

As explained in Section 4, the bilateral RER measure used in this study is the year average official nominal exchange rate corrected by GDP deflators. Imbs, Mumtaz, Ravn, and Rey (2005) use a more detailed measure of monthly RER by aggregating sectoral price indices for nineteen goods categories. Their measure is available for ten of our 136 countries for the period 1981-1995 with respect to the US. A year average bilateral measure is built with such data in order to check the quality of the RER measure used in this study. Table 11 is reproduced for the reduced sample of ten countries using both RER measures (Imbs et al.'s and ours). Results on the bilateral real exchange rate elasticity of exports, not reported for brevity, are very close in magnitude and significance under both RER measures.

We compute trade weighted RER and estimate aggregate sectoral export responses by exporter (as opposed to bilateral) for the HI&MIX sample.[35] Results show an insignificant average aggregate sectoral response among homogeneous sectors and a significant average aggregate sectoral response among differentiated sectors of 0.05. Results show lower sectoral responses at the aggregate level (using trade weighted RER) when compared with bilateral sectoral responses. Still, results show higher export responses in differentiated than in homogeneous sectors. Moreover these results fall in the lower end of the range of elasticity estimates derived in this paper. Overall results are consistent with the main results of the paper.

6.5 Measures of Credit Constraints

As mentioned earlier, the presence of credit constraints is consistent with the observed smaller trade response of developing countries to fluctuations in real exchange rates, both as exporters and importers. A story consistent with the findings is that developing countries face higher credit constraints which impede an export increase when a real depreciation of the exporter happens and impede an import increase when a real appreciation of the importer happens. Moreover, a more refined story is that sectors more prevalent in developing countries face higher credit constraints. We present a test for both credit constraint stories and find that there is not much support for them in the data.

Four measures of credit constraints are incorporated following Manova (2006). Financial development indicates the ratio of private credit to GDP over time for the exporter and importer country (C_{it} and C_{jt}). The use of the financial development measures reduces the bilateral sample from 140,627 to 103,413 observations. Asset tangibility and external finance dependence are sector level measures based on average US data of publicly traded firms for the period 1986-1995. Asset tangibility (C_s^1) is the share of net property, plant and equipment in total assets for the median US firm in each sector. External finance dependence (C_s^2) is the share of capital expenditures not financed by cash flow from operations for the median US firm in each sector. Both sector measures are available for manufacturing

[35] Bilateral RERs among each exporter and its trading partners are weighted by how much the exporter trades with each importer as Burstein et al (2005).

industries at the 3-digit ISIC classification. A matching is performed between the 3-digit ISIC sectors with credit constraint data and our 4-digit SITC data when a unique 3-digit ISIC corresponds to each 4-digit SITC. Such matching leaves us with 74 out of 440 sectors with complete data which translates into 923,004 out of 8 million observations.

Modified bilateral regression (2') with credit constraint data is estimated for each exporter $i = 1, 2, ...136$:

$$\begin{aligned} \ln(T_{ijt}) &= \beta_1 \ln(Y_{jt}) + \beta_2 \ln(Y_{it}) + \beta_3 \ln(y_{jt}) + \beta_4 \ln(y_{it}) \\ &\quad + \eta \ln(\widehat{RER}_{ijt}) + \gamma_1 C_{it} + \gamma_2 C_{jt} \\ &\quad + \delta_{ij} + \tau_{it} + \varepsilon_{ijt} \end{aligned} \tag{11}$$

Results are similar to those reported in Tables 12 and 13 suggesting that credit constraints may not account for the observed elasticity differentials. Complementarily a regression model adding interaction terms to (11) is estimated as follows:

$$\begin{aligned} \ln(T_{ijt}) &= \beta_1 \ln(Y_{jt}) + \beta_2 \ln(Y_{it}) + \beta_3 \ln(y_{jt}) + \beta_4 \ln(y_{it}) \\ &\quad + \eta \ln(\widehat{RER}_{ijt}) + \gamma_1 C_{it} + \gamma_2 C_{jt} \\ &\quad + \chi_1 [\ln(\widehat{RER}_{ijt}) * C_{it}] + \chi_2 [\ln(\widehat{RER}_{ijt}) * C_{jt}] \\ &\quad + \delta_{ij} + \tau_{it} + \varepsilon_{ijt} \end{aligned} \tag{12}$$

To evidence the importance of credit constraints in diminishing the response of trade to real depreciations we should observe significant and positive estimates of χ_1 and χ_2. The estimation does not provide such evidence.

Moreover we run the modified sector-level regression (3') with credit constraints data pooling homogeneous and differentiated sectors in two separate regressions of the form:

$$
\begin{aligned}
\ln(T_{sijt}) &= \beta_1 \ln(Y_{jt}) + \beta_2 \ln(Y_{it}) + \beta_3 \ln(y_{jt}) + \beta_4 \ln(y_{it}) \\
&\quad + \eta \ln(\widehat{RER}_{ijt}) + \gamma_1 C_{it} + \gamma_2 C_{jt} + \gamma_3 C_s^1 + \gamma_4 C_s^2 \\
&\quad + \delta_{ij} + \tau_t + \varepsilon_{sijt}
\end{aligned} \tag{13}
$$

Results show once again an elasticity differential between country groups suggesting that credit constraints may not explain the lack of export response in developing countries. Complementarily we estimate (13) with interaction terms between credit constraints (C_s^1 and C_s^2) and real exchange rate and we do not find the pattern predicted by the credit constraint story.

6.6 Serial Correlation

The Wooldridge (2002) test for autocorrelation in panel data is performed on the bilateral regressions from the model (2'). Under the null of no serial correlation the residuals from the regression of the first-differenced variables should have an autocorrelation of -0.5. The null of no first-order autocorrelation is rejected in all cases at the 1% level.

To study the importance of the serial correlation in the results we model the disturbance term as a first-order autoregressive process following Baltagi and Wu (1999). Results are similar to those in Table 11. In particular the overall elasticity with serial correlation correction is 0.031 (as opposed to 0.055), the homogeneous sectors elasticity is 0.009 (versus 0.031), that of reference sectors is 0.069 (versus 0.104), and that for differentiated sectors is 0.054 (versus 0.080), all significant except for the homogeneous elasticity. Results show an overall elasticity of the same order of magnitude and of similar value, and similar homogeneous/differentiated pattern.

Moreover Newey-West standard errors are computed. The error structure is assumed to be heteroskedastic (by exporter-importer) and autocorrelated up to one lag. Estimates, by exporter, of export responses to real exchange rate fluctuations from estimating equation (2') with Newey-West standard errors show stronger significance than those presented in

Tables 12 and 13 in all cases.

7 Conclusion

Literature on price elasticities of exports up to the mid 1990s typically indicates unity elasticities for high-income countries and well below unity for developing countries (from, e.g., Hooper and Marquez, 1995 and Reinhart, 1994). The estimates in this paper are broadly consistent with this "old" consensus, although the elasticity of high-income countries exporting to the world, as opposed to just exporting to other high-income countries, is found to be well below one at only 0.13. Novel to the literature, I find a pattern in sectoral export elasticities where differentiated sectors have a larger elasticity than homogeneous sectors. The differential holds as long as high-income countries are included in the sample and is larger when high-income countries are exporters as opposed to importers in the sample.

The above estimations are obtained from a broader data set (a bilateral sample of 136 countries – 34 high-income and 102 developing – and 440 sectors for the period 1981-1997) than samples used for previous studies, especially in the country and sector dimensions. In particular, the estimated distribution, by exporter and by sector, of real exchange rate elasticities is obtained by exploiting the yearly country-pair variation of the bilateral real exchange rate and sectoral bilateral export flows, beyond country-pair, sector and time specific factors.

International trade and international finance offer in many cases opposite predictions on important questions. This study exploits the rich currently available trade data to attempt to identify theories that are better aligned with reality. First, I find that, on average, exports of high-income countries respond more to real exchange rate fluctuations than those of developing countries, as long as high-income countries are not exporting to developing countries. This finding is not consistent with Schumpeter-like theories where larger shocks, in this case faced by developing countries regarding real exchange rates, are expected to have more than proportional effects on exports. On the other hand, this first finding is consistent with the presence of credit constraints for developing countries, both as exporters and importers. Interestingly, when we incorporate measures of credit constraints available for a subsample, we are unable to confirm their importance. Such evidence calls for additional research to determine which alternative theory may generate the estimated pattern.

Second, I find that, on average, the export response to real exchange rate fluctuations of a differentiated sector is significantly larger than that of the average homogeneous sector, as long as high-income countries are in the sample. These sectoral differentials among elasticities is pronounced when high-income countries are exporters in the sample. This evidence is not consistent with the Krugman (1980) benchmark trade theory of product differentiation and scale economies with identical firms. Additional research contrasting the data with alternative models of sectoral export behavior would further advance our understanding on this issue.

Lastly, the estimated export elasticities inform the puzzle on the elasticity of substitution between domestic and foreign goods. Elasticities between 10 and 15 are supported by trade models that study trade patterns and effects of tariffs and trade liberalizations. Elasticities between 1 and 2 are supported by international macro models that study real business cycles. Estimates from this paper, between zero and one, indicate that small values of the substitution elasticity are appropriate. Overall, heterogeneous elasticity estimates are found for different development status and sectors suggesting that those factors may play a role in explaining the stated elasticity puzzle. Colacelli (2009) studies the role of the sectoral extensive and intensive margin of trade in explaining the puzzle concluding that the sectoral margin behavior is a potential puzzle explanation.

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A Tables and Figures

Table 1: 136 Countries in the Sample, Period 1981-1997. Part 1.

	Country Name	Code (from Feenstra)	Exporter Frequency	Exporter %	Importer Frequency	Importer %
1	ALBANIA	580080	178	0.13	238	0.17
2	ALGERIA	130120	758	0.54	1,245	0.89
3	ANGOLA	160240	305	0.22	535	0.38
4	ARGENTINA	330320	1,719	1.22	1,249	0.89
5	AUSTRALIA	710360	1,949	1.39	1,664	1.18
6	AUSTRIA	550400	2,018	1.44	1,806	1.28
7	BAHAMAS	350440	852	0.61	889	0.63
8	BAHRAIN	440480	864	0.61	959	0.68
9	BANGLADESH	450500	1,343	0.96	935	0.66
10	BARBADOS	350520	684	0.49	947	0.67
11	BELIZE	360840	423	0.3	729	0.52
12	BENIN	162040	382	0.27	687	0.49
13	BHUTAN	450640	233	0.17	322	0.23
14	BOLIVIA	330680	680	0.48	902	0.64
15	BRAZIL	330760	1,880	1.34	1,367	0.97
16	BRUNEI	450960	381	0.27	629	0.45
17	BULGARIA	581000	802	0.57	680	0.48
18	BURKINA FASO	168540	390	0.28	610	0.43
19	BURUNDI	161080	454	0.32	562	0.4
20	CAMBODIA	451160	201	0.14	183	0.13
21	CAMEROON	141200	825	0.59	980	0.7
22	CANADA	211240	2,087	1.48	1,937	1.38
23	CENTRAL AFR. REP.	141400	384	0.27	604	0.43
24	CHAD	141480	298	0.21	481	0.34
25	CHILE	331520	1,507	1.07	1,298	0.92
26	CHINA	481560	1,815	1.29	1,392	0.99
27	COLOMBIA	331700	1,427	1.01	1,298	0.92
28	COMOROS	161740	233	0.17	454	0.32
29	CONGO	141780	574	0.41	769	0.55
30	COSTA RICA	341880	1,141	0.81	985	0.7
31	COTE D'IVOIRE	163840	1,051	0.75	995	0.71
32	CYPRUS	441960	1,330	0.95	1,296	0.92
33	CZECHOSLOVAKIA	582000	501	0.36	437	0.31
34	DENMARK	532080	2,121	1.51	1,898	1.35
35	DJIBOUTI	162620	252	0.18	494	0.35
36	DOMINICAN RP	352140	798	0.57	886	0.63
37	ECUADOR	332180	1,024	0.73	1,042	0.74
38	EGYPT	138180	1,294	0.92	1,326	0.94
39	EL SALVADOR	342220	719	0.51	915	0.65
40	EQ. GUINEA	162260	183	0.13	317	0.23
41	ETHIOPIA	162300	580	0.41	871	0.62
42	FIJI	722420	540	0.38	761	0.54
43	FINLAND	552460	1,998	1.42	1,634	1.16
44	FM USSR	688100	389	0.28	411	0.29
45	FRANCE	532500	2,130	1.51	2,097	1.49
46	GABON	142660	663	0.47	803	0.57
47	GAMBIA	162700	411	0.29	603	0.43
48	GERMANY	532800	2,135	1.52	2,117	1.51
49	GHANA	162880	844	0.6	877	0.62
50	GREECE	533000	1,820	1.29	1,739	1.24

Table 2: 136 Countries in the Sample, Period 1981-1997. Part 2.

	Country Name	Code (from Feenstra)	Exporter Frequency	%	Importer Frequency	%
51	GUATEMALA	343200	1,020	0.73	1,004	0.71
52	GUINEA	163240	384	0.27	499	0.35
53	GUINEA-BISSAU	166240	432	0.31	606	0.43
54	GUYANA	363280	660	0.47	679	0.48
55	HAITI	353320	557	0.4	788	0.56
56	HONDURAS	343400	815	0.58	965	0.69
57	HONG KONG	453440	2,108	1.5	1,758	1.25
58	HUNGARY	583480	1,372	0.98	1,117	0.79
59	ICELAND	553520	859	0.61	1,004	0.71
60	INDIA	453560	1,925	1.37	1,517	1.08
61	INDONESIA	453600	1,634	1.16	1,347	0.96
62	IRAN	443640	992	0.71	853	0.61
63	IRELAND	533720	2,057	1.46	1,684	1.2
64	ISRAEL	413760	1,460	1.04	1,146	0.81
65	ITALY	533800	2,132	1.52	2,068	1.47
66	JAMAICA	353880	793	0.56	1,039	0.74
67	JAPAN	413920	2,133	1.52	2,097	1.49
68	JORDAN	444000	920	0.65	1,163	0.83
69	KENYA	164040	1,228	0.87	1,126	0.8
70	KIRIBATI	722960	328	0.23	515	0.37
71	KOREA RP (SOUTH)	454100	1,969	1.4	1,563	1.11
72	KUWAIT	444140	798	0.57	933	0.66
73	LAOS P.DEM.R	454180	378	0.27	355	0.25
74	LEBANON	444220	507	0.36	537	0.38
75	LIBERIA	164300	600	0.43	821	0.58
76	MADAGASCAR	164500	744	0.53	818	0.58
77	MALAWI	164540	853	0.61	678	0.48
78	MALAYSIA	454580	1,829	1.3	1,464	1.04
79	MALDIVES	454620	54	0.04	68	0.05
80	MALI	164660	497	0.35	646	0.46
81	MALTA	574700	997	0.71	1,077	0.77
82	MAURITANIA	164780	478	0.34	649	0.46
83	MAURITIUS	164800	894	0.64	993	0.71
84	MEXICO	334840	1,627	1.16	1,515	1.08
85	MONGOLIA	484960	174	0.12	199	0.14
86	MOROCCO	135040	1,468	1.04	1,389	0.99
87	MOZAMBIQUE	165080	666	0.47	698	0.5
88	NEPAL	455240	524	0.37	643	0.46
89	NETHERLANDS	535280	2,129	1.51	2,065	1.47
90	NEW CALEDONIA	725400	564	0.4	741	0.53
91	NEW ZEALAND	715540	1,734	1.23	1,409	1
92	NICARAGUA	345580	536	0.38	774	0.55
93	NIGER	165620	430	0.31	670	0.48
94	NIGERIA	165660	922	0.66	1,100	0.78
95	NORWAY	555780	2,062	1.47	1,675	1.19
96	OMAN	445120	832	0.59	1,060	0.75
97	PAKISTAN	455860	1,874	1.33	1,431	1.02
98	PANAMA	365900	831	0.59	1,080	0.77
99	PAPUA N.GUINEA	725980	620	0.44	682	0.48
100	PARAGUAY	336000	669	0.48	838	0.6

Table 3: 136 Countries in the Sample, Period 1981-1997. Part 3.

	Country Name	Code (from Feenstra)	Exporter Frequency	%	Importer Frequency	%
101	PERU	336040	1,358	0.97	1,141	0.81
102	PHILIPPINES	456080	1,581	1.12	1,275	0.91
103	POLAND	586160	785	0.56	705	0.5
104	PORTUGAL	536200	1,964	1.4	1,779	1.27
105	ROMANIA	586420	1,394	0.99	1,038	0.74
106	RWANDA	166460	388	0.28	548	0.39
107	SAUDI ARABIA	446820	997	0.71	1,272	0.9
108	SENEGAL	166860	788	0.56	1,015	0.72
109	SEYCHELLES	166900	307	0.22	684	0.49
110	SIERRA LEONE	166940	511	0.36	687	0.49
111	SINGAPORE	457020	1,712	1.22	1,583	1.13
112	SOLOMON ISLDS	720900	356	0.25	432	0.31
113	SOUTH AFRICA	117100	1,440	1.02	1,263	0.9
114	SPAIN	537240	2,018	1.44	1,978	1.41
115	SRI LANKA	451440	1,410	1	1,101	0.78
116	SUDAN	137360	774	0.55	860	0.61
117	SURINAM	367400	463	0.33	664	0.47
118	SWEDEN	557520	2,123	1.51	1,918	1.36
119	SWITZERLAND	557560	2,113	1.5	2,001	1.42
120	SYRN ARAB RP	447600	740	0.53	1,013	0.72
121	THAILAND	457640	1,962	1.4	1,515	1.08
122	TOGO	167680	573	0.41	871	0.62
123	TRINIDAD-TOBAGO	357800	1,097	0.78	1,112	0.79
124	TUNISIA	137880	1,278	0.91	1,266	0.9
125	TURKEY	447920	1,628	1.16	1,448	1.03
126	UGANDA	168000	532	0.38	613	0.44
127	UNITED KINGDOM	538260	2,134	1.52	2,109	1.5
128	UNTD ARAB EM	447840	883	0.63	1,096	0.78
129	UNTD RP TANZANIA	168340	454	0.32	458	0.33
130	URUGUAY	338580	1,222	0.87	1,070	0.76
131	USA	218400	2,128	1.51	2,108	1.5
132	VENEZUELA	338620	1,084	0.77	1,161	0.83
133	VIETNAM	487040	618	0.44	477	0.34
134	YEMEN	448870	257	0.18	319	0.23
135	ZAMBIA	168940	692	0.49	697	0.5
136	ZIMBABWE	167160	1,224	0.87	949	0.67

Table 4: Bilateral Trade Flows and Measured RER, Summary Statistics. 136 countries, 1981-1997.

	Bilateral Trade Flows (1,000 of 1995 US dollars)	Measured Bilateral RER
Mean	368,826	3,437
Median	6,887	0.9862
St. Dev.	2,895,763	275,247
St. Dev./Mean	8	80
St. Dev./Median	420	279,109
Observations	140,627	140,627

Table 5: Bilateral Trade Flows by Type of Good, Summary Statistics. 136 countries, 1981-1997.

	Bilateral Trade Flows (1,000 of 1995 US dollars)		
	Homogeneous	**Reference Price**	**Differentiated**
Mean	94,265	63,177	189,343
Median	3,079	1,958	1,967
St. Dev.	576,698	408,914	1,731,817
St. Dev./Mean	6	6	9
St. Dev./Median	187	209	881
Observations	95,299	104,220	126,127

Table 6: Sector Level Bilateral Trade Flows by Type of Good, Summary Statistics. 136 countries, 1981-1997.

	Sector Level Bilateral Trade Flows (1,000 of 1995 US dollars)			
	All Trade Flows	**Homogeneous**	**Reference Price**	**Differentiated**
Mean	5,110	12,673	3,673	4,545
Median	155	282	177	138
St. Dev.	79,447	140,751	28,351	79,453
St. Dev./Mean	16	11	8	17
St. Dev./Median	511	498	160	575
Observations	7,977,399	754,424	1,858,663	5,364,312

Table 7: 34 High Income Countries in the Sample, Period 1981-1997.

	Country Name	**Code (from Feenstra)**	**Non OECD (12)**	**OECD (22)**
1	AUSTRALIA	710360		1
2	AUSTRIA	550400		1
3	BAHAMAS	350440	1	
4	BAHRAIN	440480	1	
5	BRUNEI	450960	1	
6	CANADA	211240		1
7	CYPRUS	441960	1	
8	DENMARK	532080		1
9	FINLAND	552460		1
10	FRANCE	532500		1
11	GERMANY	532800		1
12	GREECE	533000		1
13	HONG KONG	453440	1	
14	ICELAND	553520		1
15	IRELAND	533720		1
16	ISRAEL	413760	1	
17	ITALY	533800		1
18	JAPAN	413920		1
19	KOREA RP (SOUTH)	454100		1
20	KUWAIT	444140	1	
21	MALTA	574700	1	
22	NETHERLANDS	535280		1
23	NEW CALEDONIA	725400	1	
24	NEW ZEALAND	715540		1
25	NORWAY	555780		1
26	PORTUGAL	536200		1
27	SAUDI ARABIA	446820	1	
28	SINGAPORE	457020	1	
29	SPAIN	537240		1
30	SWEDEN	557520		1
31	SWITZERLAND	557560		1
32	UNITED KINGDOM	538260		1
33	UNTD ARAB EM	447840	1	
34	USA	218400		1

Table 8: Bilateral Trade Flows and Measured RER by Country Group, Summary Statistics. 34 High Income and 102 Developing Countries, 1981-1997.

		Bilateral Trade Flows (1,000 of 1995 US dollars)	Measured Bilateral RER
HI	**Mean**	2,040,783	41
	Median	178,940	1
	St. Dev.	7,542,183	263
	St. Dev./Mean	4	6
	St. Dev./Median	42	263
	Observations	17,252	17,252
HI & MIX	**Mean**	759,103	164
	Median	23,379	0
	St. Dev.	4,389,205	8,994
	St. Dev./Mean	6	55
	St. Dev./Median	188	51,143
	Observations	56,759	56,759
DC	**Mean**	32,115	9,137
	Median	1,493	1
	St. Dev.	156,390	473,937
	St. Dev./Mean	5	52
	St. Dev./Median	105	450,412
	Observations	47,391	47,391
DC & MIX	**Mean**	104,700	5,653
	Median	2,936	4
	St. Dev.	921,817	356,325
	St. Dev./Mean	9	63
	St. Dev./Median	314	82,854
	Observations	83,868	83,868

Table 9: Bilateral Trade Flows by Type of Good for Country Groups, Summary Statistics. 34 High Income and 102 Developing Countries, 1981-1997.

		Bilateral Trade Flows (1,000 of 1995 US dollars)		
		Homogeneous	Reference Price	Differentiated
HI	Mean	307,822	275,615	1,030,652
	Median	18,779	25,202	62,737
	St. Dev.	1,228,589	939,296	4,392,642
	St. Dev./Mean	4	3	4
	St. Dev./Median	65	37	70
	Observations	15,045	15,998	16,953
HI & MIX	Mean	133,654	108,788	384,839
	Median	3,979	4,281	8,552
	St. Dev.	764,007	569,374	2,546,269
	St. Dev./Mean	6	5	7
	St. Dev./Median	192	133	298
	Observations	41,453	49,551	54,871
DC	Mean	22,688	9,013	10,292
	Median	1,405	619	385
	St. Dev.	92,876	39,995	64,700
	St. Dev./Mean	4	4	6
	St. Dev./Median	66	65	168
	Observations	26,251	28,386	39,052
DC & MIX	Mean	63,942	21,836	38,801
	Median	2,544	942	658
	St. Dev.	370,333	146,077	513,862
	St. Dev./Mean	6	7	13
	St. Dev./Median	146	155	781
	Observations	53,846	54,669	71,256

Table 10: Sector Level Bilateral Trade Flows by Type of Good for Country Groups, Summary Statistics. 34 High Income and 102 Developing Countries, 1981-1997.

		Sector Level Bilateral Trade Flows (1,000 of 1995 US dollars)			
		All Trade Flows	**Homogeneous**	**Reference Price**	**Differentiated**
HI	**Mean**	10,072	17,384	6,950	10,090
	Median	401	390	378	412
	St. Dev.	127,334	190,492	43,494	135,491
	St. Dev./Mean	13	11	6	13
	St. Dev./Median	317	489	115	329
	Observations	2,633,831	266,737	634,596	1,732,498
HI & MIX	**Mean**	5,831	11,679	4,204	5,643
	Median	186	249	194	178
	St. Dev.	88,921	143,997	31,986	92,895
	St. Dev./Mean	15	12	8	16
	St. Dev./Median	478	579	165	523
	Observations	5,580,814	485,166	1,304,986	3,790,662
DC	**Mean**	1,499	6,838	1,287	761
	Median	78	249	109	61
	St. Dev.	17,016	48,324	8,290	7,212
	St. Dev./Mean	11	7	6	9
	St. Dev./Median	219	194	76	117
	Observations	1,064,704	107,407	253,220	704,077
DC & MIX	**Mean**	3,432	14,463	2,420	1,901
	Median	105	354	144	81
	St. Dev.	50,928	134,685	16,870	26,879
	St. Dev./Mean	15	9	7	14
	St. Dev./Median	484	380	117	331
	Observations	2,396,585	269,258	553,677	1,573,650

Table 11: Bilateral Export Response to Real Exchange Rate Fluctuations for 136 Sample, 1981-1997.

	Dep Var is Log of Bilateral Trade Flows			
	All Flows	**Homogeneous**	**Reference Price**	**Differentiated**
Ln(RER)	0.055***	0.031***	0.104***	0.080***
	[0.008]	[0.011]	[0.010]	[0.008]
Observations	140,627	95,299	104,220	126,127
# country-pairs	13,917	10,737	11,151	13,021
R-squared	0.09	0.02	0.08	0.16

1. Robust standard errors in brackets
2. * significant at 10%; ** significant at 5%; * significant at 1%**
3. GDP and GDPpc for the exporter and the importer included. Fixed Effects for country-pairs and years included.

Table 12: Summary Stats of Bilateral Export Responses to Real Exchange Rate Fluctuations for Overall Sample, By Exporter, 1981-1997.

	Sample		
	Overall	HI&MIX	DC&MIX
Avg. Estimate	0.14*	0.13*	0.15*
% of Significant	45	74	35
Avg. R^2	0.85	0.90	0.83
Avg. # Observations	1,076	1,669	864
Max	Togo	Greece	Togo
	Gambia	New Zealand	Gambia
	Yemen	Portugal	Yemen
Min	Oman	Kuwait	Gabon
	Albania	United Arab Em.	Oman
	Brunei	Brunei	Albania

1.* Indicates different from zero at 5% level
2. 129 estimates included

3. 7 outliers excluded: Djbouti (-0.90), Burkina Faso (1.14), Seychelles (1.15), Rwanda (1.73), Eq. Guinea (2.53), Maldives (2.86), Cambodia (3.27)

Table 13: Summary Stats of Bilateral Export Responses to Real Exchange Rate Fluctuations for HI and DC Samples, By Exporter, 1981-1997.

	Sample	
	HI	DC
Avg. Estimate	0.67*	0.18*
% of Significant	53	36
Avg. R^2	0.93	0.78
Avg. # Observations	507	493
Max	Bahamas	Gambia
	Cyprus	Mali
	Korea Rp (S)	Burkina Faso
Min	Brunei	Gabon
	Kuwait	Oman
	Saudi Arabia	Djibouti

1.* Indicates different from zero at 5% level
2. 129 estimates included

3. 7 outliers excluded: Comoros (-2.31), Solomon Islds (-1.80), Albania (-1.33), Cambodia (2.65), Rwanda (3.58), Mongolia (3.97), Maldives (8.69)

Table 14: Summary Stats of Bilateral Export Responses for High Income Countries, By Sector, 1981-1997.

Estimated Coefficients for Bilateral RER for Sectors (HI&MIX Sample):

	Homogeneous	**Differentiated**
Avg. Estimate	0.05*	0.20*
% of Significant	31	89
Avg. R^2	0.07	0.11
Avg. # Obs.	5,408	16,194
Max	Ores & Concentrates of Uranium and Thorium	Knitted/Crocheted Fabrics of Fibres Oth. Than Synth.
	Sugars, Beet and Cane, Raw, Solid	Parts of the machines of 726.31, 726.4-, 726.7-
	Zinc, Ores and Concentrates	Mach., Appar., Access. For Type Founding or Setting
Min	Sawlogs and Veneer Logs, of Non Coniferous Species	Furskins, Tanned/Dressed, Pieces/Cutting of Furskin
	Ores & Concentrates of Precious Metal; Waste, Scra.	Industrial Diamonds Sorted, Whether or not Worked
	Rice in the husk or husked, but not further prepar.	Tobacco Refuse

1.* Indicates different from zero at 5% level
2. 86 (224) estimates for Homogeneous (Differentiated) sectors included
3. 7 outlier sectors excluded: Roasted Iron Pyrites, Whether or Not Agglomerated (-0.75, Hom), Sesame (sesamum) seeds (1.26, Hom), Sheep and Lamb Skins Without the Wool, Raw (Fresh etc) (-0.43, Diff), Under Garments, Knitted, of Synthetic Fibers (0.91,Diff), Castor Oil Seeds (0.95,Diff), Maps, Greeting Cards Music, Printed (1.23,Diff) and Petroleum Oil Prep & Residues NES (1.47, Diff)

Estimated Coefficients for Bilateral RER for Sectors (HI Sample):

	Homogeneous	**Differentiated**
Avg. Estimate	0.02	0.56*
% of Significant	31	76
Avg. R^2	0.09	0.15
Avg. # Obs.	3,024	7,602
Max	Sesame (sesamum) seeds	Builderscarpentry and Joinery
	Sheep and Goats, Live	Maps, Greeting Cards Music, Printed
	Plywood consisting of Sheets of Wood	Tubes and Pipes, of Cast Iron
Min	Tobacco, Not Stripped	Asbestos
	Durum Wheat, Unmilled	Sheep and Lamb Skins Without the Wool, Raw (Fresh etc)
	Tin Ores and Concentrates	Tobacco Refuse

1.* Indicates different from zero at 5% level
2. 88 (227) estimates for Homogeneous (Differentiated) sectors included
3. 2 outlier sectors excluded: Under Garments, Knitted, of Synthetic Fibers (2.33, Dif) and Petroleum Oil Prep & Residues NES (7.49, Diff)

Table 15: Summary Stats of Bilateral Export Responses for Developing Countries, By Sector, 1981-1997.

Estimated Coefficients for Bilateral RER for Sectors (DC&MIX Sample):

	Homogeneous	Differentiated
Avg. Estimate	0.03*	0.05*
% of Significant	31	51
Avg. R^2	0.09	0.12
Avg. # Obs.	2,802	6,433
Max	Sheep and Goats, Live	Building and Monumental Stone not Further Worked
	Rye, Unmilled	Peat, whether or not Compres. Into Bales not agglomera
	Cotton Seeds	Coats and Jackets of Textile Fabrics
Min	Animal Oils, Fats and Greases, NES	Castor Oil Seeds
	Gold, Non-Monetary	Briouet. Ovoids & Sim.Solid Fuels, of Coal Peat Lig.
	Pulpwood (Including chips and wood waste)	Sheep & Lamb Skins Without the Wool, Raw (Fresh etc)

1.* Indicates different from zero at 5% level
2. 87 (221) estimates for Homogeneous (Differentiated) sectors included
3. 9 outlier sectors excluded: Roasted Iron Pyrites, Whether or Not Agglomerated (-0.58, Hom), Maps, Greeting Cards Music, Printed (-0.58, Diff), Shavers and Hair Clippers with motor and parts (-0.46, Diff), Petroleum Oil Prep & Residues NES (0.43, Diff), Industrial Diamonds Sorted, Whether or not Worked (0.45, Diff), Knitted/Crocheted Fabrics of Fibres Oth. Than Synth. (0.53, Diff), Mach., Appar., Access. For Type Founding or Setting (0.81, Diff), Parts of the machines of 726.31, 726.4-, 726.7- (0.92, Diff), Under Garments, Knitted, of Synthetic Fibers (1.35, Diff).

Estimated Coefficients for Bilateral RER for Sectors (DC Sample):

	Homogeneous	Differentiated
Avg. Estimate	0.03	0.04*
% of Significant	28	35
Avg. R^2	0.13	0.12
Avg. # Obs.	1,175	2,876
Max	Raw Silk (Not Thrown)	Knitted/Crocheted Fabrics of Fibres Oth. Than Synth.
	Sheep and Goats, Live	Work Trucks, Mechanically Propelled, For Short Distance
	Butter	Suits & Costumes, Womens, of Textile Fabrics
Min	Animal Oils, Fats and Greases, NES	Castor Oil Seeds
	Rape and Colza Seeds	Sheep & Lamb Skins Without the Wool, Raw (Fresh etc)
	Ores & Concentrates of Precious Metal; Waste, Scra.	Briouet. Ovoids & Sim.Solid Fuels, of Coal Peat Lig.

1.* Indicates different from zero at 5% level
2. 81 (220) estimates for Homogeneous (Differentiated) sectors included
3. 14 outlier sectors excluded (5 Hom. and 9 Diff.)

Table 16: Persistent Bilateral Export Response to Real Exchange Rate Fluctuations for 136 Sample, 1981-1997.

Dep Var is Log of Bilateral Trade Flows

	All Flows	Homogeneous	Reference Price	Differentiated
Ln(RER)	0.072***	0.057***	0.144***	0.093***
	[0.016]	[0.019]	[0.017]	[0.014]
Observations	40,719	29,554	30,931	37,051
# country-pairs	13,917	10,737	11,151	13,021
R-squared	0.09	0.02	0.10	0.19

1. Robust standard errors in brackets
2. * significant at 10%; ** significant at 5%; * significant at 1%**
3. GDP and GDPpc for the exporter and the importer included. Fixed Effects for country-pairs and periods included.

Table 17: Summary Stats of Persistent Bilateral Export Responses for HI Sample, By Sector, 1981-1997.

Estimated Coefficients for Bilateral RER for Sectors (HI&MIX Sample):

	Homogeneous	Differentiated
Avg. Estimate	0.05*	0.17*
% of Significant	35	83
Avg. R^2	0.07	0.14
Avg. # Obs.	1,959	5,056

1.* Indicates different from zero at 5% level
2. 84 (224) estimates for Homogeneous (Differentiated) sectors included
3. 9 outlier sectors excluded (4 Hom. and 5 Diff.)

Estimated Coefficients for Bilateral RER for Sectors (HI Sample):

	Homogeneous	Differentiated
Avg. Estimate	0.002	0.56*
% of Significant	20	71
Avg. R^2	0.10	0.19
Avg. # Obs.	1,003	2,152

1.* Indicates different from zero at 5% level
2. 86 (226) estimates for Homogeneous (Differentiated) sectors included
3. 4 outlier sectors excluded (2 Hom. and 2 Diff.)

Table 18: Summary Stats of Persistent Bilateral Export Responses for DC Sample, By Sector, 1981-1997.

Estimated Coefficients for Bilateral RER for Sectors (DC&MIX Sample):

	Homogeneous	Differentiated
Avg. Estimate	0.05*	0.08*
% of Significant	23	49
Avg. R^2	0.09	0.15
Avg. # Obs.	1,251	2,546

1.* Indicates different from zero at 5% level
2. 83 (222) estimates for Homogeneous (Differentiated) sectors included
3. 12 outlier sectors excluded (5 Hom. and 7 Diff.)

Estimated Coefficients for Bilateral RER for Sectors (DC Sample):

	Homogeneous	Differentiated
Avg. Estimate	0.05*	0.08*
% of Significant	28	41
Avg. R^2	0.14	0.14
Avg. # Obs.	555	1,233

1.* Indicates different from zero at 5% level
2. 82 (221) estimates for Homogeneous (Differentiated) sectors included
3. 8 outlier sectors excluded (2 Hom. and 6 Diff.)

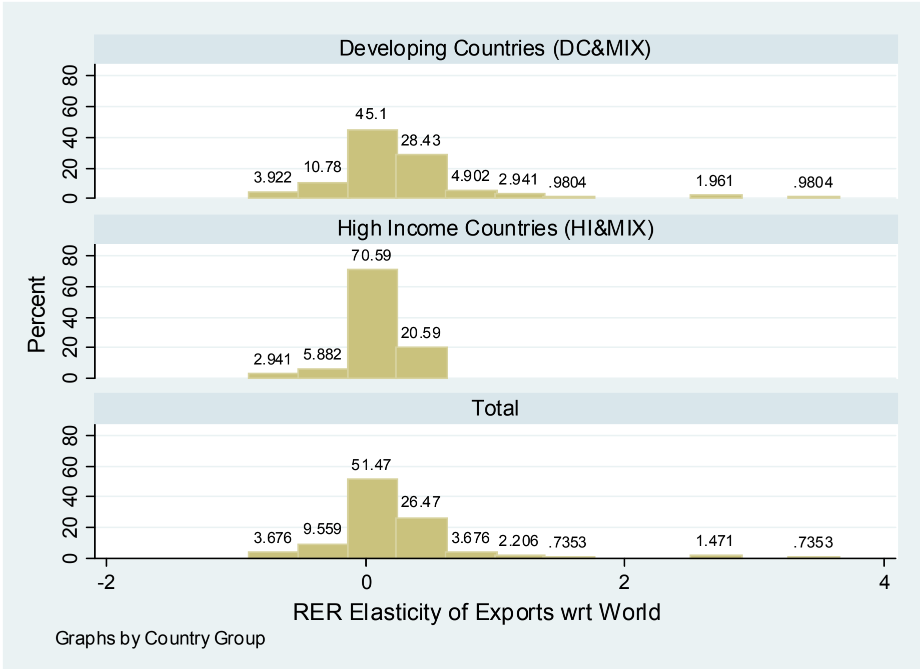

Figure 1: Distribution of Bilateral Export Responses to Real Exchange Rate Fluctuations for Overall Sample, By Exporter, 1981-1997.

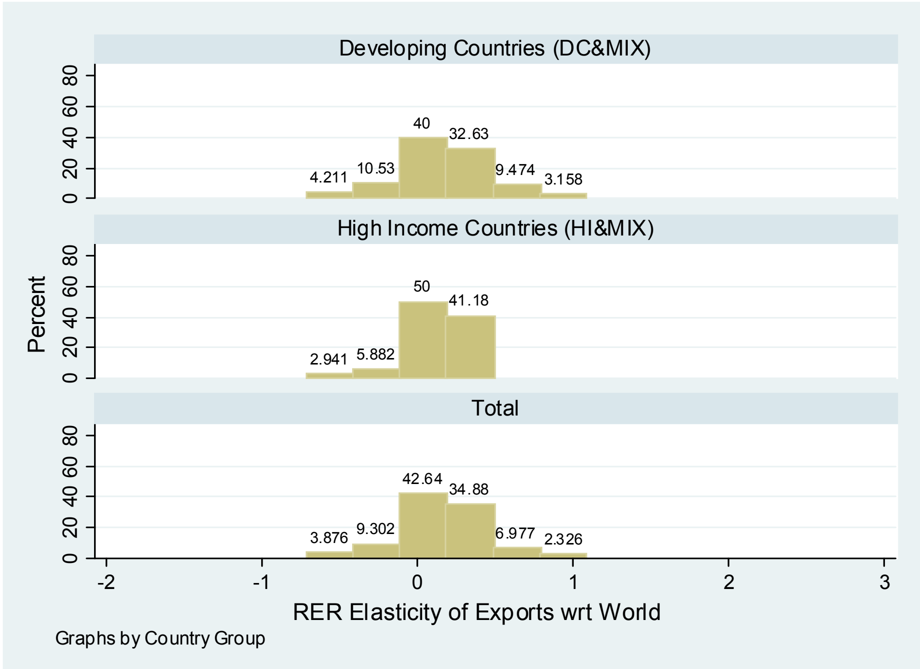

Figure 2: Distribution of Bilateral Export Responses to Real Exchange Rate Fluctuations for 129 Sample, By Exporter, 1981-1997.

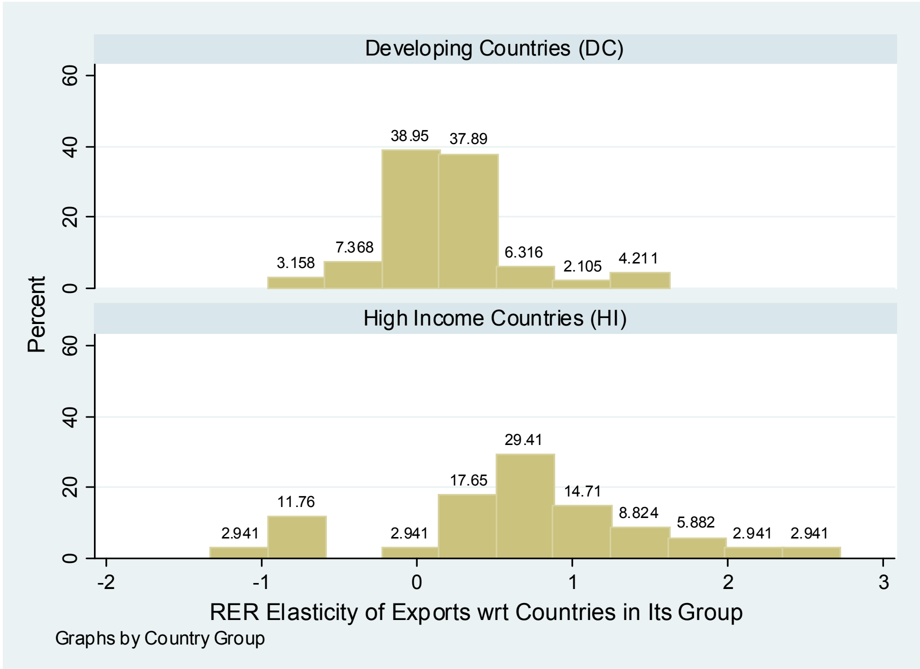

Figure 3: Distribution of Bilateral Export Responses to Real Exchange Rate Fluctuations for HI and DC Samples, By Exporter, 1981-1997.

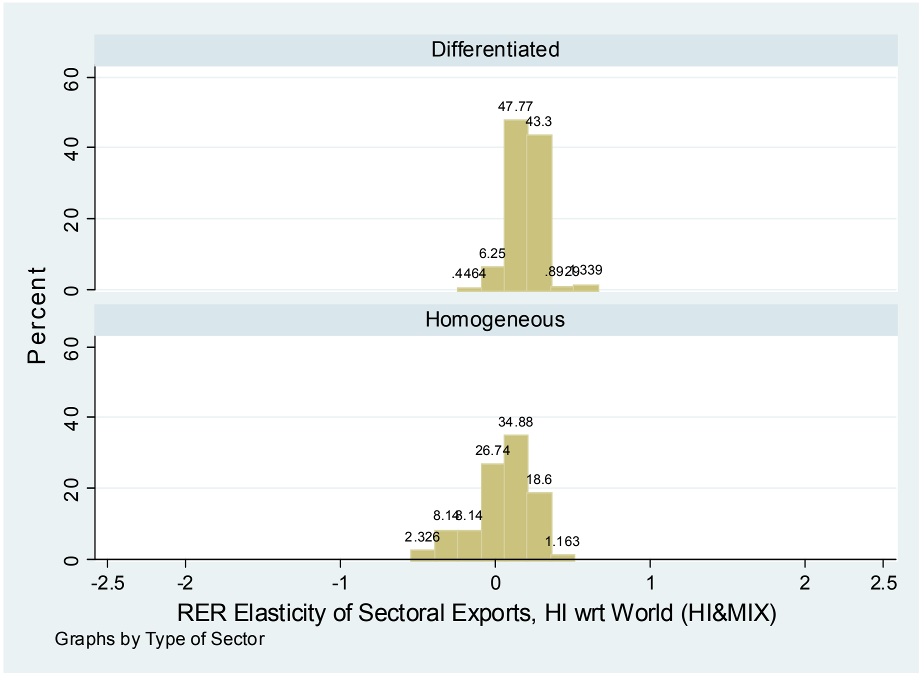

Figure 4: Distribution of Bilateral Export Responses to Real Exchange Rate Fluctuations (η) for HI&MIX Sample, By Sector, 1981-1997.

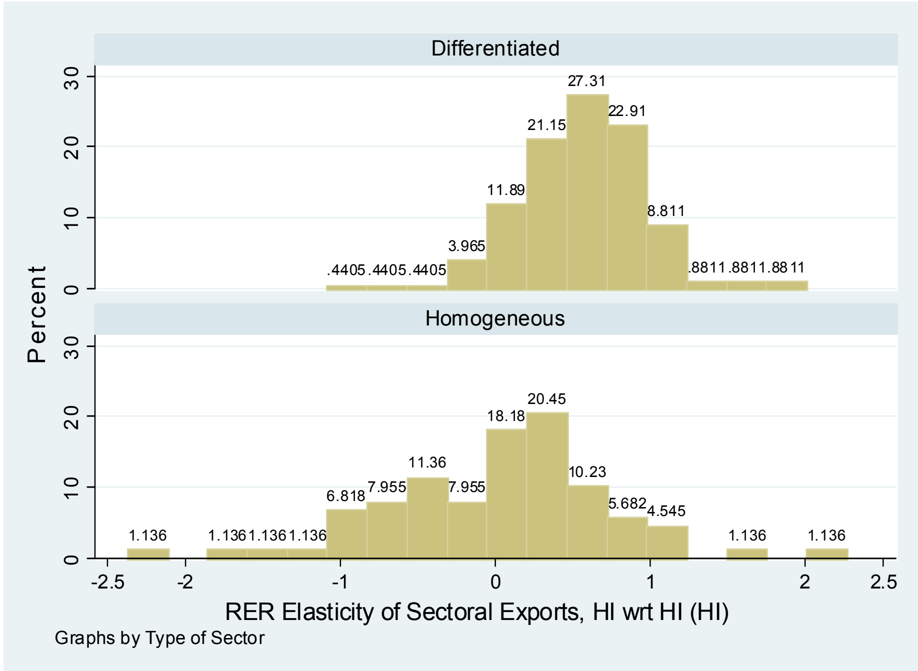

Figure 5: Distribution of Bilateral Export Responses to Real Exchange Rate Fluctuations (η) for HI Sample, By Sector, 1981-1997.

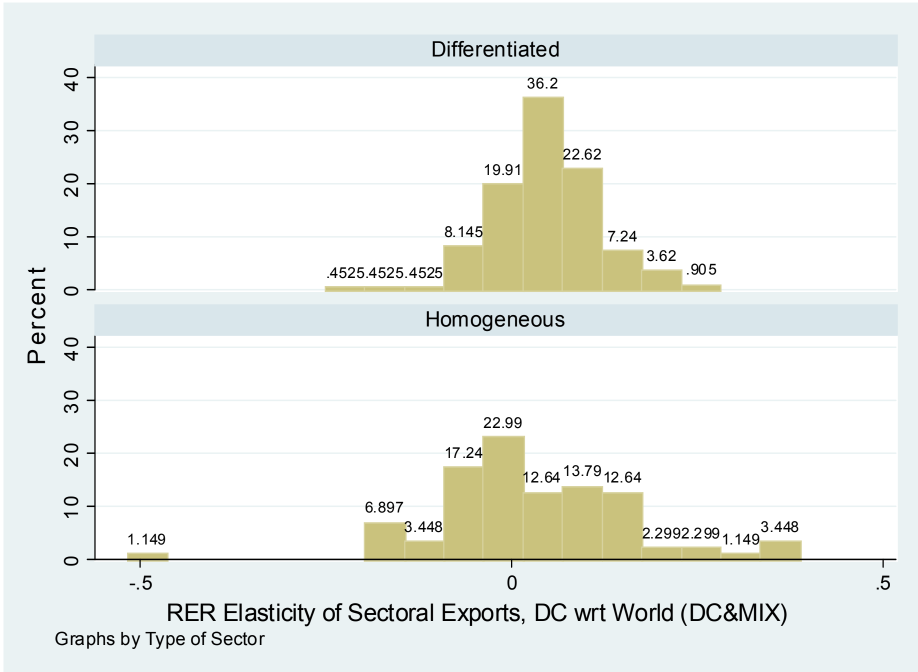

Figure 6: Distribution of Bilateral Export Responses to Real Exchange Rate Fluctuations (η) for DC&MIX Sample, By Sector, 1981-1997.

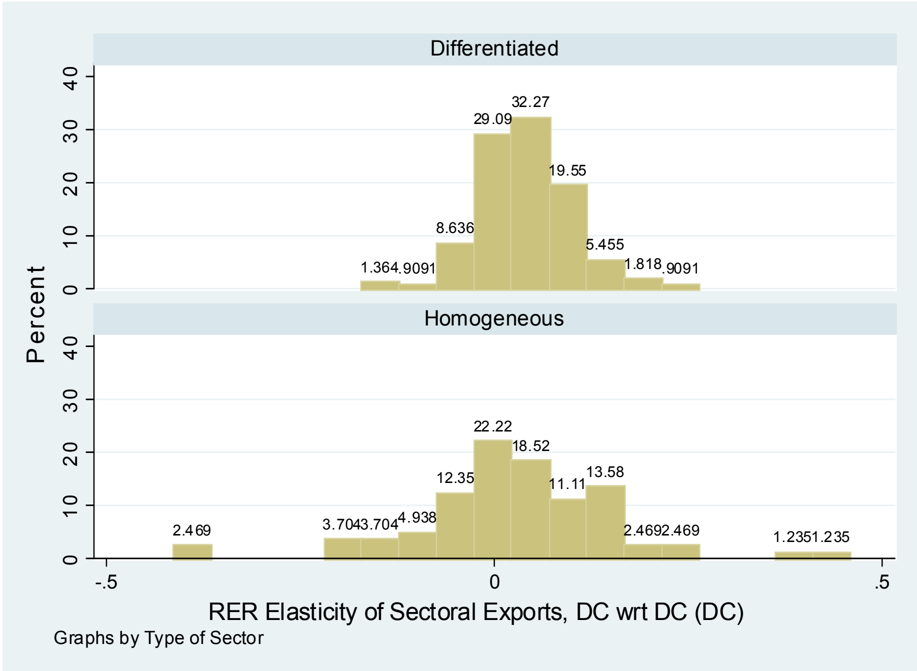

Figure 7: Distribution of Bilateral Export Responses to Real Exchange Rate Fluctuations (η) for DC Sample, By Sector, 1981-1997.