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Exchange Rate Pass-through in Global Value Chains: The Effects of Upstream Suppliers

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Abstract

In this paper, we estimate the effect of fluctuations in nominal exchange rates on trade in manufactured goods for final use. We estimate an econometric model of international trade that incorporates data on the value-added content of trade flows. Our analysis indicates that the value-added trade data can significantly improve estimates of exchange rate pass-through rates and trade elasticities by more fully accounting for the effects of a reduction in the value of an exporter's currency on its own costs and the costs of its international competitors.

1. Introduction

Fluctuations in exchange rates can have significant effects on the competitiveness of foreign producers who export to the U.S. market. As long as there are rigidities in nominal wages and prices, reductions in the nominal value of an exporter's currency will lower its relative costs of production and may lower the relative price of its exports. The change in export prices will depend on whether the exporter tries to maintain the local-currency value of its prices (by incompletely passing through the exchange rate fluctuations) or tries to maintain the producer-currency value of its prices (by completely passing through the exchange rate fluctuations). The magnitude of the resulting change in the volume of trade flows will depend on the substitutability of imports from other countries and on the currency denomination of the costs of these international competitors.

There is a sizeable empirical and theoretical literature that investigates the pass-through of nominal exchange rate fluctuations into import prices and the resulting change in international trade flows.[1] Goldberg and Knetter (1997) provide a broad review of the literature on exchange rate pass-

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[1] Exchange rate pass-through is relevant to the effectiveness of monetary policy and the optimal choice of exchange rates, as well as the adjustment of international trade flows. This point is emphasized in Devereaux and Engel (2003), Marazzi et al. (2005), and Brun-Aguerre et al. (2012).

through. They summarize evidence of incomplete pass-through. In some cases, foreign currency prices of exports adjust by less than half of the change in nominal exchange rates, and the difference is absorbed in the exporters' mark-ups. More recently, Campa and Goldberg (2005) demonstrate that exchange rate pass-through is especially low within the U.S. manufacturing sector. They estimate a long-run pass-through rate of 0.44. Brun-Aguerre et al. (2012) estimate a nearly identical pass-through rate in their first-differences model of 0.42. Other studies have estimated even lower pass-through, particularly in recent years. Marazzi et al. (2005) and Vigfusson et al. (2009) estimate that the pass-through rate for imports into the United States has fallen over time to about 0.2–0.3.[2]

These empirical studies of exchange rate pass-through all assume that each exporter's entire marginal cost of product is denominated in the exporter's domestic currency. However, if some of the exporter's intermediate inputs are imported, and these costs are not denominated in the exporter's domestic currency, then the exporter's marginal costs of production will only be partly exposed to fluctuations in the value of its currency. In this more realistic case, the effect of the exchange rate changes will depend on the share of domestic value added in marginal costs.

This limitation—the unrealistic representation of the currency exposure of production costs—is often recognized in the literature as a caveat, but it difficult to resolve because there is often only limited information on costs of production.[3] More realistic modeling of costs requires information about each country's value-added contribution to the costs of the exporting country, but it also requires information about the currency denomination of the marginal costs of all of the other countries that compete in the same destination market. For example, an appreciation of the renminbi will affect the marginal costs (and prices) of exporters from China, according to the domestic share of the value added in their exports, but it will also affect the marginal costs (and prices) of any exporters in Mexico or other countries whose products include value added from China. Thankfully, recent developments in the estimation of value-added trade flows provide the needed information in a form that is easy to use.[4]

There is widespread evidence that global production has become more deeply integrated over the past few decades, with value increasingly added in multiple locations. Hence, traditional trade

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[2] Bergin and Feenstra (2009) discusses other studies with lower estimates.

[3] Goldberg and Knetter (1997) discuss the possibility that foreign sourcing of intermediate inputs can mute exchange rate pass-through, leading to a downward bias in estimates, but they do not provide a solution to the problem.

[4] There is a burgeoning literature examining the sources of value added in final goods traded and consumed internationally. Examples include Johnson and Noguera (2012), Koopman, Wang, and Wei (2012), Powers (2012), Stehrer (2012), and Timmer et al. (2012).

statistics that treat all value as if it originated in the country of export give an understated or distorted view of international integration and the sources of value in exports (De Backer and Yamano, 2012, Powers, 2012). Newly developed estimates of the sources of value in global production networks based on international input-output models give a much clearer picture. Johnson and Noguera (2012), for example, estimate that the share of foreign value in exports has increased for nearly every country since the 1970s.[5] A number of studies have now estimated that foreign value accounts for 20–25 percent of global export values, with much higher shares for specific products, such as electronics, or specific exporters, such as Mexico or China. In addition to value shares, industrial capabilities, product complexity, and international competitiveness are also poorly measured with export data (Wang and Wei, 2010, Van Assche and Gangnes, 2010). National competitiveness measures based on value added can challenge or contradict more traditional measures. For example, Timmer et al. (2012) finds that European employment in manufacturing supply chains has actually increased, after accounting for all sources of value in those networks.

Despite the importance of foreign value added in global production and exports, we are not aware of any previous study that has estimated exchange-rate pass-through with data on value added in trade. In this paper, we estimate a set of econometric models of exchange rate pass-through and the link between exchange rates and trade flows using data on the value-added content of trade. Our analysis focuses on trade in non-petroleum manufactured goods for final use over the last decade, as recorded in the World Input Output Database (WIOD). We translate our parameter estimates into pass-through rates and Armington elasticities, and then ultimately into trade elasticities (defined here as the change in export value resulting from a change in the nominal exchange rate). We find that value-added trade data can significantly improve estimates of exchange rate pass-through rates and trade elasticities by more fully accounting for the effects of a reduction in the value of an exporter's currency on its own costs and the costs of its international competitors.

Bems and Johnson (2012) is an important recent study of exchange rates that also addresses vertical specialization in trade and weights prices using countries' shares of trade in value added. However, there are significant differences in emphasis from our paper. Bems and Johnson present a model of trade in value added, from which they derive a new formula for the real effective exchange rate, while we estimate an econometric model of gross trade in final goods. Bems and Johnson do not estimate exchange rate pass-through rates or a price elasticity of demand, the two elasticities that we

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[5] Norway is the lone exception in their dataset.

emphasize in this paper. On the other hand, Bems and Johnson demonstrate why GDP deflators, rather than CPIs, should be used to construct national cost measures, and we adopt this important methodological point.

2. Modeling Framework

In this section, we develop a structural model of international trade in final goods that incorporates value-added trade data. We first generate a specification that allows us to estimate elasticities of substitution and exchange rate pass-through as a function of observable data on trade, domestic expenditure, prices, and exchange rates. We then derive a simple formula for the trade elasticity based on these parameters and value-added trade information.

2.1 Elasticity of Substitution and Exchange Rate Pass-Through

We assume that consumers have CES preferences for the products within each sector, viewing products from different countries as imperfect substitutes with an elasticity of substitution equal to σ. With CES demands, we can represent relative expenditures on different products as a constant elasticity function of the relative prices in the consumer's currency.

$$\frac{V_{ijt}}{V_{jjt}} = \varphi \left(\frac{P_{ijt}}{P_{jjt}}\right)^{1-\sigma}. \tag{1}$$

The variable V_{jjt} is the value of domestic shipments in destination country j in year t, V_{ijt} is the value of exports from country i to country j in the currency of country j, P_{jjt} is the price of domestic goods in country j, and P_{ijt} is the price of exports from country i in the currency of country j. The relative demand specification avoids the need to measure sector-specific total expenditure or a sector-specific CES price index for destination country j. We do not include a subscript for sector, since the model is sector-specific.

After totally differentiating, equation (1) becomes, in the "hat" algebra of proportional changes,

$$\hat{V}_{ijt} - \hat{V}_{jjt} = (1-\sigma)\left[\hat{P}_{ijt} - \hat{P}_{jjt}\right]. \tag{2}$$

The price of exports from country i in the currency of country j is a weighted average of the price of the inputs used in production in the currency of the countries of origin, P_{kkt}, divided by the country k foreign currency price of the currency of country j, E_{ijt}, possibly with an additional mark-up determined by the extent of exchange rate pass-through, represented by λ.[6] This implies equation (3).

$$\hat{P}_{ijt} = \lambda \sum_k \theta_{kit} \left(\hat{P}_{kkt} - \hat{E}_{kjt} \right). \qquad (3)$$

The variable θ_{kit} represents the cost share of country k in the sector's exports from country i in year t. Substituting (3) into (2),

$$\hat{V}_{ijt} - \hat{V}_{jjt} = -(1-\sigma)\hat{P}_{jjt} + \lambda\,(1-\sigma) \sum_k \theta_{kit} (\hat{P}_{kkt} - \hat{E}_{kjt}). \qquad (4)$$

Equation (5) is our sector-specific econometric specification.

$$\hat{V}_{ijt} - \hat{V}_{jjt} = \beta_0 + \beta_1 \hat{P}_{jjt} + \beta_2 \sum_k \theta_{kit} \left(\hat{P}_{kkt} - \hat{E}_{kjt} \right) + \eta_{ijt}. \qquad (5)$$

The variable η_{ijt} is an error term with conventional distributional assumptions. We can recover the underlying parameters of the model from the regression coefficients in (5). The elasticity of substitution, σ, is equal to $1 + \beta_1$. The exchange rate pass-through rate, λ, is equal to $-\beta_2/\beta_1$.

We also consider a special case, in which the exports from country $i$contain 100% domestic content, so $\theta_{kit} = 0$ for $k \neq i$ and $\theta_{kit} = 1$ for $k = i$. In this case, the econometric specification simplifies to (6).

$$\hat{V}_{ijt} - \hat{V}_{jjt} = \beta_0 + \beta_1 \hat{P}_{jjt} + \beta_2 \left(\hat{P}_{iit} - \hat{E}_{ijt} \right) + \varepsilon_{ijt}. \qquad (6)$$

2.2 Trade Elasticity

To calculate the trade elasticity, we rewrite the CES demands in terms of the level of expenditure on exports from country i to country j, rather than relative demands.

$$V_{ijt} = Y_{jt} \left(Z_{jt} \right)^{\sigma-1} \left(P_{ijt} \right)^{1-\sigma} \qquad (7)$$

The variable Y_{jt} represents total consumer expenditure in the sector in country j, and Z_{jt} represents the sector's CES price index in country j in year t.

After totally differentiating, equation (7) becomes, in the "hat" algebra of proportional changes,

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[6] The parameter λ, which represents the exchange pass-through rate, is directly estimated in the econometric analysis. Specifically, it is pass-through rate for changes in marginal costs, which are weighted average of the changes in the exchange rates relevant to imported inputs. The pass-through rate with respect to the currency of a single country, like country k, is $\lambda\theta_{kit}$.

$$\hat{V}_{ijt} = \hat{Y}_{jt} + (\sigma - 1)\big(\hat{Z}_{jt} - \hat{P}_{ijt}\big) \tag{8}$$

The percentage change in the sector's price index, $\hat{Z}_{jt}$, is an expenditure-weighted average of the percentage changes in the prices of imports from each country.

$$\hat{Z}_{jt} = \textstyle\sum_k \gamma_{kjt}\,\widehat{P}_{kjt} \tag{9}$$

The variable k is an index of the countries that export the sector's final goods to country j, and γ_{kjt} denotes the share of exports from country k to country j in the total expenditures of country k (in the sector) in year t. Substituting equations (3) and (9) into equation (8), and setting $\hat{Y}_{jt} = \widehat{P}_{ijt} = 0$ for all i and j, gives equation (10).

$$\hat{V}_{ijt} = (1-\sigma)\big(\lambda \textstyle\sum_k \theta_{ikt}\ \gamma_{kjt}\hat{E}_{ijt} - \lambda\,\theta_{iit}\hat{E}_{ijt}\big). \tag{10}$$

And therefore, the trade elasticity, defined as the percentage change in the value of exports from country i to country j in response to a one percent increase in E_{ijt} is equal to:

$$TE_{ijt} = \underbrace{(1-\sigma)\,\lambda\,(-\theta_{iit})}_{\text{own price effect}} + \underbrace{(1-\sigma)\,\lambda\,\textstyle\sum_k \theta_{ikt}\gamma_{kjt}}_{\text{price index effect}}. \tag{11}$$

We expect that the trade elasticity in equation (11) will be positive, since the Armington elasticity σ is greater than one and a country's share of the value added in its own production is usually larger than its share of the value added in foreign production. We decompose the trade elasticity in equation (11) into two parts, an own price effect and a price index effect. The own price effect is always positive, and it is increasing in country i's share of the value added in its own production in the sector. The price index effect is always negative, and it is declining in the country j expenditure-weighted average of country i's share of the value added in the production of each country that exports to country j. Analyses of the impact of exchange rates on trade in a value-added framework, like Xing and Detert (2010), usually recognize the own price effect but often do not address the price index effect. However, our calculations below suggest that the price effect can be large for some countries.

Finally, for the sake of comparison, we also consider a special case of the trade elasticity that ignores the data on the value-added content of gross trade flows. It adopts the simplifying assumption that is common in the economics literature on exchange rate pass-through: all of the exporters' marginal costs are denominated in their own currency. This is equivalent to setting the value-added shares θ_{kit} equal to one if $k = i$ and equal to zero otherwise.

3. Econometric Estimates

The econometric specification is based on equations (5) and (6), with the proportional changes approximated by the first-differences of the logs of the variables. All data for the estimation come from the World Input Output Database (WIOD). The database contains data on the international sourcing of intermediate inputs and final goods in35 sectors among 40 countries (27 EU plus 13 other major countries) for 1995–2009. It also contains the data on final expenditure and sectoral value-added in production required to estimate the sources of value added in final goods traded and consumed throughout the world.[7] The estimate of value-added shares relies on a transformation from the direct input-output table provided by WIOD into the Leontief inverse matrix, which describes all inputs, direct and indirect, used in the provision of final goods.[8] For our estimates, the WIOD database provides the required data on sectoral trade, domestic expenditure, and, after transformation, the value-added shares. Other than nominal exchange rates, however, the WIOD database does not contain price information. Following Bems and Johnson (2012), we use local-currency GDP deflators (from the IMF) to measure local prices. We estimate the model using OLS and a panel of log-first-differences from 2000 to 2009 for 13 non-petroleum manufacturing sectors in 28 of the largest countries in the WIOD dataset.[9]

Table 1 presents the estimates of the exchange rate pass-through and the substitution elasticity for each sector based on econometric estimates of β_1 and β_2 in equations (5) and (6).[10] Overall, the estimated pass-through rates are sensible and precisely estimated in our preferred specification (first three columns of the table). In 8 of the 13 sectors, estimates are bounded between zero and one at the 95 percent significance level, and only two sectors (transportation equipment and food, beverages, and tobacco) have point estimates outside this range. Thus for most of the sectors, we can strongly reject the hypothesis that the pass-through rate is equal to one, as would be the case if there were perfect competition and consumer prices reflected all fluctuations in the value of the producer's currency. For most of the sectors, we can also strongly reject the hypothesis that the pass-through rate is zero, as would be the case if the exporter strictly maintained its local currency prices despite the exchange rate fluctuation. The median pass-through estimate is 0.44. This magnitude is close to the estimated pass-

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[7] See Timmer (2012) for details of the content and construction of the database.

[8] See Timmer et al. (2012) for a discussion of the Leontief inverse. We thank Zhi Wang for the provision of these inverses.

[9] We exclude 12 small countries from the estimation sample because of the prevalence of zero flows in their exports. It is not possible to calculate a log-first-difference for a variable with a zero value.

[10] Appendix Tables 1 and 2 report the point estimates and standard errors for the β coefficients.

through rates in Campa and Goldberg (2005) and Brun-Aguerre et al. (2012), though higher than estimates in Marazzi et al. (2005).

The estimates for substitution elasticity for our preferred specification in table 1 are also precisely estimated. The point estimates are all greater than one, and significantly different from one in nine sectors at the 95 percent significance level. The median elasticity is 1.84. For comparison, we are not aware of any estimates employing the current methodology or WIOD data, but elasticities in the GTAP model may be the closest available estimates at a similar level of aggregation. The median elasticity in the 15 non-food, non-petroleum manufacturing sectors in the GTAP model is 3.75, twice the median estimate in this study.

Table 1 also presents estimates employing the alternative specification, given in equation (6), that exports contain 100 percent domestic content. These estimates depart from the preferred estimates employing value-added estimates in consistent ways. Although elasticities are generally higher in the alternative specification, estimates of pass-through rates are consistently lower. The alternative estimates are not preferred on statistical grounds. The table reports F-statistics of the joint hypothesis that the coefficients in the regression models are equal to zero, along with p-valued in parentheses. The alternative specification has a lower F-statistic in 10 of the 13 sectors than the preferred specification. Thus the model based on value-added shares performs better than the simpler model that ignores this information.

4. Trade Elasticities

In this section, we report trade elasticity estimates for exports to the United States in 2009, based on the model in equation (11). We use WIOD data for all countries in 2009 to calculate the value-added shares and U.S. expenditure shares of exports from 27 countries in 13 manufacturing sectors.[11] We use our econometric estimates of λ and σ from Table 1.

Table 2 provides specific examples for exports of electrical and optical equipment in 2009 from four different countries to the United States. The table reports the two sets of trade elasticity estimates, and it reports the value-added shares measures that underlie the differences in the estimates across the four countries. For example, the China column indicates that a 10 percent increase in the renminbi price of a U.S. dollar (a 10 percent renminbi depreciation relative to the dollar) will increase

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[11] The exporters include all countries in the estimation sample other than the United States.

the value of China's exports to the U.S. in this sector by 2.0 percent (if the value-added trade data are not used in the estimate) or by 1.4 percent (if the value-added trade data are used in the estimate). The latter is almost a third lower. The trade elasticity that uses the value-added trade data is a combination of a negative own price effect (equal to -2.16 percent in this case) and a positive price index effect (equal to -0.8 percent) that offsets some of the own price effect.

The trade elasticity estimates for exports from Brazil are much larger than their counterparts for China, reflecting Brazil's relatively small share of U.S. imports, its relatively large domestic share of the value added in its exports, and its relatively small share in the value added of competing exporters like Mexico. These factors also imply that there is a small—in fact negligible—price index effect for the imports of electrical and optical equipment from Brazil.

The third column reports a large difference in the two trade elasticity estimates for Hungary, reflecting the country's unusually low share of the value added in its exports of electrical and optical equipment to the United States. Like Brazil, the price index effect is negligible and the trade elasticity is determined almost entirely by the own price effect.

The trade elasticity estimates for Korea are larger than those for exports from China, but the ratio of the two trade elasticity estimates is nearly identical. The price index effect for exports from Korea is smaller than its counterpart for China. This reflects Korea's relatively small value-added share in the U.S. import price index for the sector.

The final row of table 2 reports each country's value-added share in U.S. imports from Mexico, the competing exporter with the largest share of U.S. imports. The value-added share of China is much higher, and this contributes to the absolute magnitude of its price index effect. An increase in the renminbi price of a U.S. dollar has a significant effect on the marginal costs of Mexican exporters, and this rise in the costs of foreign competitors mitigates much of the own price effect on China's exports to the United States.

Table 3 reports an average of the sector-specific trade elasticity estimates for 27 exporting countries. The trade elasticity estimates range from 0.1932 for Ireland to 0.3392 for France. The final column reports the ratio of these averages. For each country, this ratio is less than one, indicating that the inclusion of the value added data reduces the estimate of the trade elasticity. The ratios of these average trade elasticities range from 0.5974 to 0.9630.The lowest are for Ireland, Hungary, the Czech Republic, and Taiwan. The highest are for Russia, Brazil, Japan, and Australia.

Table 4 reports the sector-specific estimates for U.S. imports from China. For each of the sectors, the trade elasticity estimate based on the value-added data is less than the baseline estimate that assumes 100% domestic content. The use of the value-added data leads to a large reduction in the trade elasticity, which we interpret as a correction of an upward bias in the baseline estimate. The largest reduction (in percentage terms) is for the electrical and optical equipment sector. The smallest reduction is for the food products sector. The final column reports the ratio of the price index effect to the own price effect for the trade elasticity based on the value-added data. For some of the sectors, there is a large price index effect that offsets much of the own price effect. This is the case for the textiles, electrical and optical equipment, and metal products sectors. For other sectors like transportation equipment and paper, there is almost no price index effect.

Table 5 reports the trade elasticity estimates for U.S. imports from Brazil. The two sets of trade elasticity estimates for exports from Brazil are much closer than the trade elasticity estimates for exports from China. The magnitudes of the trade elasticity estimates using the value-added data are greater than their counterparts for exports from China for every sector. This is because Brazil's domestic share of value added is higher and there are only small price index effects.

Table 6 reports the trade elasticity estimates on U.S. imports from Hungary. The ratio of the two trade elasticity estimates is greater than either Brazil or China, indicating the importance of the value-added trade data for estimating the effects of fluctuations in the value of the Hungarian currency. Like Brazil, there are virtually no price index effects for the imports from Hungary.

5. Conclusions

This paper presents a practical tool for estimating the effect of fluctuations in nominal exchange rates on the value of U.S. imports of manufactured goods using a structural model of trade and a value-added decomposition of gross trade flows. We find that trade elasticity estimates that do not incorporate value-added trade data are systematically overstated. The upward biases are largest for imports from Hungary and Ireland. The estimates also demonstrate that the price index effect is important in the case of exports from China, and that this seemly complex effect can be easily calculated with the formulas in this paper and the value-added trade data.

Our analysis of exchange rates and value-added trade data can be usefully extended in several directions. It can be applied to trade in services and to trade in intermediate goods. It can be used to calculate the change in trade balances due to specific historical changes in exchange rates.

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Table 1: Estimates of Exchange Rate Pass-through and the Substitution Elasticity

	Estimates Based on Value-Added Shares			Alternative Assuming 100% Domestic Content		
	λ	σ	F-Statistic	λ	σ	F-Statistic
Food, Beverages, and Tobacco Products	2.649	1.092	4.17	1.799	1.136	4.50
	(10.236)	(0.356)	(0.016)	(4.688)	(0.353)	(0.011)
Textiles	0.433	1.607	4.81	0.383	1.686	5.28
	(0.327)	(0.400)	(0.008)	(0.255)	(0.398)	(0.005)
Leather Products	0.534	1.764	5.31	0.458	1.787	4.62
	(0.190)	(0.354)	(0.005)	(0.158)	(0.370)	(0.010)
Wood Products	0.365	2.727	29.83	0.324	2.796	27.99
	(0.047)	(0.247)	(0.000)	(0.040)	(0.260)	(0.000)
Paper	0.463	1.373	1.64	0.402	1.383	1.41
	(0.356)	(0.318)	(0.194)	(0.301)	(0.329)	(0.245)
Chemicals	0.507	1.917	16.51	0.429	2.000	15.14
	(0.135)	(0.274)	(0.000)	(0.104)	(0.288)	(0.000)
Rubber and Plastic Products	0.380	2.403	29.45	0.320	2.505	26.63
	(0.050)	(0.241)	(0.000)	(0.039)	(0.256)	(0.000)
Non-Metallic Mineral Products	0.462	2.438	13.65	0.422	2.499	14.11
	(0.066)	(0.312)	(0.000)	(0.058)	(0.319)	(0.000)
Metal Products	0.550	1.403	2.79	0.449	1.363	1.58
	(0.502)	(0.394)	(0.062)	(0.455)	(0.406)	(0.206)
Machinery	0.225	1.770	8.05	0.198	1.796	7.81
	(0.073)	(0.193)	(0.000)	(0.063)	(0.201)	(0.000)
Electrical and Optical Equipment	0.372	1.871	16.18	0.307	1.958	15.95
	(0.074)	(0.172)	(0.000)	(0.055)	(0.183)	(0.000)
Transportation Equipment	-0.083	1.844	4.93	0.008	1.954	4.72
	(0.219)	(0.396)	(0.007)	(0.151)	(0.424)	(0.009)
Other Manufacturing	0.436	2.191	20.58	0.369	2.212	17.75
	(0.065)	(0.235)	(0.000)	(0.055)	(0.245)	(0.000)
Median	0.436	1.844	8.050	0.383	1.954	7.81

Note: Robust standard errors of the parameter estimates and p-values of the F statistics in parentheses.

Table 2: Numerical Examples from the Electrical and Optical Equipment Sector in 2009

	Brazil	China	Hungary	Korea
Trade Elasticity without Value-Added Trade Data	0.2936	0.2039	0.2934	0.2896
	(0.0610)	(0.0424)	(0.0610)	(0.0602)
Trade Elasticity with Value-Added Trade Data	0.2648	0.1373	0.1273	0.1954
	(0.0548)	(0.0284)	(0.0264)	(0.0405)
Own Price Effect	0.2662	0.2156	0.1278	0.2032
	(0.0551)	(0.0446)	(0.0265)	(0.0421)
Price Index Effect	-0.0014	-0.0783	-0.0005	-0.0078
	(0.0003	(0.0162)	(0.0001)	(0.0016)
Ratio of the Two Trade Elasticities	0.9019	0.6734	0.4339	0.6747
Ratio of the Price Index Effect to the Own Price Effects	-0.0053	-0.3632	-0.0039	-0.0384
Components of the Value-Added Elasticity Estimate				
Domestic Share of the Value-Added in the Country’s Exports	0.821	0.665	0.394	0.627
The Country’s Value-Added Share in the U.S. Import Price Index	0.006	0.395	0.002	0.038
The Country’s Value-Added Share in U.S. Imports from Mexico	0.006	0.149	0.001	0.030

Note: Robust standard errors in parentheses.

Table 3: Average Trade Elasticity for Each Exporting Country

Exporting Country	Trade Elasticity with Value-Added Data	Trade Elasticity without Value-Added Data	Ratio of Trade Elasticity Estimates
Australia	0.2925	0.3236	0.9038
Austria	0.2495	0.3239	0.7704
Belgium	0.2109	0.3234	0.6522
Brazil	0.3109	0.3235	0.9613
Canada	0.2602	0.3147	0.8269
China	0.2176	0.2637	0.8253
Czech Republic	0.2235	0.3242	0.6894
Denmark	0.2531	0.3239	0.7815
Finland	0.2606	0.3242	0.8039
France	0.2890	0.3392	0.8522
Germany	0.2607	0.3201	0.8144
Great Britain	0.2741	0.3217	0.8519
Hungary	0.2064	0.3242	0.6366
India	0.2708	0.3112	0.8704
Ireland	0.1932	0.3234	0.5974
Italy	0.2739	0.3198	0.8565
Japan	0.2992	0.3212	0.9315
Korea	0.2348	0.3231	0.7267
Mexico	0.2663	0.3177	0.8384
Netherlands	0.2317	0.3238	0.7154
Poland	0.2513	0.3239	0.7758
Portugal	0.2566	0.3240	0.7920
Russia	0.3123	0.3243	0.9630
Spain	0.2733	0.3235	0.8449
Sweden	0.2415	0.3209	0.7526
Taiwan	0.2252	0.3224	0.6984
Turkey	0.2691	0.3239	0.8308

Table 4: Estimated Trade Elasticity for U.S. Imports from China

Sector	Trade Elasticity without Value-Added Data	Trade Elasticity with Value-Added Data	Ratio of Price Index Effect to Own Price Effect
Food, Beverages and Tobacco Products	0.2421 (0.0812)	0.2103 (0.0731)	-0.0273
Textiles	0.1817 (0.0644)	0.1358 (0.0502)	-0.3836
Leather	0.1313 (0.0432)	0.1203 (0.0369)	-0.6494
Wood Products	0.5157 (0.0773)	0.4546 (0.0664)	-0.1318
Paper	0.1533 (0.0936)	0.1348 (0.0760)	-0.0239
Chemicals	0.4197 (0.0767)	0.3327 (0.0584)	-0.0484
Rubber & Chemical Products	0.3969 (0.0550)	0.3196 (0.0421)	-0.2038
Non-Metallic Mineral Products	0.5435 (0.1044)	0.4616 (0.0904)	-0.1577
Metal Products	0.1094 (0.0617)	0.1047 (0.0444)	-0.3491
Machinery	0.1376 (0.0552)	0.1090 (0.0425)	-0.1596
Electrical and Optical Equipment	0.2039 (0.0424)	0.1373 (0.0284)	-0.3632
Transportation Equipment	0.0071 (0.1448)	-0.0496 (0.1155)	-0.0552
Other Manufacturing	0.3855 (0.0661)	0.3577 (0.0567)	-0.1846

Note: Robust standard errors in parentheses.

Table 5: Estimated Trade Elasticity for U.S. Imports from Brazil

Sector	Trade Elasticity without Value-Added Data	Trade Elasticity with Value-Added Data	Ratio of Price Index Effect to Own Price Effect
Food, Beverages and Tobacco Products	0.2449 (0.0821)	0.2248 (0.0781)	-0.0044
Textiles	0.2626 (0.0930)	0.2371 (0.0876)	-0.0080
Leather	0.3522 (0.1160)	0.3618 (0.1111)	-0.0306
Wood Products	0.5814 (0.0871)	0.5868 (0.0857)	-0.0032
Paper	0.1541 (0.0940)	0.1567 (0.0883)	-0.0019
Chemicals	0.4291 (0.0784)	0.3965 (0.0696)	-0.0048
Rubber and Chemical Products	0.4814 (0.0667)	0.4532 (0.0597)	-0.0040
Non-Metallic Mineral Products	0.6332 (0.1217)	0.6019 (0.1179)	-0.0027
Metal Products	0.1624 (0.0916)	0.1924 (0.0817)	-0.0128
Machinery	0.1567 (0.0629)	0.1510 (0.0589)	-0.0072
Electrical and Optical Equipment	0.2936 (0.0610)	0.2648 (0.0548)	-0.0053
Transportation Equipment	0.0072 (0.1459)	-0.0579 (0.1351)	-0.0069
Other Manufacturing	0.4462 (0.0765)	0.4730 (0.0749)	-0.0050

Note: Robust standard errors in parentheses.

Table 6: Estimated Trade Elasticity for Imports from Hungary

Sector	Trade Elasticity without Value-Added Data	Trade Elasticity with Value-Added Data	Ratio of Price Index Effect to Own Price Effect
Food, Beverages and Tobacco Products	0.2452 (0.0822)	0.1650 (0.0573)	-0.0006
Textiles	0.2629 (0.0931)	0.1530 (0.0565)	-0.0013
Leather	0.3599 (0.1185)	0.2209 (0.0678)	-0.0014
Wood Products	0.5816 (0.0872)	0.4020 (0.0587)	-0.0005
Paper	0.1541 (0.0940)	0.1083 (0.0610)	-0.0000
Chemicals	0.4292 (0.0784)	0.2861 (0.0502)	-0.0014
Rubber and Chemical Products	0.4812 (0.0666)	0.2847 (0.0375)	-0.0014
Non-Metallic Mineral Products	0.6329 (0.1216)	0.4329 (0.0848)	-0.0014
Metal Products	0.1628 (0.0918)	0.1203 (0.0510)	-0.0017
Machinery	0.1572 (0.0631)	0.0949 (0.0370)	-0.0011
Electrical and Optical Equipment	0.2934 (0.0610)	0.1273 (0.0264)	-0.0039
Transportation Equipment	0.0072 (0.1462)	-0.0328 (0.0764)	-0.0030
Other Manufacturing	0.4470 (0.0767)	0.3205 (0.0508)	-0.0009

Note: Robust standard errors in parentheses.

Appendix Table 1: Regression Coefficients Using Value-Added Shares

	β_0	β_1	β_2	R^2	N
Food, Beverages, and Tobacco Products	0.0628 (0.0117)	0.0924 (0.3557)	-0.2447 (0.0850)	0.0032	6,802
Textiles	0.0896 (0.0143)	0.6073 (0.3999)	-0.2632 (0.0972)	0.0015	6,638
Leather Products	0.0892 (0.0140)	0.7644 (0.3538)	-0.4080 (0.1253)	0.0019	5,992
Wood Products	-0.0293 (0.0101)	1.7271 (0.2474)	-0.6312 (0.0922)	0.0099	6,439
Paper	0.0227 (0.0110)	0.3833 (0.3286)	-0.1541 (0.0940)	0.0006	6,790
Chemicals	0.0918 (0.0109)	0.9167 (0.2744)	-0.4648 (0.0816)	0.0036	6,775
Rubber and Plastic Products	0.0314 (0.0076)	1.4029 (0.2408)	-0.5331 (0.0702)	0.0135	6,752
Non-Metallic Mineral Products	-0.0382 (0.0096)	1.4382 (0.3122)	-0.6646 (0.1301)	0.0090	6,681
Metal Products	0.0507 (0.0119)	0.4029 (0.3943)	-0.2217 (0.0941)	0.0010	6,704
Machinery	0.0415 (0.0074)	0.7705 (0.1930)	-0.1730 (0.0674)	0.0036	6,747
Electrical and Optical Equipment	0.0326 (0.0074)	0.8707 (0.1721)	-0.3241 (0.0671)	0.0053	6,801
Transportation Equipment	0.0308 (0.0142)	0.8438 (0.3962)	0.0698 (0.1627)	0.0022	6,656
Other Manufacturing	0.0572 (0.0094)	1.1913 (0.2353)	-0.5198 (0.0823)	0.0074	6,765

Note: Robust standard errors of the parameter estimates in parentheses.

Appendix Table 2: Regression Coefficients with Assumption of 100% Domestic Content

	β_0	β_1	β_2	R^2	N
Food, Beverages, and Tobacco Products	0.0611 (0.0116)	0.1363 (0.3527)	-0.2452 (0.0822)	0.0034	6,802
Textiles	0.0868 (0.0141)	0.6860 (0.3977)	-0.2629 (0.0931)	0.0016	6,638
Leather Products	0.0869 (0.0143)	0.7868 (0.3698)	-0.3600 (0.1185)	0.0017	5,992
Wood Products	-0.0337 (0.0104)	1.7956 (0.2598)	-0.5816 (0.0872)	0.0095	6,439
Paper	0.0237 (0.0108)	0.3726 (0.3183)	-0.1727 (0.0973)	0.0007	6,790
Chemicals	0.0872 (0.0111)	1.0003 (0.2876)	-0.4294 (0.0785)	0.0036	6,775
Rubber and Plastic Products	0.0268 (0.0079)	1.5047 (0.2562)	-0.4815 (0.0667)	0.0131	6,752
Non-Metallic Mineral Products	-0.0422 (0.0097)	1.4994 (0.3188)	-0.6334 (0.1217)	0.0090	6,681
Metal Products	0.0499 (0.0121)	0.3629 (0.4062)	-0.1629 (0.0919)	0.0006	6,704
Machinery	0.0403 (0.0076)	0.7958 (0.2014)	-0.1572 (0.0631)	0.0036	6,747
Electrical and Optical Equipment	0.0293 (0.0075)	0.9583 (0.1832)	-0.2940 (0.0611)	0.0053	6,801
Transportation Equipment	0.0295 (0.0145)	0.9541 (0.4241)	-0.0072 (0.1462)	0.0022	6,656
Other Manufacturing	0.0545 (0.0095)	1.2121 (0.2449)	-0.4471 (0.0767)	0.0064	6,765

Note: Robust standard errors of the parameter estimates in parentheses.