Policy Research Working Paper 10490

Trade Elasticities in Aggregate Models

Estimates for 191 Countries

Shantayanan Devarajan
Delfin S. Go
Sherman Robinson

World Bank Group
Development Economics
Prospects Group
June 2023

Policy Research Working Paper 10490

Abstract

Armington's insight that imports and domestically produced goods were imperfect substitutes has unleashed extensive estimates of the associated trade elasticity, primarily for developed countries. This notion of product differentiation, which extends symmetrically to exports and domestic goods, has underpinned trade-focused, computable general equilibrium models of developing countries, including the aggregate, compact version, the 1–2–3 model. Noting that estimates of trade elasticities for developing countries are few, this paper remedies the situation. Using the vector error correction model as the primary method and controlling for global trends and other factors, the analysis derives the long-run elasticity estimates for 191 countries, ranging from China (population of 1.4 billion) to Tuvalu (11,200), including 45 of 48 Sub-Saharan African countries and understudied countries such as Benin, the Republic of Congo, Niger, Fiji, Haiti, Kiribati, and Tajikistan. Import and export elasticities of high-income countries average about 1.4, reflecting the greater diversity of their economies; developing countries' elasticities average around 0.7 for imports and 0.6 for exports. Elasticities generally rise with per capita income. That the elasticity is greater than one for developed and less for developing countries implies asymmetric responses to shocks, which conforms to intuition and corroborates the analytical results from the 1–2–3 model.

This paper is a product of the Prospects Group, Development Economics. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://www.worldbank.org/prwp. The authors may be contacted at sd294@georgetown.edu, dgo@worldbank.org, and srobinson@piie.com.

Trade Elasticities in Aggregate Models: Estimates for 191 Countries

by

Shantayanan Devarajan, Delfin S. Go, and Sherman Robinson[1]

Keywords – trade elasticities, Armington, econometric estimates

JEL codes – F14, C13, C68

[1] Devarajan: Georgetown University, sd294@georgetown.edu; Go: The World Bank, dgo@worldbank.org; Robinson: Peterson Institute of International Economics, srobinson@piie.com. We thank Jongrim Ha and Ergys Islamaj for comments and suggestions and Hiroko Maeda and Eric Roland Metreau for help in downloading and interpreting the data from the World Bank World Development Indicators and the country classifications used for various country groups. We also thank all collaborators of the 1-2-3 model for their previous insights.

I. Introduction

Paul Armington's seminal 1969 paper, "A Theory of Demand for Products Distinguished by Place of Production," showed that imports and domestically produced goods in the same sector could be imperfect substitutes, with the degree of substitutability captured by the elasticity of substitution, or Armington elasticity. This insight helped explain why we observe domestic and foreign goods in the same sector sold at different prices in the same country. It also enabled more realistic simulation results from computable general equilibrium (CGE) models where, otherwise, small changes in policies or terms of trade would lead to huge swings in countries' trade patterns (Deardorff 2006). The notion of product differentiation, which extends symmetrically to exports and domestic goods, has since underpinned trade-focused, computable general equilibrium models,[2] including the aggregate, compact version, the 1-2-3 model, and additionally recent open-economy macroeconomic models.[3] In this regard, Devarajan, Lewis, and Robinson (1990) used the Armington assumption to specify the 1-2-3 model that captured most of the results from more disaggregated models in a transparent and data-economizing way.[4] The 1-2-3 model has been extended to incorporate dynamics (Devarajan and Go 1998) and uncertainty (Devarajan et al. 2017) and used to analyze equilibrium exchange rates (Devarajan et al. 1993), trade policy (de Melo and Robinson 1992), welfare costs of taxation (Auriol and Warlters 2012), and poverty (Devarajan and Go 2003).

Alongside the widespread use of the Armington framework, there has been considerable effort in estimating the magnitude of Armington elasticities at the sectoral level. Bajzik et al. (2020) collected 3,524 estimates in their meta-analysis on the 50th anniversary of Armington's paper. Almost all of these estimates are for developed countries at the sectoral level. Meanwhile, many CGE models of developing countries, including the 1-2-3 model, have been built with the Armington elasticities exogenously specified rather than empirically estimated. The reason is that there has not been sufficient time-series data to estimate these elasticities econometrically (some African countries gained independence only in the 1960s). Yet, as Schurenberg-Frosch (2015) shows in her sensitivity analysis of the Armington elasticity, model results can be highly sensitive to the magnitude of the elasticity. Hilberry and Hummels (2013) put it more bluntly: "It is no exaggeration to say that [the Armington elasticity] is the most important parameter in modern trade theory."

Furthermore, apart from a few studies like Devarajan, Go, and Li (1999), there are hardly any direct estimates of export elasticity. A few studies take a country's exports as imports from its major trading partners, thus estimating it indirectly as export demand from the rest of the world through an Armington function. In the 1-2-3 model, however, the export elasticity derives from a constant elasticity of transformation (CET) of supply, which, as mentioned above, is symmetric with the Armington function for imports in a general equilibrium framework. Thus, estimating it directly is also possible.

In this paper, we estimate the Armington and export elasticities for the 1-2-3 model for 191 countries using data from 1970-2018. Of these, 128 are developing countries, including almost all the countries in Sub-Saharan Africa and many under-studied ones like Benin, the Republic of Congo, Niger, Fiji, Haiti, Kiribati, and Tajikistan. The list includes several microstates, such as Nauru, Tuvalu, and

---

2 de Melo and Robinson (1989) used an aggregate framework that anticipates the 1-2-3 model to derive the theoretical properties of product differentiation in CGE models. Later, Thierfelder and Robisnon (2003) discussed how the 1-2-3 model qualifies the results of trade theory with perfect-substitution between foreign and domestic goods.

3 The recent literature of open-economy macroeconomics using the Armington formulation includes the New Keynesian framework and the associated class of dynamic stochastic general equilibrium models. See, for example, Gali (2015), Uribe and Schmitt-Grohé (2017) and Végh (2013).

4 See also the next section and Devarajan and Robinson (2013) for a discussion of how the 1-2-3 model extends the tradability factor of the Salter-Swan framework and its relations to disaggregated CGE models in policy analysis of developing countries. Also, Devarajan, Lewis, and Robinson (1993) discussed its macro properties.

Liechtenstein. The results are generally consistent with macro or aggregate estimates and recent research findings. The more detailed results below show that trade elasticities typically rise with income. And consistent with the theoretical results behind the 1-2-3 model, the average elasticity is less than one (about 0.65) for developing countries and higher than one (about 1.4) for high-income countries.

In the next section, we briefly review the literature on estimating trade elasticities to inform our choice of specification and technique. Section III presents the 1-2-3 model, which serves as the specification of our estimates of trade elasticities in Section IV. Section V contains some concluding remarks.

II. Previous Estimates of Trade Elasticities

We survey the vast literature on estimates of trade elasticities selectively to highlight three points: 1) There are few estimates of trade elasticities for developing countries, not just the Armington elasticity but also the export supply elasticity; 2) past estimates vary substantially but appear lower in recent studies; and 3) some issues, such as trends and fluctuations, are especially relevant to developing countries.

Fifty years after Armington's contribution, Bajzik et al. (2020) counted 3,524 estimates of the elasticity of substitution, varying widely, mainly for developed countries and many at the sectoral level. The authors attributed the substantial differences in magnitude to differences in data: aggregation, frequency, size, and dimension. After correcting for biases against weak results and study quality, their meta-regression analysis implied a median Armington elasticity of 3.8 with a range of 2.5-5.1; the few developing countries in the survey were predominantly upper-middle-income countries by World Bank classification (such as former Soviet Republics).

Anderson and Wincoop (2004) and Head and Mayer (2014) reviewed the variation in past studies from the lenses of trade costs and the gravity framework, respectively. The elasticity estimates tend to support a high value of 3 to 7, which was the conventional wisdom in the past. Within the EU market, Zofío et al. (2020) estimated the foreign trade elasticity at 2.2, lower than the national trade elasticity. Nevertheless, the estimates vary widely, and the median values are as low as 0.9 (Gallaway et al. 1997) and 0.97 (Reinert and Roland-Holst 1992) and as high as 6.5 (Hertel et al. 2007). Moreover, many estimates pertain to the sectoral level and primarily higher-income countries.

Although estimates have varied widely, common patterns have emerged from reviews of past studies. Ahmad, Montgomery, and Schreiber (2020), McDaniel and Balistreri (2003), and Imbs and Mejean (2015) found trade elasticity estimates to decrease with the level of aggregation. In particular, commodities exhibit a high Armington elasticity, while differentiated products (like manufactures) tend to have a low elasticity. McDaniel and Balistreri (2003) also observed that long-run elasticities are higher than their short-run counterparts and that reduced-form time-series analyses have a lower magnitude than cross-sectional studies. Imbs and Mejean (2015) argued that aggregation restricted sector elasticities to be homogeneous and suggested using a weighted average of sector elasticities for aggregated ones to avoid heterogeneity bias. Although worth exploring further, data constraints in developing countries will make comparing macro estimates with averages of econometric estimations of sector values challenging.

But are macro elasticities consistently lower than those from micro elasticity studies of more specific sectors or commodities? Feenstra et al. (2018) found the results mixed: for between two-thirds and three-quarters of sample goods, there is no significant difference between the macro- and micro-elasticities, but the micro elasticity is significantly higher for the rest. There are also differences in findings at the disaggregated levels as well. Brenton and Winters (1992) do not assume separability between home and foreign goods and find low import price elasticities. In contrast, Panagariya, Shah, and Mishra (1996) employ better data, such as explicit competitors' prices (not proxies), and find high elasticities. These elasticities apply to more specific groups of commodities, i.e., not at the level of aggregation of the 1-2-3 model. At the aggregate level, foreign and domestic goods are composites of many different goods, and the substitution possibility (e.g., as found in Devarajan, Go, and Li, 1999) will lead to smaller elasticity values and ranges than more disaggregated cases (e.g., in Hillberry and Hummels, 2013; Bajzik et al. 2020).

Recent estimates tend to point towards elasticities that are lower in magnitude. For example, Boehm, Levchenko, and Pandalai-Nayar (2023) compared the differential effects on imports of countries that changed Most Favored Nations (MFN) tariffs with their trading partners relative to a control of countries not subject to the MFN scheme. The authors identified the trade elasticity for the short and long horizons. They found the short-term elasticity (one year after the exogenous tariff change) to be 0.76 and the long-run elasticity ranging from 1.75 to 2.25 (typically after 7-10 years). The sample covered trade flows of goods at the disaggregation level of HS6 (Harmonized System at the 6-digit codes). Each panel of countries had over 80 countries, most of them high-income; the developing countries included were mainly upper-middle-income or large countries in global trade like China and India. The method did not differentiate by country, so the paper did not provide elasticities for developing countries.

An earlier study by Whalley (1985) likewise inferred the value of the Armington elasticity from trade liberalization episodes and yielded an estimate in the neighborhood of 1.5 over 5-10 years.

Past studies concentrated on the Armington elasticity between imports and domestic goods, ignoring much of the export supply side because of estimation issues. In CGE models, the export supply side is usually defined as a function with a constant elasticity of transformation between exports and domestic goods, a symmetric formulation to the Armington formulation (see further discussion below). Hillberry and Hummels (2013) suggested that future research uses firm-level heterogeneity to uncover export behavior and elasticity, which affect trade flows jointly with the demand side.

Only a few studies investigated export supply explicitly. Diewert and Morrison (1988) employ a production-based approach initially developed in Kohli (1978) to obtain export supply and import demand. Faini (1994) directly estimates transformation elasticities from a CET function and considers adjustment lags, factor prices, and the importance of capacity utilization. He finds that the CET elasticity is less than one for Morocco but much greater than one for Türkiye. It would be difficult to replicate these studies for many countries without extensive microdata. One reason is the measurement problems of factor accumulations and their returns. Another issue is the adjustment lags in supply that may require measuring capacity utilization. The impact of lagged variables may also require time-series estimation that accounts for nonstationarities, such as vector autoregression (VAR) or its restricted form, the vector error correction (VEC) model, which we use in our analysis below.

The few studies examining developing countries' exports indirectly modeled exports as import demand from major trade partners, e.g., Reinhart (1995) and Senhadji and Montenegro (1999). Reinhart (1995) calculated the import demand for 12 developing countries and the corresponding export demand (from industrial countries). Senhadji and Montenegro (1999) estimated export price and income elasticities as import demand from trading partners for 53 industrial and developing countries. As a salient feature, both studies used time-series estimation to handle nonstationarity issues and the lack of cointegration that might result in spurious relationships. Devarajan, Go, and Li (1999) also used time series and other techniques but estimated the Armington and CET elasticities directly for many developing countries. They found some export elasticities have the wrong sign, possibly because of the short data series and potential identification issues affecting export supply (see below).[5] These elasticities were excluded from the final estimates.

In addition to world prices, domestic prices affect imports and exports. However, the literature is divided on the impact and significance of the real exchange rate, or the ratio of domestic to world prices, on the trade balance. Earlier papers such as Branson (1972), Khan (1974), Rittenberg (1986), Bond (1987), and Marquez and McNeilly (1988) found that trade flows respond significantly to changes in relative prices. They are criticized today for inference problems associated with time-series variables with unit roots. Empirical work that considered the time-series properties of trade flows and prices, such as Rose (1990 and 1991) and Ostry and Rose (1992), found little evidence that relative prices affect trade flows. Yet, the lack of theory in time-series techniques makes the estimates difficult to interpret. Marquez (1994), for example, stressed the importance of optimizing behavior and simultaneity in determining expenditures on domestic and foreign goods. For developing countries, Faini, Pritchett, and Clavijo (1988) discussed the importance of trade policy and restrictions, which are likely to understate the structural demand elasticities. Reinhart (1995) uses dynamic optimizing behavior with time-series techniques and finds significant trade relationships. Our analysis follows this approach by combining the optimizing behavior of the 1-2-3 model with time-series techniques.

Nonetheless, recent open-economy macroeconomic models use a trade elasticity below or around unity, often assumed, calibrated, or estimated for high-income countries. For example, Corsetti, Dedola, and Leduc (2008), Gust, Leduc, and Sheets (2009), and Justiniano and Preston (2010) have elasticity estimates between 0.8 and 0.86, while Galí and Monacelli (2005) used unity. Among textbooks, Végh (2013) examined the impact of devaluation under alternative elasticity of substitution between tradables and nontradables from 0.2 to 1.0;[6] Uribe and Schmitt-Grohé (2017) set the elasticity to unity but tested the economic impact of terms-of-trade shocks of alternative values of 0.75 and 1.5.[7]

Another issue is the assumption of homotheticity of the Armington or CET function, which is violated by the time trends observed in trade shares. Import and export shares in GDP for many countries appear to be increasing, independently of relative price movements. For example, Alston et al. (1990) note that while the implicit assumption of homotheticity in the CES and CET formulations is theoretically appealing, it is highly restrictive in CGE modeling. The standard correction usually employs a scale variable, such as an income term, to denote aggregate income activity. Alternative formulations like the almost ideal demand system (AIDS) or one of the flexible functional forms are often suggested.

While it is plausible that the capacity to import among countries rises with income, Petri (1984) and Ho and Jorgenson (1997) believe that the estimated high-income elasticities are probably spurious. Trade shares seem to increase over time for rich and poor countries, as would be the case with increasing

---

[5] Several estimates in Devarajan, Go, and Li (1999) used OLS (ordinary least squares) with simple time trends. While that approach could capture rising trade shares over time, it might not alleviate autocorrelation in the residuals, making the coefficient estimates inefficient or the standard t-tests improper. Seemingly unrelated regression (SUR) that assumes a joint distribution of error terms across countries (with a small sample) was also used to improve the efficiency of the variance. That approach is not necessary with a larger sample size now available for each country.

[6] p. 295, Table 6.1.

[7] P. 252, Table 7.8.

globalization. A natural breakpoint was the 1970s when the international monetary and trading system changed substantially. Even for large industrial countries like the United States, there was a sharp acceleration in the import share in the 1970s. For developing and transitional economies, periods of rapid economic and trade liberalization (particularly in the late 1980s) are crucial factors. Compared to the earlier periods of inward orientation, changes in trade policy in the latter periods often led to structural breaks in the trade shares. We use a time trend to account for the shifts in trade shares or the ratios of factors (equations 7 and 8 below).

Moreover, trade ratios might not rise steadily; they may fluctuate erratically due to policy reversals, crises, or conflicts, particularly in developing countries. For example, Arbache et al. (2008) found that growth collapses in Sub-Saharan Africa were frequent before 1995. Weather conditions could also affect exports of developing countries when they are mainly agricultural products. In these cases, the trade shares in output are likely co-dependent variables with no exogenous trends.

III. Methodology: The Model, Data, and Specification

The 1-2-3 Model

The 1-2-3 model became a practical economic tool at the World Bank and for teaching more complex models due to its transparent algebraic and conceptual results and accessible numerical implementation using only national accounts and popular spreadsheet software (see Devarajan, Lewis, and Robinson 1990 and 1993; Devarajan, Go, Lewis, Robinson, and Sinko 1997). Since its inception, the 1-2-3 model has addressed various policy issues in developing countries. The most common application has been the real exchange rate effects (including Dutch disease effects) of commodity price shocks or changes in capital flows (such as foreign aid and transfers). The algebraic and numerical spreadsheet solutions anticipate the relationship between external shocks and policy responses of more complex models. For example, the model was used to determine the pre-1994 overvaluation of the CFA franc (Devarajan 1997, 1999), which informed the discussion about the magnitude of the 1994 devaluation. Since the new millennium, the authors have conducted similar exercises as part of World Bank operational work in CFA countries, the Arab Republic of Egypt, Zambia, and other African countries.

Another productive application has been the economic effects of trade reform, especially in the 1990s when the issue was crucial for many developing countries. Devarajan, Go, and Li (1999) quantify the fiscal effects of trade reform and show how the results depend on the substitution elasticity between foreign and domestic goods. Devarajan and Go (1998) incorporate rational-expectations dynamics to capture the intertemporal effects of trade reform and import price shocks. Relatedly, de Melo and Robinson (1992) use the framework to examine export externalities in developing countries. Taking advantage of the model's simplicity and minimal data requirements, Auriol and Warlters (2012) use the 1-2-3 model to calculate the marginal welfare cost of public funds in 38 African countries.

Devarajan and Go (2003) link the framework to growth and poverty modules to examine the implications of growth and poverty reduction strategies, especially in those classified as Heavily Indebted Poor Countries (HIPCs) in Africa. The model has also been used to study the macroeconomic dynamics of scaling up foreign aid (Devarajan, Go, Page, Robinson, and Thierfelder, 2008). Extending the regional integration application in Devarajan, Go, Suthiwart-Narueput, and Voss (1997b), a global version called the R23 model exploits its parsimonious structure to link, through trade flows, over 200 1-2-3 models

(McDonald, Thierfelder, and Walmsley 2012). Finally, Devarajan, Dissou, Go, and Robinson (2017) developed a dynamic stochastic general equilibrium version to examine budget rules when the export price of a resource-rich country is uncertain.

Specification of Trade Elasticities in the 1-2-3 Model

The 1-2-3 model is specified for one country producing two commodities: an export good (E) traded and sold only to foreigners and a domestic good (D) that is nontraded and sold domestically. The third commodity is a traded import (M) sold in the domestic market. One representative consumer receives all income and allocates it according to preferences for the two goods sold on the domestic market, D and M. The country is small in world markets, facing exogenous world prices for exports and imports. The two traded goods (E and M) and the nontraded good (D) are imperfect substitutes, a feature found in most CGE models that follows the distinction of "tradable" (imports and exports) and "nontradable" (the domestic good) of Salter (1959) and Swan (1960). The consumer's utility function consists of the Armington CES function of D and M. Production is specified by a CET production possibility frontier of D and E. There is no need for separate production functions for D and E—the transformation function is all that is needed for the analysis.[8] The two elasticities in the model characterize the trade substitution possibilities. These are the key parameters to be estimated.

The CES and CET functions have the same algebraic form and are distinguished by their parameters (convex for the CES and concave for the CET). Equation 1 represents the common CES and CET functions. Equation 2 is its corresponding dual price equation.

(1) $$X = \bar{A}\left[\alpha \cdot X_1^{\rho} + (1-\alpha) \cdot X_2^{\rho}\right]^{\frac{1}{\rho}}$$

(2) $$P_x = \bar{A}^{-1}\left[\alpha^{1/(1-\rho)} \cdot P_{x_1}^{\rho/(\rho-1)} + (1-\alpha)^{1/(1-\rho)} \cdot P_{x_2}^{\rho/(\rho-1)}\right]^{\frac{\rho-1}{\rho}}$$

where X is the CES or CET composite Q^S or $\bar{X}$; $\bar{A}$ is the shift parameter, α is the share parameter, and ρ is the exponent: In the CES case, $X_1 \equiv M$ and $X_2 \equiv D^D$; and in the CET case, $X_1 \equiv E$ and $X_2 \equiv D^S$. The P's are the corresponding domestic prices of the inputs, $P^e, P^m,\ and\ P^d$. The CES substitution elasticity σ and CET transformation elasticity Ω are given by $\sigma = 1/(1-\rho)$; $-\infty < \rho < 1$ in the CES case and $\Omega = 1/(\rho - 1)$; $1 < \rho < \infty$ in the CET case.

Both the CET and CES functions exhibit constant returns to scale. The allocation of the composite good into its components depends on the relative prices of the individual components. Noting that $D^D = D^S = D$ in equilibrium, the corresponding export supply and import demand functions are expressed as ratios from the first-order conditions for profit and utility maximization (equations 3 and 4):

(3) $$\frac{E}{D} = \left[\frac{(1-\delta)\cdot P^e}{\delta \cdot P^d}\right]^{\Omega}$$ export supply, and

[8] There are examples of extended 1-2-3 models that include production functions for D and E. It can be shown that if production is specified by Cobb-Douglas functions with different factor proportions, the implicit production possibility frontier is approximately CET.

(4) $$\frac{M}{D} = \left[\frac{\beta \cdot P^d}{(1-\beta) \cdot P^m}\right]^{\sigma}$$ import demand,

where δ and β are the corresponding share parameters in the CET export transformation and CES import aggregation functions.[9]

The CET function describes the production transformation frontier between D and E for a fixed level of $\bar{X}$ or real GDP (since there are no intermediate inputs). The assumption that $\bar{X}$ is fixed is equivalent to assuming full employment of all primary factors. The composite good price P^x corresponds to the GDP deflator. The composite price P^q of Q corresponds to the consumer price index. Following the numerical implementation in Devarajan et al. (1997), GDP not sold to the rest of the world (i.e., E, exports of goods and services) defines the domestic good D. Given price indices, P^x and P^e, the implicit price for the domestic good, P^d, can be derived from the GDP identities: $P^x\bar{X} = P^qQ + P^eE - P^mM = P^dD + P^eE$ where Q is aggregate demand. The model can therefore be implemented using national data for macro aggregates (see Devarajan, Go, Lewis, Robinson, and Sinko 1997).

Estimating Equation

The log-linear transformation of the supply and demand equations (3) and (4) provides a convenient way to estimate the elasticities:

(5) $$ln\left[\frac{E_t}{D_t}\right] = C_1 + \Omega ln\left[\frac{P_t^e}{P_t^d}\right] + \epsilon_t$$

(6) $$ln\left[\frac{M_t}{D_t}\right] = C_2 + \sigma ln\left[\frac{P_t^d}{P_t^m}\right] + \varepsilon_t$$

where $C_1 = \Omega\ln\left[\frac{(1-\delta)}{\delta}\right]$, $C_2 = \sigma ln\left[\frac{\beta}{(1-\beta)}\right]$, t the time subscript, and $\varepsilon_{t,}\epsilon_t$ are the error terms.

Note that equations 5 and 6 extend beyond the 1-2-3 model. As mentioned in the literature review, the import equation derived from the CES function is also known as the Armington import demand in the trade literature. Exports are also often expressed as Armington import demand from the rest of the world. However, in our case, the CET function and the estimation of Ω complete the country-specific model.

Data

Data are from the World Bank's World Development Indicators (WDI)[10] and the United Nations National Accounts database.[11] WDI is used where available. The two sources are combined to extend series or fill in missing observations. We retain the WDI levels and base year for constant prices where the two

[9] Note that the CES and CET functions are not defined for elasticities that equal 1 (a Cobb-Douglas formulation can be used). However, the export supply and import demand equations are well defined for unitary elasticities and the estimation procedure will work in that case.

[10] https://databank.worldbank.org/source/world-development-indicators.

[11] https://unstats.un.org/unsd/snaama/Index.

sources are spliced. We use the series measured in current and constant U.S. dollars to derive the implicit price indices for the quantities. The base year is 2015, and WDI uses that year to calculate the world totals.[12] Using uniform dollar units affords two innovations in the estimation. First, it provides consistent units across countries to estimate trade elasticities. Second, having the world's aggregate GDP and its components in comparable dollar units yields global demand variables for a country's exports, potentially correcting an identification issue in the CET estimation for some cases (see below).

Where available, we obtain time series for 1970-2018, potentially having 49 data points for each country. We avoid the 1950s and 1960s because many developing countries had just become independent, which is a reason why the sample size was small for many countries in the previous estimation of Devarajan, Go, and Li (1999). Seventeen or more Sub-Saharan African countries became independent only in 1960 and after (e.g., Cameroon, Kenya, Madagascar, Senegal, Tanzania, Uganda, Zambia, etc.). Nascent developing countries often have limited statistical capacity in the early years after independence, with issues of measurement reliability. Moreover, we exclude the years after 2018 because of the coronavirus of 2019 (COVID-19) and the disruptive effects of the pandemic on supply chains and global trade.

In cases where the series is shorter, we flag them. For example, for countries belonging to the former Soviet Union, data can only begin from about 1990. As a general rule, we omit countries with fewer than 20 observations.

Nonstationarity

Macroeconomic series and aggregate price indices (such as E, M, D, P^e, P^d) are known to be nonstationary. It typically takes differencing twice to make the series stationary, implying an integration order of two, i.e., I(2). Without further transformation, the significant time trend present in the data could lead to spurious relationships and estimates.

Fortunately, the log ratios of the variables in the estimating equations above reduce the order of integration. Using the Augmented Dickey-Fuller (ADF) unit root test of each transformed variable ($ln\left[\frac{M_t}{D_t}\right], ln\left[\frac{E_t}{D_t}\right], ln\left[\frac{P_t^d}{P_t^m}\right], ln\left[\frac{P_t^e}{P_t^d}\right]$), we cannot reject nonstationarity in the null hypothesis. However, differencing the series just once makes each case stationary, implying an integration order of one, I(1). We confirm this finding to be true for each variable for each country.

Cointegration

The presence of the same level of integration at I(1) suggests a possible cointegrating relationship between $ln\left[\frac{E_t}{D_t}\right]$ and $ln\left[\frac{P_t^e}{P_t^d}\right]$ in one set and $ln\left[\frac{M_t}{D_t}\right]$ and $ln\left[\frac{P_t^d}{P_t^m}\right]$ in the other. We employ the Johansen cointegration test, including its alternative assumptions and specifications about the presence of a deterministic trend (linear or quadratic) and intercept in the cointegration equation (CE) or the VAR. We add exogenous variables such as global demand conditions for some CET cases (see identification below) or the appropriate trade share in GDP if there are unusual fluctuations in the dependent variable.

[12]The WDI methods and ratios to impute missing observations are described in the link here.

Identification

For some countries, the CET equation (5) might have identification problems as export supply could co-depend on global demand, expressed as an Armington import demand condition similar to equation 4:

$$(7) \qquad \frac{E_t}{D_t^w} = \left[\frac{\beta^w P_t^{dw}}{(1-\beta^w)P_t^e}\right]^{\sigma^w}$$

The demand for E_t as a ratio to the global domestic good D_t^w is a function of their relative price $\frac{P_t^{dw}}{P_t^e}$; β^w is the underlying CES share parameter. The log transformation of equation 7 is the familiar export demand equation in the literature, similar to Reinhart (1995) and Senhadji and Montenegro (1999):

$$(8) \qquad ln\left[\frac{E_t}{D_t^w}\right] = C_3 + \sigma^w ln\left[\frac{P_t^{dw}}{P_t^e}\right] + \mu_t$$

Previous literature often uses just the aggregation of industrial countries for D_t^w and P_t^{dw} with the bilateral trade flows as weights. However, the trade weights are shifting significantly over time, difficult to derive, or unavailable consistently for each country's entire 1970-2018 period. For this reason, we use the global aggregation of national accounts already available in the WDI database to derive D_t^w and P_t^{dw}, which are consistent with the specification of the 1-2-3 model. Since the global GDP and its components are also expressed in current and constant U.S. dollars, the global variables are consistent with the country variables.

However, for the 1-2-3 model, we are interested in the CET elasticity Ω from equation 5 and not the CES elasticity σ^w linked to global demand in equation 8. Whenever the identification issue arises (usually if there is an incorrect sign for the CET coefficient), we consider including the variables of equation 8 as additional cointegrating or exogenous variables in the long-term cointegration equation or part of the error correction of the VEC.

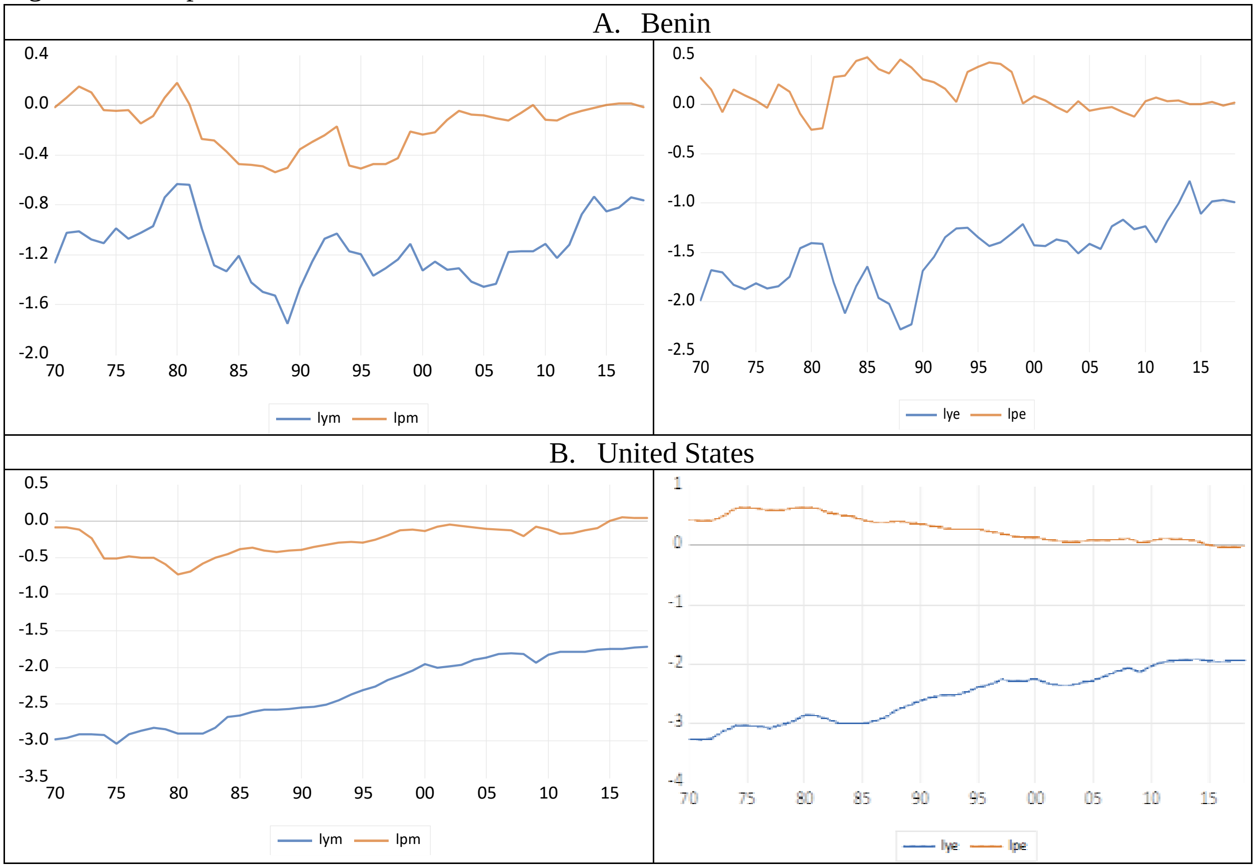
Equations 5 and 8 could also be solved simultaneously, yielding equation 9 as another option for estimating Ω. We apply a time series technique like VEC to it.

$$(9) \qquad ln\left[\frac{D_t^w}{D_t}\right] = C_4 + \Omega ln\left[\frac{P_t^e}{P_t^d}\right] + \sigma^w ln\left[\frac{P_t^e}{P_t^{dw}}\right] + \gamma_t$$

Fluctuations and Breaks

For many developing countries, the variables are often characterized by fluctuations rather than a single break, mainly due to policy reversals, crises, conflicts, or exogenous shocks from the weather (e.g., drought, hurricanes, etc.). Figure 1 shows the frequent fluctuations of relevant variables in Benin in contrast to the smoother movements in the United States. In these situations, we find that the growth rates of output, real exports, and real imports, as well as the appropriate share of trade in GDP, work well as extra exogenous variables in the cointegration equation or the error correction part. The growth rates are stationary, so they do not add to the number of cointegration equations for estimation if introduced as endogenous variables in rare instances. We adopt this approach for most countries.

Figure 1: Examples of variable fluctuations – Benin versus the United States



Source: Authors' calculations.

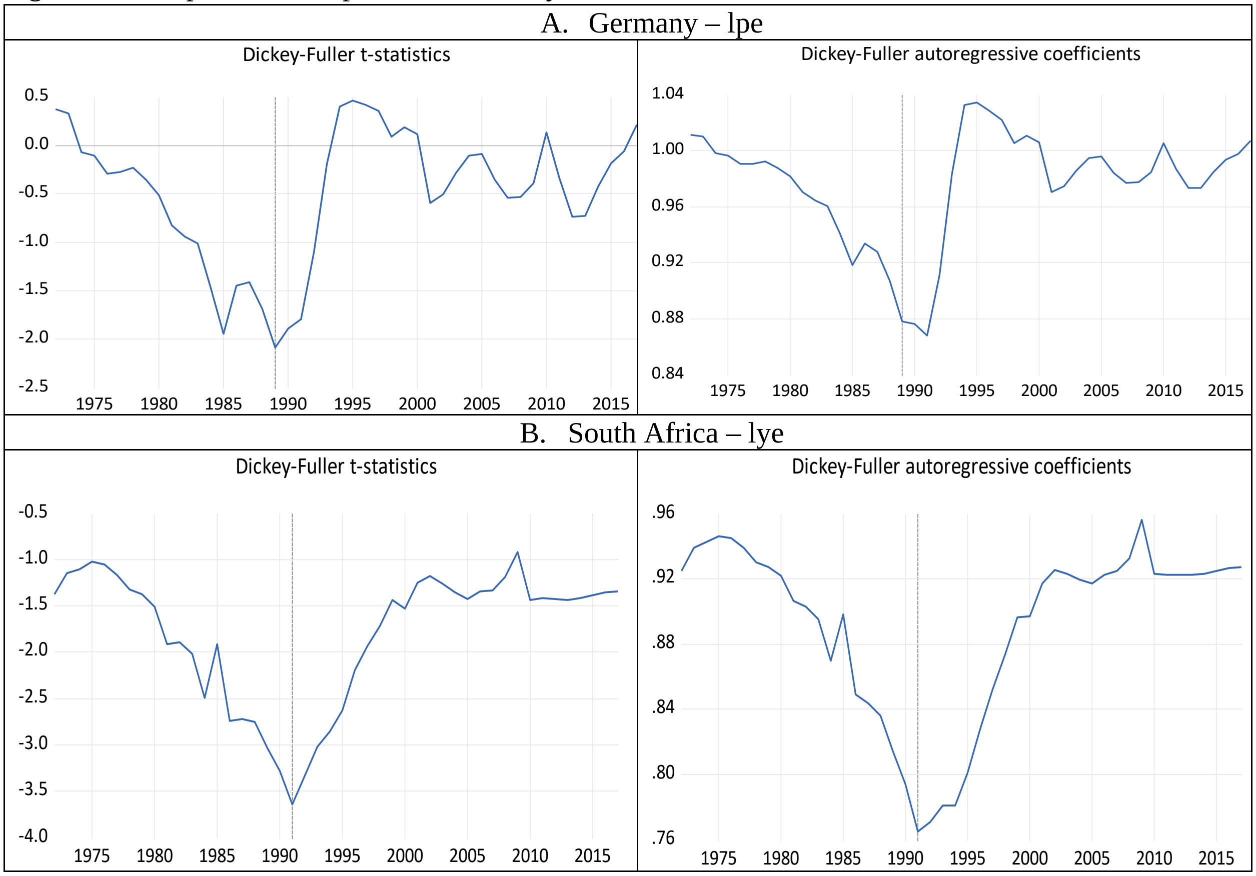
Notes: lym = $ln\left[\frac{M_t}{D_t}\right]$; lpm = $ln\left[\frac{P_t^d}{P_t^m}\right]$; lye = $ln\left[\frac{E_t}{D_t}\right]$; lpe = $ln\left[\frac{P_t^e}{P_t^d}\right]$.

An episodic structural change could lead to a false unit root in a stationary series with a structural break. In this possible situation, we use a breakpoint unit root test to consider a dummy variable and its timing and ensure that the null hypothesis of a unit root is not rejected by the Dickey-Fuller t-test (with or without a dummy). The dummy break often pertains to the intercept but could also involve intercept and trend. The innovation associated with a structural change could be gradual (versus a one-time break) after the event; changes could also build up in the years before a significant historical event; and the type and timing could differ among the cointegration equation variables. Because of the many factors and different possible dates for the variables in the cointegration equation, we minimize using dummy variables.

Moreover, the statistical determination of a break could benefit from knowledge of the economic history of a country. However, except for well-known events, an in-depth understanding of the timing of actual events, shocks, or crises is beyond this study's scope (given the number of countries). In the estimation, we also consider a dummy when the time patterns of the right- and left-side variables begin to diverge over their past behavior, combining breakpoint unit root tests, visual inspection, and, if available, relevant economic information[13] to determine possible timings.

[13] Such as country reports from the World Bank, IMF, Economist Intelligence Unit (EIU), or Wikepedia.

Figure 2: Examples of Breakpoints – Germany and South Africa



Source: Authors' calculations.

Notes: lye = $ln\left[\frac{E_t}{D_t}\right]$; lpe = $ln\left[\frac{P_t^e}{P_t^d}\right]$. The graphs are from Eviews' breakpoint unit root test for intercept break and innovation outlier.

Take two well-known cases, Germany and South Africa. Figure 2A indicates a break for $ln\left[\frac{P_t^e}{P_t^d}\right]$ in 1989 for Germany, coinciding with the fall of the Berlin Wall that led to the unification of East and West Germany in 1990.[14] Figure 2B shows that South Africa had a break for $ln\left[\frac{E_t}{D_t}\right]$ in 1991, the year trade sanctions began to end when the country repealed its Apartheid legislation, leading to a new democratic government in 1995. In the case of Germany, however, the tests also suggest 1989 for $ln\left[\frac{P_t^e}{P_t^d}\right]$ but 1994 for $ln\left[\frac{M_t}{D_t}\right]$ and 1985 for $ln\left[\frac{P_t^d}{P_t^m}\right]$. In the case of South Africa, the breakpoint tests also indicate 1987 for $ln\left[\frac{P_t^e}{P_t^d}\right]$, 1990 for $ln\left[\frac{M_t}{D_t}\right]$, and 1989 for both intercept and trend of $ln\left[\frac{P_t^d}{P_t^m}\right]$. After testing alternatives and considering the history, we choose 1990 for Germany and 1991 (versus 1995) for South Africa for an intercept break. As a final check, we confirm the existence of a cointegration equation with the Johansen test (using both the Trace and Max-eigenvalues rank tests).

Conflicts, regime changes, and crises could also affect data quality. In this regard, we follow WDI's data vetting process about the first year to use while allowing for data splicing from the U.N. national accounts for one or two data series of a country. We only include countries with at least 20 years of time series data.

[14] Unlike former Soviet republics and the allied communist states, Germany has data prior to the unification in 1990 and that goes back to 1970.

Re-exports or Sudden Surges in Exports

Significant surges in re-exports are related to fluctuations and breaks, where foreign goods (imports, then exports) pass through from one country to another. Examples include Hong Kong SAR, China, after China's economic liberalization in 1978 and Ireland after the Good Friday Agreement for Northern Ireland in 1998. Singapore is another case with growing re-exports. With no good data yet to separate re-exports, the total value of exports will far exceed GDP, leaving a negative difference for an estimate of the domestic good. The log factor ratios of equations 7 and 8 will become indeterminate. In these cases, we avoid imputing domestic goods from historical shares since the proportions could fluctuate even before the surge in re-exports. Instead, we use the input demand and supply relative to output (GDP) for equations 7 and 8. In place of D_t and P_t^d, we use X_t and P_t^x, respectively, in both equations (using a country's aggregate output to approximate its aggregate demand on the import side). We use the same approach for equation (9), reasoning that a country's output is also a good approximation of domestic goods relative to the global variables. The solutions appear to work well for these few countries.

Sudden export surges or changes due to oil finds, mineral exports, or tourism could have the same effects. Examples include Antigua and Barbuda, Grenada, and Iraq.

Estimation Methods

As an estimation priority, we employ the vector error correction (VEC) model, a restricted form of the vector autoregression (VAR) model.[15] The method's output has two parts. The first part produces the cointegration equation (CE) or the long-term equilibrium (equations 5, 6, or 9), providing the desired elasticity estimates. It may include possible adjustments or exogenous variables like trends and global variables, which, as a general rule, we restrict to a relevant few. We use the Dickey-Fuller distribution that corrects for the fact that the p-value for the standard t-statistic is skewed to the left. The second part of the output is the error correction. The latter contains the impact of lagged variables that ensure perturbations or deviations will return to the long-term relationship estimated in the first part. We check the system for stability but only report the estimated elasticities and the corrected p-value and t-tests in the long-run cointegration relationship.

Alternatively, we try single cointegrated regressions using the Fully Modified OLS (FMOLS), which allows for various trends and additional regressors. The Wald test for simple linear restriction checks that the elasticities are not zeroes. For the CET case, we also apply VEC to equation 9. If VEC and FMOLS do not yield satisfactory results, we use the Generalized Method of Moments (GMM)). At least one of these methods almost always seems to produce reasonable estimates, so there was no need to look beyond them.[16]

Each country presents unique circumstances suggesting a potential for self-contained estimation (for example, see discussion about Figures 2 and 3). However, we limit the interventions to a minimum consistent set across countries. In addition to possible intercepts, trends (linear or quadratic), and lag structure, we confine the introduction of other variables to those already defined in the equations or derived from them, such as trade shares, growth rates of underlying variables in real terms (like exports, imports,

[15] We use the software Eviews for the estimation.

[16] Except in one case where we employed the limited information maximum likelihood method.

and outputs), or global demand and price ratios. If included, they are usually done as exogenous variables in CE or VAR in VEC; the CE deterministic regressors or additional deterministic regressors in FMOLS; or instrument variables in GMM.

Whatever the interventions, we further check the Johansen cointegration test summary and ensure that the chosen estimation has a cointegration equation in the case of VEC. In FMOLS, we look at tests such as Hansen Instability, Engle-Granger, etc., for confirmation. If the Ω estimation is the reduced form of the export system in equation 9, there could be up to two cointegration equations. No such proof is needed in the GMM case.

IV. Estimates

Using the methodology described above, we estimated elasticities for as many as 191 countries.[17] Tables A1 and A2 in the appendix present the estimated elasticities, the method used, the t-tests, and a summary of the interventions introduced. Table A3 lists the data source and years covered for each country. The elasticities appear reasonable, and the t-tests (except for a handful) are significant. As the summary in Table 1 shows, one hundred twenty-six countries (66.0%) have the full sample size of 1970-2018; 153 countries (80.1%) have at least 30 years of observations in their data. Of the 38 cases (19.9%) with less than 30 observations, 58% (22 cases) are borderline, with 29 observations covering 1990-2018 and mostly former Soviet republics and allied communist states.

The estimates cover 45 of 48 countries in Sub-Saharan Africa, including low-income countries like Benin, the Republic of Congo, Niger, etc. Island economies of various sizes tally as many as 47, including Fiji, Kiribati, Marshall Islands, etc. The list includes seven microstates, economies with fewer than 1,000 residents, and 49 hectares of land, such as Nauru, Tuvalu, Liechtenstein, etc. Many of these countries have severe data constraints that would have made estimation difficult with more elaborate formulations and data requirements.[18]

Table 1: Sample size distribution in the estimation

Sample Size	No. of countries	Percent distribution
49 (full sample)	126	66.0%
40 - 48	8	4.2
30 - 39	19	9.9
20 - 29	38	19.9
Total	191	100.0%

Source: Authors' calculation.
Note: Full sample = 1970-2018.

[17] The terms – countries, territories, and economies – are used interchangeably. We include any that have national accounts data in the WDI and UN sources.

[18] Even so, it was not possible to estimate elasticities of some countries. A few of these are countries that have experienced severe conflicts – such as Afghanistan, Somalia, Sudan, and South Sudan. For some small countries - like Curaçao, Monaco, New Caledonia, Palau, Nepal etc., flat relative prices are registered for an extended or entire period. In those instances, the countries employed exactly the same implicit price indices for GDP, exports, imports, and (therefore) domestic goods. Hence, the estimated elasticities were essentially zeros. These countries were excluded.

Table 2: Average elasticities by income and regional classification (simple averages)

Group Classification	Armington (σ)		CET (Ω)		Obs	
1. Incomce groups						
All developing countries	0.707		0.593		128	
Low income		0.686		0.566		26
Lower middle income		0.692		0.583		50
Upper middle income		0.731		0.616		52
High income	1.417		1.465		63	
2. Regional groups						
East Asia and the Pacsific	0.967		0.818		31	
High income		1.515		1.353		11
Developing countries		0.666		0.523		20
Europe and Central Asia	1.142		1.206		52	
High income		1.463		1.601		31
Developing countries		0.668		0.623		21
Latin America and the Caribbean	0.837		0.751		33	
High income		1.080		1.271		9
Developing countries		0.746		0.555		24
Middle East and North Africa	1.008		0.966		21	
High income		1.432		1.345		8
Developing countries		0.747		0.733		13
North America	1.668		1.442		3	
South Asia	0.726		0.638		6	
Sub-Saharan Africa	0.716		0.598		45	
High income		1.071		1.240		1
Developing countries		0.708		0.584		44

Source: Authors' calculations.
Notes: Groupings follow World Bank income and regional classifications. Income groups are defined by GNI per capita in US$ (Atlas methodology) in 2015: Low income <= 1025; lower middle income 1026-4035; upper middle income 4036-12,475; high income > 12,475.

Table 2 presents the simple averages of the Armington σ (import) and CET Ω (export) elasticities for various income and regional groups according to World Bank classification. The income classification is based on GNI (gross national income) per capita in U.S. dollars (Atlas methodology) for 2015, the base year of the constant price series in the estimation. The table averages could provide "rules of thumb" estimates for missing countries. They also show interesting tendencies by broad income categories. The average σ and Ω of high-income countries tend to be higher than 1.0, about 1.4, while those of the lower-income groups are less than 1.0. The average elasticities for low-income and lower-middle-income countries tend to be close to one another, around 0.7 for σ and slightly less than 0.6 for Ω. The upper-middle-income countries tend to have slightly higher values but still less than 1.0, around 0.7 for σ, and somewhat more than 0.6 for Ω. For practical purposes, the elasticities in developing countries could be approximated as 0.65.

Regarding regional averages, the North America region (NAR) and the Europe and Central Asia (ECA) groups have the highest elasticities. They are followed by the Middle East and North Africa (MENA), East Asia and the Pacific (EAP), Latin America and the Caribbean (LAC), South Asia region (SAR), and Sub-Saharan Africa (SSA). The order generally follows the average regional income. Where some regions have mixed incomes, the table shows the average differences between high-income and developing countries. The only high-income country in SSA in 2015 was Seychelles, while Mauritius is approaching this category. The pattern generally supports the hypothesis that trade elasticities increase with per-capita income.

Figure 3 shows the scatter plots of the elasticities against GDP per capita in 2015 U.S. dollars, the constant price series base year in the estimation and income group classification.[19] The simple correlation of the variables is about 0.71 for both the σ and the Ω cases. The regression line in each plot confirms an approximately positive relationship.[20] The graphs could also easily be non-linear, flat for much of the lower income levels, then dispersing and rising rapidly at higher income at around $22,000 (log of 10). The dichotomy of elasticities at about 1.0 is consistent with the summary in Table 2.

The split of elasticities at 1.0 between low and high-income countries is also consistent with the trade theory behind the 1-2-3 model (see Devarajan et al. 1997 and other studies in the sub-section on the 1-2-3 model). When the world price of imports (say) rises in an economy, there are two effects: an income effect (as the consumer's real income is now lower) and a substitution effect (as the domestic good now becomes more attractive). The resulting equilibrium will depend on which effect dominates. When $\sigma < 1$, the income effect dominates. The economy contracts the output of the domestic good and expands that of the export commodity. To pay for the needed, imperfectly substitutable import, the real exchange rate depreciates. However, when $\sigma > 1$, the substitution effect dominates. The economy's long-term response is to contract exports (and hence also imports) and produce more of the domestic substitute. For most developing countries, it is likely that $\sigma < 1$, so that the standard policy advice to depreciate the real exchange rate in the wake of an adverse terms-of-trade shock is correct.[21] For developed economies, one might reasonably expect substitution elasticities to be high. In this case, the response to a terms-of-trade shock is a real appreciation, substitution of domestic goods for the more expensive (and non-critical) imports, and a contraction in the aggregate volume of trade. In all countries, one would expect substitution elasticities to be higher in the long run. The long-run effect of the real exchange rate will thus differ, and may be of the opposite sign from the short-run effect.

Another example relates to the revenue effects of tariff reforms. Devarajan, Go, and Li (1999) show how the fiscal impact of tariff liberalization also depends on the substitution elasticity between foreign and domestic goods. Unless there is an upward shift in output productivity, a reduction in tariffs will invariably involve losses in revenue for much of the plausible range of the trade elasticities unless compensated by increases in domestic taxes. There is no Laffer Curve for import tariffs.

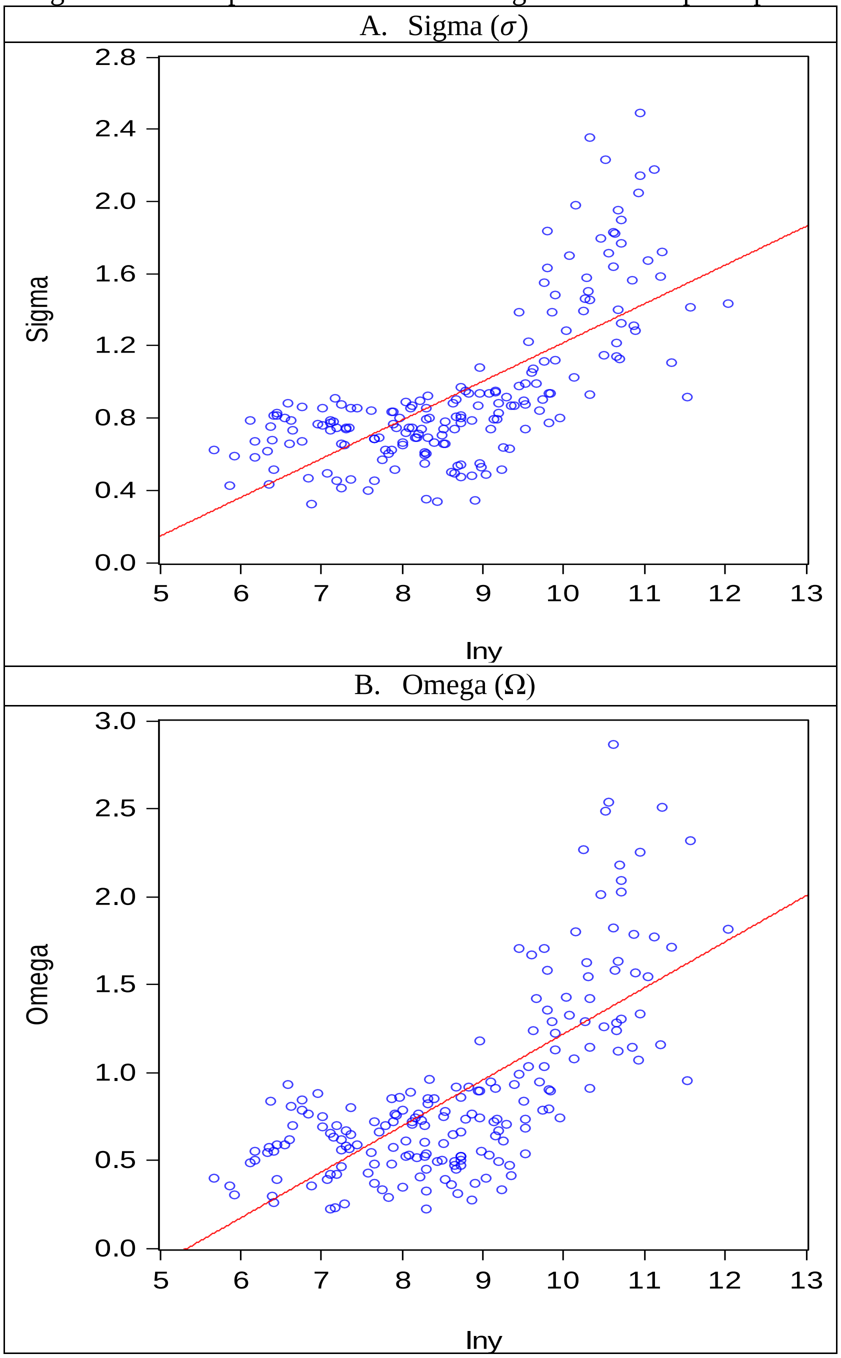
---

[19] We also tried two altermative income per capita measurements from the World Bank WDI – the 2015 gross national income per capita using the Atlas and purchasing power parity methods. The patterns of the scatter plots remain largely the same. Because some countries have missing observations using these methods, we did not choose them.

[20] The R-squared of the regression line is about 0.50 in both cases. The regression coefficient in each case is positive and significant at prob=0.05.

[21] This is confirmed in the empirical estimation of substitution elasticities in Devarajan, Go and Li (1994).

Figure 3: Scatter plots of the elasticities against income per capita



Source: Authors' calculations.
Note: lny = natural log of GDP per capita, U.S. dollars, 2015.

Table 3 provides additional summary descriptive statistics for the two main income groups. The median trade elasticities are close to the simple averages in all cases. In developing countries, the upper range is also less but close to one for both the Armington and CET elasticities. Countries with elasticities near the value of one are usually those close to the boundaries of the high-income group, such as emerging economies like Brazil and South Africa and some Latin American countries like Costa Rica and

Argentina.[22] Although the average and median elasticity of high-income countries is higher than one, the lower range is less than one, overlapping with the upper range of the developing countries. The reasons are many: the boundary is ad hoc, and the income range for high income is wide; at the lower range are new entrants, such as former communist countries like Latvia and Poland, and island and Latin American countries like Barbados, Bermuda, and Chile. If we restrict the group to early OECD countries, the lower value is greater than 1.10 for both elasticities.

Table 3: Descriptive Statistics for developing and high-income countries

	Armington (σ)		CET (Ω)	
	Developing countries	High-income countries	Developing countries	High-income countries
Average	0.71	1.42	0.59	1.46
Median	0.74	1.39	0.59	1.33
Standard deviation	0.16	0.42	0.19	0.50
Range	0.32-0.99	0.78-2.49	0.22-0.96	0.74-2.87

Source: Authors' calculations.

Our results are consistent with recent findings of lower elasticities for macro or aggregate elasticities than those of micro elasticity studies of specific sectors or commodities. Because a cointegration equation corresponds to a long-term equilibrium, the results are comparable to the range of 1.75 to 2.25 for the long-term elasticity estimates of Boehm, Levchenko, and Pandalai-Nayar (2023), especially for the high-income group. Past results that do not correct for nonstationarity issues in time-series estimation will also be spuriously high. The survey and analysis by Bajzik et al. (2020), including many past studies at sectoral levels, show a broader range in magnitude. Plausible explanations mentioned before include aggregated imports, exports, and domestic goods are composites of many goods; developing countries are less diversified, and the composition of these goods tends to differ; and the external balance of payments constraint at the macro level could limit substitution possibilities. Finally, this study provides country-specific estimates of trade elasticities for many countries, 128 developing countries and 63 high-income countries. Not only were estimates for developing countries lacking in the literature, but estimates of the export supply side were also lacking.

V. Conclusion

This paper tries to fill a lacuna in the literature. While the Armington elasticity has been estimated at the sectoral level for a number of (mostly) developed countries, the equivalent elasticity in the widely used aggregate, 1-2-3 model of developing countries has typically been assumed. We provide empirical estimates of the import and export elasticities of the 1-2-3 model for 191 countries. Using data from 1970-2019 and the Vector Error Correction model as the dominant technique, we derive robust estimates that also square with intuition. Elasticities for high-income countries are generally greater than one, averaging around 1.4, while those of lower-income countries are below one, averaging around 0.65. Not only do these estimates confirm

[22] Argentina became high-income in 2017.

that most of the assumed parameters were broadly correct, but they provide the foundation for future, multi-country use of the 1-2-3 model, whose parsimony and data economy have been the hallmarks of its extensive application.

References

Ahmad, Saad, Christopher Montgomery, and Samantha Schreiber. 2020. "A Comparison of Armington Elasticity Estimates in the Trade Literature." Economics Working Paper 2020-04-A, US International Trade Commission, Washington, DC.

Alston, Julian M., and Richard Green. 1990. "Elasticities in AIDS Models." *American Journal of Agricultural Economics*. 72(2): 442-45.

Alston, Julian M., Colin A. Carter, Richard Green, and Daniel Pick. 1990. "Whither Armington Trade Models." *American Journal of Agricultural Economics*. 72(2): 455-67.

Anderson, James E., and Eirc van Wincoop. 2004. "Trade Costs." *Journal of Economic Literature* 42 (3): 691-751.

Arbache, Jorge, Delfin S. Go, and John Page (2008). "Is Africa's Economy at a Turning Point?" In Delfin S. Go and John Page, eds., *Africa at a Turning Point? Growth, Aid, and External Shocks.* Washington, DC: The World Bank.

Armington, Paul. 1969. "A Theory of Demand for Products Distinguished by Place of Production." *IMF Staff Papers*, Vol. 16, pp. 159-178.

Arrow, Kenneth J., Hollis B. Chenery, Bagicha S. Minhas, and Robert M. Solow. 1961. "Capital-Labor Substitution and Economic Efficiency." *Review of Economics and Statistics,* 43(3):225-50.

Bajzik, Josef, Tomas Havranek, Zuzana Irsova, Jiri Schwarz (2020). "Estimating the Armington Elasticity: The Importance of Design Study and Publication Bias." *Journal of International* Economics 127 103383. See also *VOX, CEPR Policy Portal, September 23, 2020. https://voxeu.org/article/armington-elasticity-and-international-trade-models-fifty-years.*

Boehm, Christoph E., Andrei A. Levchenko, and Nitya Pandala-Nayar. 2023. "The Long and Shor (Run) of Trade Elasticities." *American Economic Review* 113 (4): 861-905.

Bond, Marian. 1987. "An Econometric Study of Primary Commodity Exports from Developing Country Regions to the World. *IMF Staff Papers* 34: 191-227.

Branson, William H. 1972. "The Trade Effects of the 1971 Currency Realignments." *Brookings Papers on Economic Activity I:* 15-58.

Corsetti, Giancarlo, Luca Dedola, and Sylvian Leduc. 2008. "International Risk Sharing and the Transmission of Productivity Shocks." *Review of Economic Studies* 75: 443-75.

de Melo, Jaime, and Sherman Robinson. 1989. Product Differentiation and the Treatment of Foreign Trade in Computable General Equilibrium Models of Small Economies." *Journal of International Economics* 27: 47-67.

Deardorff, Alan V. 2006. Glossary of International Economics. World Scientific Publishers.

Devarajan, Shantayanan and Sherman Robinson. 2013. "Contribution of Computable General Equilibrium Modeling to Policy Formulation in Developing Countries." In P.B. Dixon and D.W.

Jorgenson, eds., *Handbook of Computable General Equilibrium Modeling.* North Holland, Eksevier V.B., pp. 227-301.

Devarajan, Shantayanan, and Delfin S. Go. 2012. "The Simplest General-Equilibrium Model of a Small, Open Economy." Chapter in a book in honor of Ernὂ Zalai, 2013.

_______. 1998. "The Simplest Dynamic General Equilibrium Model of an Open Economy." *Journal of Policy Modeling* 29(6): 677-714.

_______. 2003. "The 123PRSP Model." In François Bourguignon and Luiz A. Pereira da Silva, *The Impact of Economic Policies on Poverty and Income Distribution.* Washington, DC: The World Bank and Oxford University Press.

Devarajan, Shantayanan, Delfin S. Go, and Hongyi Li. 1999. "Quantifying the Fiscal Effect of Trade Reform: A General Equilibrium Model Estimated for 60 Countries." Policy Research Working Paper 2162. World Bank, Development Research Group, Washington, DC.

Devarajan, Shantayanan, Delfin S. Go, Jeffrey D. Lewis, Sherman Robinson, and Pekka Sinko. 1997. "Simple General Equilibrium Modeling." In Joseph F. Francois and Kenneth A. Reinert, eds., Applied Methods for Trade Policy Analysis: A Handbook. Cambridge: Cambridge University Press.

Devarajan, Shantayanan, Delfin S. Go, John Page, Sherman Robinson, and Karen Thierfelder. 2008. "The Macroeconomic Dynamics of Scaling Up Foreign Aid." In Delfin S. Go and John Page, eds. *Africa at a Turning Point? Growth, Aid, and External Shocks.* Washington, DC: The World Bank.

Devarajan, Shantayanan, Delfin S. Go, Sethaput Suthiwart-Narueput, and John Voss. 1997b. "Direct and Indirect Fiscal Effects of the Euro-Mediterranean Free Trade Agreements." Paper presented at the Mediterranean Development Forum, Knowledge and Skills for Development in the Information Age, Marrakech, Morocco, May 12-17, 1997.

Devarajan, Shantayanan, Jeffrey D. Lewis, and Sherman Robinson. 1990. "Policy Lessons from Trade-focused, Two-sector Models." *Journal of Policy Modeling* 12(4): 625-57.

_______. 1993. "External Shocks, Purchasing Power Parity, and the Equilibrium Real Exchange Rate." World Bank Economic Review 7(1): 45-63.

Devarajan, Shantayanan, Yazid Dissou, Delfin S. Go, and Sherman Robinson. 2017. "Budget Rules and Resource Booms and Busts – A Dynamic Stochastic General Equilibrium Analysis," *World Bank Economic Review* (2017) 31(1):71-96. https://doi.org/10.1093/wber/lhv059.

Devarajan, Shantayanan. 1997. "Real Exchange Rate Misalignment in the CFA Zone." *Journal of African Economies* 6(10): 35-53.

_______. 1999. "Estimates of Real Exchange Rate Misalignment with a Simple General-Equilibrium Model." In Lawrence E. Hinkle and Peter J. Montiel, *Exchange Rate Misalignment: Concepts and Measurement for Developing Countries*. Washington, DC: World Bank and Oxford University Press.

Faini, Ricardo, Lant Pritchett, and Fernando Clavijo. 1992. "Import Demand in Developing Countries." *International Trade Modelling*, 279-97.

Faini, Ricardo. 1994. "Export Supply, Capacity and Relative Prices." *Journal of Development Economics* 45: 81-100.

Feenstra, Robert C., Philip Luck, Maurice Obstfeld, and Katheryn N. Russ. 2018. "In Search of the Armington Elasticity." *The Review of Economics and Statistics* 100(1): 135–150.

Fleming, Marcus J. 1962. “Domestic Financial Policies Under Fixed and Floating Exchange Rates.” *IMF Staff Papers* 9 (3): 369-79.

Galí, Jordi, and Tommaso Montacelli (2005). "Monetary Policy and Exchange Rate Volatility in a Small Open Economy." *Review of Economic Studies* 72(3): 707-34.

Gali, Jordi. 2015. *Monetary Policy, Inflation, and the Business Cycle – An Introduction to the New Keynesian Framework and Its Applications,* second edition. Princeton University Press, Princeton, New Jersey.

Gallaway, Michael P., Christine A. McDaniel, and Sandra A. Rivera. 2003. "Short-Run and Long-Run Industry-Level Estimates of US Armington Elasticities." *The North American Journal of Economics and Finance* 14: 49-63.

Gust, Christopher, Sylvain Leduc, and Nathan Sheets. 2009. "The Adjustment of Global External Balances: Does Partial Exchange-Rate Pass-Through to Trade Prices Matter?" *Journal of International Economics* 79: 173-85.

Hanson, Kenneth, Sherman Robinson, and Stephen Tokarick. 1993. "U.S. Adjustment in the 1990's: A CGE Analysis of Alternative Trade Strategies." *International Economic Journal* 7: 27-49.

Head, Keith, and Thierry Mayer. 2014. “Gravity Equations: Workhorse, Toolkit, and Cookbook.” In Elhanan Helpman, Kenneth Rogoff, and Gita Gopinath, eds., *Handbook of International Economics*, Vol. 4, 131-95. Amsterdam: Elsevier.

Hertel, Thomas, David Hummels, Maros Ivanic, and Roman Keeney. 2007. "How Confident Can We Be of CGE-based Assessments of Free Trade Agreements?" *Economic Modelling* 24: 611-635.

Hillberry, Russell and David Hummels. 2013. "Trade Elasticity Parameters for a Computable General Equilibrium Model." In Peter B. Dixon and Dale W. Jorgenson, eds. *Handbook of Computable General Equilibrium Modeling, Vol. 1B.* Oxford: North-Holland, Elsevier, pp. 1213-70.

Ho, Mun S., and Dale W. Jorgenson. 1998. "Modeling Trade Policies and U.S. Growth: Some Methodological Issues." In N. Benjamin, ed., *The Economic Implications of Liberalizing APEC Tariff and Nontariff Barriers to Trade.* Washington, D.C: U.S. International Trade Commission (Publication 3101).

Justiniano, Alejandro, and Bruce Preston. 2010. "Can Structural Small Open Economy Models Account for the Influence of Foreign Disturbances?" *Journal of International Economics* 81: 61-74.

Khan, Moshin S. 1974. "Import and Export Demand in Developing Countries. *IMF Staff Papers* 21: 678-93.

Kohli, Ulrich R. 1978. "A Gross National Product Function and Derived Demand for Imports and Supply of Exports. *Canadian Journal of Economics* 11(2): 167-82.

Marquez, Jaime, and Caryl McNeilly. 1988. Income and Price Elasticities for Exports of Developing Countries. *Review of Economics and Statistics* 70: 306-14.

Marquez, Jaime. 1994. "The Econometrics of Elasticities or the Elasticity of Econometrics: an Empirical Analysis of the Behavior of U.S. Imports." *Review of Economics and Statistics* 76(3): 471-81.

McDaniel, Christine A., and Edward J. Blistreri (2003). "A Review of Armington Trade Substitution Elasticities." *Économie international* 94-95: 301-14.

McDonald, Scott, Karen Thierfelder, and Terry Walmsley. 2012. "R23 Model: A SAM Based Global Macro CGE Model." Mimeo. The World Bank DEC Prospects Group.

Mundell, Robert A. 1963. "Capital Mobility and Stabilization Policy Under Fixed and Flexible Exchange Rates." *Canadian Journal of Economic and Political Science* 29 (4): 475-85.

Ostry, Jonathan D., and Andrew K. Rose. 1992. "An Empirical Evaluation of the Macroeconomic Effects of Tariffs." *Journal of International Money and Finance* 11:63-79.

Panagariya, Arvind, Shekhar Shah, and Deepak Mishra. 1996. "Demand Elasticities in International Trade - Are They Really Low?" World Bank Policy Research Working Paper 1712, Washington D.C.

Petri, Peter A. 1984. *Modeling Japanese-American Trade.* Cambridge: Cambridge University Press.

Reinert, Kenneth, and David Roland-Holst. 1992. "Armington Elasticities for United States Manufacturing Sectors." *Journal of Policy Modeling* 14: 631-639.

Reinhart, Carmen M. (1995). "Devaluation, Relative Prices, and International Trade: Evidence from Developing Countries." *IMF Staff Papers* 42 (2): 290-312.

Rittenberg, Libby. 1986. "Export Growth Performance of Less-developed Countries." *Journal of Development Economics* 24: 167-77.

Rose, Andrew K. 1990. "Exchange Rates and the Trade Balance: Some Evidence from Developing Countries." *Economic Letters* 34: 271-75.

Rose, Andrew K. 1991. "The Role of Exchange Rates in Popular Models of International Trade: Does the Marshall-Lerner Condition Hold? *Journal of International Economics* 30:1-16.

Rutherford, Thomas. 2003. "Lecture Notes on Constant Elasticity Functions." Mimeo, University of Colorado.

Salter, Wilfred E. G. 1959. "Internal and External Balance: The Role of Price and Expenditure Effects." *Economic Record*, Vol 35, pp. 226-238.

Schurenberg-Frosch, H (2015), "We Could Not Care Less about Armington Elasticities–But Should We? A Meta-Sensitivity Analysis of the Influence of Armington Elasticity Misspecification on Simulation Results", Ruhr Economic Papers 594/2015, Ruhr Universitat Bochum, Germany.

Senhadji, Abdelhak S., and Claudio E. Montenegro. 1999. "Time Series Analysis of Export Demand Equations: A Cross-Country Analysis." *IMF Staff Papers* 46 (3): 259-73.

Shiells, Clinton R., David W. Roland-Holst, and Kenneth A. Reinert. 1993. "Modeling a North American Free Trade Area: Estimation of Flexible Functional Forms." *Weltwirtschaftliches Archiv*. 129:1, 55-77.

Swan, Trevor. 1960. "Economic Control in a Dependent Economy." *Economic Record*, Vol. 36, pp. 51-66.

Uribe, Martin, and Stephanie Schmitt-Grohé. 2017. *Open Economy Macroeconomics.* Princeton University Press, Princeton, New Jersey.

Végh, Carlos A. 2013. *Open Economy Macroeconomics in Developing Countries.* The MIT Press, Cambridge, Massachusetts.

Whalley, John. 1985. *Trade Liberalization among Major World Trading Areas.* MIT Press, Cambridge, MA.

Zofío, José L., Jorge Días-Lanchas, Damiaan Persyn, and Javier Barbero. 2020. "Estimating Foreign and National Trade Elasticities in the EU Internal Market Using Generalized Transport Costs." Joint Research Center Working Papers on Territorial Modelling and Analysis No. 05/2020, the European Commission.

Appendix Table A1: Estimates of σ, the Armington CES Elasticities

Country	Estimate and test				Model			
	σ	Standard Error	t-statistic	NOB after adj	Method	Lags intervals in VEC	Constant and trend structure in VEC	Additional specifications
Albania	0.551	0.235	2.342	28	FMOLS			CE deterministic regressors= C, T, xgr; additional deterministic regressors: T^2
Algeria	0.801	0.110	7.282	46	VEC	1,2	C in CE	mshare exogenous in VAR
Angola	0.716	0.064	11.165	36	VEC	1,2	C in CE, VAR	eshare exogenous in CE, VAR
Antigua and Barbuda	1.054	0.304	3.467	41	FMOLS			factor demand spec; CE deterministic regressors = C, T, eshare, xgr; additional deterministic regressors = T^2
Argentina	0.993	0.055	18.109	43	VEC	1,5	C, T in CE,VAR	mshare exogenous in CE; a dummy for 1998-2002 (depression)
Armenia	0.709	0.094	7.532	26	VEC	1,2	C in CE,VAR	mshare exogenous in VAR
Aruba	1.393	0.294	4.743	24	VEC	1,3	C in CE,VAR	xgr exogenous in CE; mshare exogenous in VAR
Australia	2.490	0.810	3.075	43	VEC	1,5		xgr exogenous in CE; eshare, egr exogenous in VAR
Austria	1.128	0.070	16.068	46	VEC	1,2	T in CE; C in VAR	mshare exogenous in VAR
Azerbaijan	0.503	0.241	2.087	23	VEC	1,3	C, T in CE; C in VAR	xgr exogenous in CE; mshare exogenous in VAR
Bahamas, The	0.931	0.047	20.006	26	VEC	1,3		dummy after 1996 exogenous in CE, VAR
Bahrain	1.283	0.437	2.937	45	VEC	1,3	C in CE	factor demand spec; eshare exogenous in VAR
Bangladesh	0.732	0.097	7.560	43	VEC	1,5		mgr, xgr exogenous in CE; mshare, xgr exogenous in VAR
Barbados	0.902	0.035	25.850	46	VEC	1,2	C in CE,VAR	mshare in VAR
Belarus	0.536	0.101	5.312	28	FMOLS			CE deterministic regressor= C
Belgium	1.637	0.394	4.151	46	VEC	1,2	C, T in CE, VAR	
Belize	0.544	0.171	3.174	48	FMOLS			CE deterministic regressors= C, T, xgr; additional deterministic regressors: T^2, mshare
Benin	0.764	0.032	23.935	42	VEC	1,6	C, T in CE; C in VAR	mshare exogenous in VAR
Bermuda	0.915	0.077	11.963	46	VEC	1,2	C in CE, VAR	mshare exogenous in VAR
Bhutan	0.836	0.160	5.232	38	FMOLS			CE deterministic regressors= C, mshare,mgr
Bolivia	0.668	0.116	5.756	48	FMOLS			CE deterministic regressors= C, T, mshare, xgr; additional deterministic regressors: T^2
Bosnia and Herzegovina	0.339	0.032	10.671	23	VEC	1,3	C, T in VAR	xgr as extra endogenous var in CE
Botswana	0.905	0.353	2.563	48	FMOLS			factor demand spec; CE deterministic regressors= C, T, lyx; additional deterministic regressors: T^2, mshare
Brazil	0.939	0.027	35.023	46	VEC	1,2	C in CE	xgr exogenous in CE; mshare exogenous in VAR
Brunei Darussalam	1.452	0.157	9.262	24	VEC	1,5		mshare exogenous in CE
Bulgaria	0.788	0.143	5.523	28	FMOLS			CE deterministic regressors = C, T, xgr, mshare
Burkina Faso	0.813	0.037	22.102	43	VEC	1,5	C in CE	xgr exogenous in CE; mshare exogenous in VAR
Burundi	0.626	0.310	2.020	46	VEC	1,2	C,T in CE, VAR	mgr as extra endogenous var
Cabo Verde	0.799	0.085	9.372	36	VEC	1,2		
Cambodia	0.496	0.191	2.595	25	GMM			C, ar(1) as extra vars; insts=mshare, mgr
Cameroon	0.411	0.094	4.355	43	VEC	1,5	C,T in CE; C in VAR	xgr exogenous in VAR
Canada	1.949	0.354	5.499	48	FMOLS			CE deterministic regressor = C
Central African Rep.	0.427	0.166	2.568	48	FMOLS			CE deterministic regressor = C
Chad	0.729	0.248	2.939	43	VEC	1,5	T in CE; C in VAR	lyx exogenous in CE; xgr, mshare exogenous in VAR
Chile	0.895	0.157	5.698	45	VEC	1,3	C in CE, VAR	lyx exogenous in CE and VAR; mgr exogenous in VAR

Appendix Table A1: Estimates of σ, the Armington CES Elasticities

Country	Estimate and test				Model			
	σ	Standard Error	t-statistic	NOB after adj	Method	Lags intervals in VEC	Constant and trend structure in VEC	Additional specifications
China	0.529	0.032	16.650	45	VEC	1,3	C, T in CE; C in VAR	xgr exogenous in CE and VAR; mshare exogenous in VAR
Colombia	0.814	0.052	15.697	44	VEC	1,4	T in CE; C in VAR	mshare exogenous in CE and VAR
Comoros	0.745	0.075	9.961	38	FMOLS	1,2		CE deterministic regressors= C, mgr, dummy after 2007; additional deterministic regressor= mshare
Congo, Dem. Rep.	0.669	0.224	2.987	48	FMOLS			CE deterministic regressors=C, T
Congo, Rep.	0.568	0.194	2.922	48	FMOLS			CE deterministic regressors=C, T,eshare; additional deterministic regressors= T^2, mshare
Cook Islands	1.116	0.266	4.190	40	VEC	1,3	C in CE	eshare exogenous in CE; mshare exogenous in VAR
Costa Rica	0.869	0.036	23.996	46	VEC	1,2	C,T in CE, C in VAR	mshare exogenous in CE and VAR
Cote d'Ivoire	0.397	0.170	2.342	48	FMOLS			CE deterministic regressors=C, T; additional deterministic regressors= T^2, mshare
Croatia	0.866	0.382	2.267	23	FMOLS			CE deterministic regressors=C, T, xgr; additional deterministic regressors= mshare, mgr
Cuba	0.871	0.071	12.310	45	VEC	1,3	C in CE	mshare exogenous in VAR
Cyprus	1.699	0.160	10.642	40	VEC	1,3	C,T in CE; C in VAR	mshare exogenous in VAR
Czech Rep.	1.835	0.364	5.042	28	FMOLS			CE deterministic regressors= C, dummy after 2002
Denmark	1.282	0.039	32.770	46	VEC	1,2	C in CE	dummy 2008 and after exogenous in CE; mshare exogenous in VAR
Djibouti	0.621	0.135	4.608	39	VEC	1,5	C in CE	factor demand spec; xgr exogenous in CE; mshare exogenous in VAR
Dominican Rep.	0.938	0.070	13.417	43	VEC	1,5	C, T in CE; C in VAR	xgr exogenous in CE; mshare exogenous in VAR
Ecuador	0.798	0.031	25.926	43	VEC	1,5	C in CE	mshare exogenous in CE
Egypt, Arab Rep.	0.868	0.022	40.085	44	VEC	1,4	C in CE, VAR	mshare exogenous in VAR
El Salvador	0.742	0.047	15.872	45	VEC	1,3	C in CE, VAR	mshare exogenous in VAR
Equatorial Guinea	0.828	0.058	14.211	34	VEC	1,4	C in CE	xgr exogenous in CE; mshare exogenous in VAR
Eritrea	0.817	0.111	7.337	25	VEC	1,3	C in CE	mshare exogenous in CE; mgr exogenous in VAR
Estonia	1.548	0.142	10.923	23	VEC	1,2	C in CE, VAR	xgr exogenous in CE; mshare exogenous in VAR
Eswatini	0.691	0.162	4.251	44	VEC	1,4	C, T in CE; C in VAR	xgr exogenous in CE; mshare exogenous in VAR
Ethiopia	0.831	0.022	37.644	26	VEC	1,2	T in CE; C in VAR	mshare exogenous in VAR
Fiji	0.659	0.157	4.207	46	VEC	1,2	C,T in CE; C in VAR	eshare exogenous in VAR
Finland	1.401	0.400	3.500	48	FMOLS			CE deterministic regressors= C, dummy for 2000 and after; additional deterministic regressor= T
France	2.232	0.378	5.911	46	VEC	1,2		mshare exogenous in CE
French Polynesia	0.776	0.186	4.181	43	VEC	1,5	C in CE	mshare exogenous in CE and VAR; xgr exogenous in VAR
Gabon	0.478	0.115	4.165	45	VEC	1,3	C, T in CE; C in VAR	
Gambia, The	0.515	0.173	2.974	48	FMOLS			CE deterministic regressors= C, lyx, dummy after 1990 and 2001; additional deterministic regressor= T
Georgia	0.793	0.232	3.420	27	FMOLS			CE deterministic regressor= C; additional deterministic regressors= T, mgr
Germany	1.827	0.361	5.065	44	VEC	1,4	C, T in CE; C in VAR	dummy 1990 and after exogenous in CE; xgr exogenous in VAR
Ghana	0.856	0.117	7.310	44	VEC	1,4	C, T in CE; C in VAR	mshare exogenous in CE; mgr exogenous in VAR
Greece	1.632	0.436	3.745	46	VEC	1,2		
Greenland	1.765	0.873	2.023	42	VEC	1,6	C in CE	dummy after 1990 as extra endogenous var; mshare exogenous in VAR
Grenada	0.486	0.116	4.175	39	VEC	1,2	C, T in CE, VAR	factor demand spec; xgr as extra endogenous var

Appendix Table A1: Estimates of σ, the Armington CES Elasticities

Country	Estimate and test				Model			
	σ	Standard Error	t-statistic	NOB after adj	Method	Lags intervals in VEC	Constant and trend structure in VEC	Additional specifications
Guatemala	0.852	0.297	2.869	45	VEC	1,3	T in CE; C in VAR	xgr exogenous in CE and VAR
Guinea	0.784	0.333	2.352	32	FMOLS			CE deterministic regressors= C, mshare, dummy for 2000 and after; additional deterministic regressors= T, T^2, xgr, mgr
Guinea-Bissau	0.752	0.083	9.051	46	VEC	1,2	C in CE, VAR	
Guyana	0.493	0.048	10.208	45	VEC	1,3	C, T in CE; C in VAR	xgr exogenous in CE; mshare exogenous in VAR
Haiti	0.873	0.016	53.691	26	VEC	1,4	C, T in CE, VAR	mshare exogenous in VAR
Honduras	0.690	0.059	11.648	46	VEC	1,2	C, T in CE, VAR	mshare exogenous in CE
Hong Kong SAR, China	1.138	0.041	28.037	46	VEC	1,2	T in CE; C in VAR	factor demand spec; eshare exogenous in CE; xgr exogenous in VAR
Hungary	1.388	0.140	9.930	27	FMOLS			CE deterministic regressors= C, mshare; additional deterministic regressors= T, T^2, dummy after 2013, xgr
Iceland	1.315	0.176	7.478	44	VEC	1,4	C in CE, VAR	xgr exogenous in CE and VAR; mshare exogenous in VAR
India	0.462	0.111	4.150	48	FMOLS			CE deterministic regressors: C, T, mshare; additional deterministic regressor= mgr
Indonesia	0.855	0.030	28.146	46	VEC	1,2	C, T in CE; C in VAR	mshare exogenous in VAR
Iran, Islamic Rep.	0.742	0.075	9.851	45	VEC	1,3	C, T in CE, VAR	mshare exogenous in CE; xgr exogenous in VAR
Iraq	0.663	0.181	3.673	45	VEC	1,3	C, T in CE; C in VAR	factor demand spec; xgr exogenous in CE; mshare exogenous in VAR
Ireland	1.674	0.260	6.430	45	VEC	1,3	T in CE; C in VAR	factor demand spec; eshare exogenous in CE; xgr exogenous in VAR
Israel	1.150	0.086	13.393	45	VEC	1,3	C, T in CE; C in VAR	mshare exogenous in CE; xgr exogenous in VAR
Italy	2.355	0.570	4.129	45	VEC	1,3		
Jamaica	0.781	0.055	14.213	46	VEC	1,2	C in CE	mshare exogenous in CE; xgr exogenous in VAR
Japan	1.794	0.097	18.469	42	VEC	1,6	C, T in CE, VAR	eshare exogenous in CE; mshare exogenous in VAR
Jordan	0.691	0.063	10.898	38	VEC	1,4	C in CE, VAR	xgr exogenous in CE and VAR; mshare exogenous in VAR
Kazakhstan	0.635	0.062	10.217	26	VEC	1,2	C in CE, VAR	mshare exogenous in VAR
Kenya	0.738	0.083	8.912	48	FMOLS			CE deterministic regressors= C, xgr; additional deterministic regressor= mshare
Kiribati	0.650	0.092	7.036	36	VEC	1,3	C in CE, VAR	xgr exogenous in VAR
Korea, Rep.	1.465	0.254	5.776	48	FMOLS			C as CE determinisitic regressor
Kosovo	0.690	0.194	3.558	26	VEC	1,2		xgr exogenous in CE; mshare exogenous in VAR
Kuwait	1.578	0.381	4.140	46	VEC	1,2	C, T in CE; C in VAR	xgr exogenous in CE and VAR; eshare exogenous in VAR
Kyrgyz, Rep.	0.760	0.105	7.207	26	VEC	1,2	C, T in CE, VAR	mshare exogenous in CE and VAR
Lao PDR	0.451	0.202	2.233	30	VEC	1,3	C,T in CE, VAR	xgr exogenous in CE and VAR; mshare exogenous in VAR
Latvia	0.875	0.875	7.223	28	FMOLS			CE deterministic regressors= C, mgr, mshare; additional deterministic regressors= T, T^2
Lebanon	0.550	0.072	7.603	26	VEC	1,2	C,T in CE, VAR	xgr as extra endogenous var
Lesotho	0.855	0.246	3.478	44	VEC	1,4	C, T in CE, VAR	mshare exogenous in CE; mgr exogenous in VAR
Liberia	0.798	0.147	5.415	46	VEC	1,2	C in CE, VAR	xgr as extra endogenous var; mshare exogenous in VAR
Libya	0.936	0.154	6.056	48	FMOLS			factor demand spec; dummy after 2010 added to endogenous vars; CE deterministic regressors: C, mshare
Liechtenstein	1.433	0.342	4.192	45	VEC	1,3	C in CE, VAR	xgr as additional endogenous var

Appendix Table A1: Estimates of σ, the Armington CES Elasticities

Country	Estimate and test				Model			
	σ	Standard Error	t-statistic	NOB after adj	Method	Lags intervals in VEC	Constant and trend structure in VEC	Additional specifications
Lithuania	1.221	0.055	22.165	26	VEC	1,2	C in CE	dummy 2010 and after exogenous in CE, VAR; mshare exogenous in VAR
Luxembourg	1.413	0.354	3.990	48	FMOLS			factor demand spec; CE deterministic regressors= C, T, xgr; additional deterministic regressor= T^2
Macao SAR, China	1.587	0.209	7.602	34	VEC	1,2	C in CE	factor demand spec; mshare exogenous in VAR
Madagascar	0.789	0.177	4.456	48	FMOLS			C deterministic regressors= C, lyx; additional deterministic regressors= T, T^2
Malawi	0.588	0.238	2.467	44	VEC	1,4	C in CE, VAR	xgr as extra endogenous var
Malaysia	0.794	0.238	3.333	45	VEC	1,3	C in CE, VAR	factor demand spec; xgr as extra endogenous var; eshare exogenous in VAR
Maldives	0.944	0.207	4.552	46	VEC	1,2		factor demand spec; mgr as extra endogenous var
Mali	0.883	0.127	6.954	45	VEC	1,3	C, T in CE; C in VAR	xgr as extra endogenous var; mshare exogenous in VAR
Malta	1.026	0.031	32.782	46	VEC	1,2	C, T in CE; C in VAR	factor demand spec; mshare exogenous in CE; eshare exogenous in VAR
Marshall Islands	0.895	0.043	20.596	42	VEC	1,6		mshare exogenous in CE; eshare exogenous in VAR
Mauritania	0.749	0.145	5.163	48	FMOLS			CE deterministic regressors= C, T, mshare; additional deterministic regressor= T^2
Mauritius	0.950	0.327	2.903	42	FMOLS			CE deterministic regressors= dummy for 1985-2014; additional deterministic regressor= mshare
Mexico	0.885	0.065	13.569	46	VEC	1,2	C, T in CE; C in VAR	mshare exogenous in VAR
Moldova	0.516	0.065	7.926	21	VEC	1,2	C, T in CE; C in VAR	mshare exogenous in CE; xgr exogenous in VAR
Mongolia	0.612	0.044	13.862	35	VEC	1,2	C, T in CE, VAR	mshare exogenous in CE; xgr exogenous in VAR
Montenegro	0.953	0.076	12.613	27	FMOLS			CE deterministic regressors= C, T, mshare; additional deterministic regressor= T^2, xgr
Morocco	0.889	0.046	19.313	46	VEC	1,2	C, T in CE; C in VAR	mshare exogenous in VAR
Mozambique	0.675	0.035	19.214	34	VEC	1,3	C, T in CE; C in VAR	mshare exogenous in VAR
Myanmar	0.788	0.068	11.626	46	VEC	1,2	C, T in CE; C in VAR	mshare exogenous in VAR
Namibia	0.660	0.057	11.626	36	VEC	1,2	C in CE, VAR	mshare exogenous in CE; xgr exogenous in VAR
Nauru	1.082	0.346	3.128	43	VEC	1,5	C in CE	mshare exogenous in VAR
Netherlands	1.326	0.097	13.614	43	VEC	1,5	C, T in CE; C in VAR	mshare exogenous in CE and VAR; dummy 2001 and after exogenous in CE
New Zealand	1.716	0.366	4.685	45	VEC	1,3	C, T in CE; C in VAR	xgr exogenous in CE
Nicaragua	0.844	0.043	19.682	45	VEC	1,3	C in CE, VAR	xgr as extra endogenous var; mshare exogenous in VAR
Niger	0.579	0.158	3.664	48	FMOLS			CE deterministic regressors= C, xgr; additional deterministic regressor= T
Nigeria	0.768	0.061	12.664	46	VEC	1,2	C, T in CE; C in VAR	mshare exogenous in CE; xgr exogenous in VAR
North Macedonia	0.704	0.223	3.160	28	FMOLS			CE deterministic regressor= lyx
Norway	1.724	0.303	5.690	46	VEC	1,2		dummy 1980 and after exogenous in CE and VAR; xgr exogenous in VAR
Oman	0.938	0.087	10.809	46	VEC	1,2	C in CE	dummy for 1982-2005 exogenous in CE and VAR; mshare exogenous in CE; xgr exogenous in VAR
Pakistan	0.779	0.032	24.206	45	VEC	1,3	C, T in CE; C in VAR	mshare exogenous in VAR
Panama	0.737	0.037	19.742	45	VEC	1,3	C in CE	mshare exogenous in VAR
Papua New Guinea	0.600	0.292	2.050	48	FMOLS			CE deterministic regressors= C, T, mshare; additional deterministic regressors= T^2, lyx
Paraguay	0.811	0.100	8.094	45	VEC	1,3	C, T in CE; C in VAR	mgr, mshare exogenous in VAR
Peru	0.776	0.056	13.762	43	VEC	1,5	C, T in CE; C in VAR	mshare exogenous in CE; xgr exogenous in VAR

Appendix Table A1: Estimates of σ, the Armington CES Elasticities

Country	Estimate and test				Model			
	σ	Standard Error	t-statistic	NOB after adj	Method	Lags intervals in VEC	Constant and trend structure in VEC	Additional specifications
Philippines	0.654	0.319	2.046	48	FMOLS			CE deterministic regressors= C, T, eshare, dummy 1988 and after; additional deterministic regressors= T^2, xgr
Poland	0.974	0.057	17.135	26	VEC	1,2	C, T in CE; C in VAR	mshare exogenous in VAR
Portugal	1.386	0.150	9.219	46	VEC	1,2		xgr, mshare exogenous in VAR
Puerto Rico	1.503	0.224	6.715	45	VEC	1,3	C in CE, VAR	mshare exogenous in VAR
Qatar	2.177	0.291	7.473	45	VEC	1,3		factor demand spec; mgr exogenous in VAR
Romania	0.736	0.063	11.738	26	VEC	1,2	C, T in CE; C in VAR	mshare exogenous in VAR
Russian Federation	0.796	0.028	28.648	26	VEC	1,2	C in CE, VAR	
Rwanda	0.657	0.086	7.675	48	FMOLS			CE deterministic regressors= C, T, mshare; additional deterministic regressors= T^2, xgr
Samoa	0.348	0.044	7.922	48	FMOLS			CE deterministic regressors= C, dummy 2002 and after, mshare
San Marino	1.215	0.025	48.905	44	VEC	1,4	C, T in CE; C in VAR	factor demand spec; xgr exogenous in CE; eshare exogenous in CE
Sao Tome and Principe	0.852	0.184	4.633	46	VEC	1,2		dummy for 1970-1986 and after 2000 exogenous in CE and VAR.
Saudi Arabia	1.480	0.135	10.943	46	VEC	1,2	C in CE	Dummy after 1973 exogenous in CE and VAR; mshare exogenous in VAR
Senegal	0.773	0.043	18.094	44	VEC	1,4	C in CE	mshare exogenous in CE and VAR; dummy after 1981 exogenous in VAR
Serbia	0.881	0.198	4.457	23	FMOLS			CE deterministic regressors= C, mshare; additional deterministic regressors= T, lyx
Seychelles	1.071	0.365	2.936	42	GMM			factor demand spec; C, ar(1), dummy 2000 and after as extra vars; insts= T, mgr, eshare
Sierra Leone	0.430	0.171	2.522	48	GMM			C, ar(1), lyx as extra vars; insts= T, T^2
Singapore	2.048	0.469	4.369	45	VEC	1,3	C, T in CE; C in VAR	factor demand spec; xgr exogenous in CE
Slovak Republic	0.840	0.259	3.246	25	VEC	1,3	C in CE	mgr as extra endogenous var; mshare exogenous in VAR
Slovenia	0.804	0.172	4.684	24	VEC	1,4	C, T in CE; C in VAR	mshare exogenous in VAR
Solomon Islands	0.681	0.131	5.220	35	VEC	1,3		xgr exogenous in CE; dummy 1993 and after exogenous in VAR
South Africa	0.968	0.032	29.823	46	VEC	1,2	C, T in CE; C in VAR	dummy 1991 and after exogenous in CE and VAR; mshare exogenous in VAR
Spain	1.979	0.098	20.138	45	VEC	1,3	C in CE, VAR	xgr exogenous in VAR
Sri Lanka	0.603	0.179	3.367	46	VEC	1,2	C in CE	dummy for 1980-2004 exogenous in CE and VAR; xgr exogenous in VAR
St. Kitts and Nevis	1.120	0.274	4.081	45	VEC	1,3	C in CE, VAR	mgr, mshare exogenous in VAR
St. Lucia	0.516	0.126	4.090	46	VEC	1,2		mgr exogenous in VAR
St. Vincent and the Grenadines	0.342	0.134	2.555	48	GMM			ar(1), C, T as extra vars; inst=mshare
Sweden	1.565	0.385	4.061	44	VEC	1,4	C, T in CE, VAR	mgr exogenous in VAR
Switzerland	1.105	0.030	37.201	46	VEC	1,2	C in CE	mgr, mshare exogenous in VAR
Syrian Arab Republic	0.864	0.151	5.737	48	FMOLS			CE deterministic regressors= C, mgr, lyx; additional deterministic regressor= xgr
Tajikistan	0.320	0.151	2.125	28	FMOLS			factor demand spec; CE deterministic regressor= C
Tanzania	0.468	0.151	3.102	28	FMOLS			CE deterministic regressor= C; additional deterministic regressor= T
Thailand	0.741	0.089	8.302	46	VEC	1,2	C, T in CE; C in VAR	mshare exogenous in VAR
Timor-Leste	0.452	0.205	2.203	25	VEC	1,3	C, T in CE, VAR	mshare exogenous in VAR
Togo	0.620	0.061	10.096	45	VEC	1,3	C, T in CE; C in VAR	mshare exogenous in VAR

Appendix Table A1: Estimates of σ, the Armington CES Elasticities

Country	Estimate and test				Model			
	σ	Standard Error	t-statistic	NOB after adj	Method	Lags intervals in VEC	Constant and trend structure in VEC	Additional specifications
Tonga	0.920	0.198	4.636	43	FMOLS			CE deterministic regressors = C, dummy 1985 and after
Trinidad and Tobago	0.937	0.168	5.580	46	VEC	1,2	C, T in CE, VAR	xgr exogenous in CE; xgr exogenous in VAR
Tunisia	0.595	0.048	12.508	46	VEC	1,2	C, T in CE; C in VAR	mshare exogenous in VAR
Türkiye	0.915	0.098	9.370	46	VEC	1,2	C, T in CE, VAR	mshare exogenous in VAR
Turkmenistan	0.471	0.088	5.323	25	VEC	1,3	C, T in CE, VAR	mgr, mshare exogenous in VAR
Tuvalu	0.745	0.071	10.553	46	VEC	1,2	C, T in CE; C in VAR	xgr, mshare exogenous in VAR
Uganda	0.669	0.125	5.358	44	VEC	1,4	C, T in CE; C in VAR	xgr exogenous in CE; dummy 1998 and after exogenous in VAR
Ukraine	0.685	0.243	2.815	26	VEC	1,2	C, T in CE, VAR	factor demand spec; mgr exogenous in VAR
United Arab Emirates	1.822	0.335	5.443	46	VEC	1,2	C, T in CE, VAR	factor demand spec; dummy 1993 and after exogenous in CE and VAR; xgr exogenous in CE; eshare exogenous in VAR
United Kingdom	1.897	0.330	5.741	45	VEC	1,3	C, T in CE, VAR	mgr exogenous in VAR
United States	2.141	0.210	10.181	45	VEC	1,3	C in VAR	mgr exogenous in VAR
Uruguay	0.989	0.023	42.842	45	VEC	1,3	C in CE, VAR	mshare exogenous in VAR
Uzbekistan	0.746	0.050	14.892	25	VEC	1,3	C, T in CE; C in VAR	xgr exogenous in CE; mshare exogenous in VAR
Vanuatu	0.837	0.141	5.926	38	FMOLS			CE deterministic regressors= C, T, mshare; additional deterministic regressors= T^2, eshare
Venezuela	0.633	0.106	5.981	44	VEC	1,4	C in CE	factor demand spec; lyx exogenous in CE
Vietnam	0.622	0.219	2.840	32	FMOLS			factor demand spec; CE deterministic regressors= C, dummy 1990 and after, T, eshare; additional deterministic regressors= T^2, xgr
West Bank and Gaza	0.747	0.056	13.375	22	VEC	1,2	C, T in CE; C in VAR	xgr exogenous in CE; mshare exogenous in VAR
Yemen	0.748	0.289	2.590	24	VEC	1,4	C in CE	factor demand spec; xgr exogenous in VAR
Zambia	0.910	0.063	14.445	48	FMOLS			CE deterministic regressors= C, dummy after 1989, additional deterministic regressors= T, mshare
Zimbabwe	0.660	0.122	5.409	48	FMOLS			CE deterministic regressors= C, T, mshare, dummy after 1997; additional deterministic regressors= T^2, dummy after 2007

Source: Authors' calculations
Notes:
C = constant
CE = cointegration equation
dummy = dummy variable
egr = growth rate of real exports
eshare = exports/GDP
FMOLS = fully modified OLS for cointegration regression
global demand and price ratios = variables in equation 9
GMM = generalized method of moments
inst(s) = instrument variable(s)
lyx = log of output (real GDP) index
mgr = growth rate of real imports
mshare = imports/GDP
NOB = number of observations after adjustments
T = linear trend
T^2 = quadratic trend
reduced eq of export system = equation 9
VEC = vector error correction
VAR = error correction part in VEC or vector autoregression
xgr = growth of output (real GDP)

Appendix Table A2: Estimates of Ω, the CET Elasticities

Country	Estimate and test				Model			
	Ω	Standard Error	t-statistic	NOB after adj	Method	Lag interval in VEC	C and trend structure in VEC	Additional specifications
Albania	0.604	0.078	7.754	28	VEC	1,2	C, T in CE, VAR	reduced eq of export system
Algeria	0.959	0.382	2.510	45	VEC	1,2		xgr as extra variable; eshare exogenous in VAR
Angola	0.609	0.161	3.774	36	VEC	1,2	C in CE, VAR	reduced eq of export system; dummy after 2000 exogenous in CE
Antigua and Barbuda	1.666	0.801	2.081	41	FMOLS			factor demand (re-export) spec.; reduced eq of export system; CE deterministic regressors= C, T, xgr; additional deterministic regressors=mshare, T^2
Argentina	0.680	0.146	4.666	42	VEC	1,6	C, T in CE; C in VAR	global demand and price ratios, dummy for 1998-2002 (depression) exogenous in CE, VAR
Armenia	0.766	0.378	2.025	25	VEC	1,3	C, T in CE, VAR	
Aruba	2.263	0.477	4.747	24	VEC	1,4	C, T in CE, VAR	
Australia	1.331	0.389	3.427	43	VEC	1,5		reduced eq of export system; eshare exogenous in CE; egr exogenous in VAR
Austria	2.180	0.485	4.497	44	VEC	1,4	C, T in CE,VAR	reduced eq of export system; xgr exogenous in VAR
Azerbaijan	0.362	0.156	2.316	26	GMM			inst= eshare
Bahamas, The	0.906	0.153	5.914	25	VEC	1,4	C, T in CE; C in VAR	reduced eq of export system
Bahrain	1.428	0.517	2.764	46	VEC	1,2		factor demand (re-export) spec; dummy 2003 and after exogenous in CE and VAR; xgr exogenous in VAR
Bangladesh	0.651	0.316	2.057	48	GMM			ar(1), xgr, global demand ratio as extra vars; insts= eshare, T, T^2
Barbados	0.785	0.241	3.265	43	VEC	1,5	C, T in CE; C in VAR	reduced eq of export system; dummy 1990 and after in CE, VAR
Belarus	0.308	0.116	2.643	27	GMM			ar(1), ma(1); insts=global demand and price ratios
Belgium	2.868	0.875	3.279	45	VEC	1,3	C, T in CE; C in VAR	reduced eq of export system; eshare exogenous in VAR
Belize	0.658	0.212	3.104	45	VEC	1,3	C in CE	dummy after 1999 exogenous in CE; xgr, global demand and price ratios exogenous in VAR
Benin	0.881	0.248	3.555	45	VEC	1,3	C in CE	reduced eq of export system; egr exogenous in VAR
Bermuda	0.955	0.412	2.320	48	FMOLS			CE deterministic regressors= C, egr, log(M); additional deterministic regressor= eshare
Bhutan	0.722	0.266	2.718	35	VEC	1,3	C in CE	reduced eq of export system
Bolivia	0.344	0.152	2.261	48	FMOLS			CE deterministic regressors= C, T, xgr, global price ratio; additional deterministic regressors= T^2, eshare
Bosnia and Herzegovina	0.496	0.089	5.558	23	VEC	1,3	C, T in VAR	reduced eq of export system; egr exogenous in VAR
Botswana	0.915	0.351	2.605	44	VEC	1,4	C, T in CE; C in VAR	factor demand (re-export) spec; reduced eq of export system; lym exogenous in VAR
Brazil	0.531	0.104	5.088	48	GMM			ar(1); inst=eshare
Brunei Darussalam	1.146	0.419	2.733	25	VEC	1,4	C, T in CE; C in VAR	dummy after 2007 exogenous in CE; xgr exogenous in VAR
Bulgaria	0.760	0.313	2.431	26	VEC	1,2	C, T in CE, VAR	reduced eq of export system; xgr exogenous in VAR
Burkina Faso	0.586	0.272	2.157	46	VEC	1,2	C, T in CE; C in VAR	reduced eq of export system; xgr exogenous in CE; egr exogenous in VAR
Burundi	0.400	0.197	2.034	46	VEC	1,2		eshare and global price ratio exogenous in VAR
Cabo Verde	0.856	0.063	13.632	34	VEC	1,4	C,T in CE ; C in VAR	global demand and price ratios exgenous in VAR
Cambodia	0.392	0.015	26.372	20	VEC	1,5	C,T in CE, VAR	
Cameroon	0.556	0.276	2.015	48	GMM			C, ar(1) as extra vars; insts=eshare, global demand ratio
Canada	1.124	0.399	2.815	46	VEC	1,2	C, T in CE; C in VAR	global demand and price ratios exogenous in VAR

Appendix Table A2: Estimates of Ω, the CET Elasticities

Country	Estimate and test				Model			
	Ω	Standard Error	t-statistic	NOB after adj	Method	Lag interval in VEC	C and trend structure in VEC	Additional specifications
Central African Rep.	0.353	0.170	2.080	49	LIML			C as extra var; insts=eshare, T
Chad	0.696	0.154	4.525	46	VEC	1,2	C,T in CE,VAR	xgr exogenous in CE,VAR
Chile	0.837	0.306	2.734	46	VEC	1,2	C in CE, VAR	reduced eq of export system
China	0.554	0.248	2.239	45	VEC	1,3		reduced eq of export system; eshare exogenous in CE
Colombia	0.502	0.132	3.806	48	GMM			egr, ar(1) as extra vars; insts= eshare, global demand ratio
Comoros	0.698	0.110	6.349	38	FMOLS			deterministic regressors= xgr, M/D ratio; additional deterministic variable=dummy after 2007
Congo, Dem. Rep.	0.503	0.245	56.713	49	GMM			C, T as extra vars; insts=eshare, global price ratio
Congo, Rep.	0.334	0.074	4.487	48	FMOLS			deterministic regressors= C, global demand and price ratios; additional deterministic regressors= T, eshare
Cook Islands	1.036	0.474	2.185	46	GMM			ar(1), dummy after 1999 as extra vars; insts= eshare, global demand and price ratios
Costa Rica	0.416	0.132	3.158	48	FMOLS			reduced eq of export system; CE deterministic regressor= C; additional deterministic regressors= T, T^2
Cote d'Ivoire	0.426	0.127	3.353	46	VEC	1,2	C in CE	global demand and price ratios exogenous in VAR
Croatia	0.929	0.261	3.559	21	VEC	1,2	C, T in CE, VAR	xgr as extra endogenous var; global demand ratio exogenous in VAR
Cuba	0.892	0.401	2.226	45	VEC	1,3		eshare exogenous in VAR
Cyprus	1.327	0.538	2.465	43	GMM			C, ar(1) as extra vars; inst= eshare
Czech Rep.	1.351	0.443	3.052	28	GMM			C, ar(1) as extra vars; inst= eshare
Denmark	1.563	0.353	4.431	44	VEC	1,4	C, T in CE; C in VAR	global demand and price ratios exogenous in CE, VAR; lyx exogenous in VAR
Djibouti	0.699	0.368	1.900*	47	GMM			ar(1), ma(1), egr, lyx as extra vars; insts= eshare, T^2, dummy 2000 and after
Dominican Rep.	0.915	0.302	3.034	44	VEC	1,4		xgr exogenous in CE; eshare exogenous in VAR; dummy after 1988 exogenous in CE,VAR
Ecuador	0.521	0.521	1.990*	48	GMM			C, T, xgr, ar(1) as extra vars; insts=eshare and global demand ratio
Egypt, Arab Rep.	0.703	0.241	2.916	48	GMM			egr, ar(1) as extra vars; insts= eshare, T, global demand ratio
El Salvador	0.726	0.327	2.220	48	GMM			exgr, ar(1) as extra vars; insts= eshare, mshare
Equatorial Guinea	0.493	0.167	2.951	36	FMOLS			C as CE deterministic regressor; T as additional deterministic regressor
Eritrea	0.550	0.175	3.143	26	VEC	1,2	C in CE	reduced eq of export system; xgr exogenous in CE
Estonia	1.706	0.511	3.337	23	VEC	1,2	C, T in CE; C in VAR	reduced eq of export system
Eswatini	0.516	0.092	5.627	44	VEC	1,4	C, T in CE; C in VAR	xgr exogeous in CE; global demand and price ratios exogenous in VAR
Ethiopia	0.390	0.167	2.332	24	VEC	1,4	C, T in CE; C in VAR	global demand and price ratios exogenous in VAR
Fiji	0.389	0.149	2.621	45	VEC	1,3	C,T in CE; C in VAR	global demand and price ratios exogenous in VAR
Finland	1.635	0.270	6.054	48	GMM			C, dummy for 2000 and after, ar(1) as extra vars; inst= eshare
France	2.488	1.035	2.403	46	VEC	1,2		lyx exogenous in CE; eshare exogenous in VAR
French Polynesia	0.899	1.405	0.640*	47	GMM			ar(1), ma(1). T, xgr as extra vars; insts= eshare, mshare
Gabon	0.275	0.118	2.325	48	GMM			ar(1) as extra var; inst= eshare
Gambia, The	0.261	0.055	4.753	46	VEC	1,2	C in CE, VAR	global demand and price ratios exogenous in VAR
Georgia	0.448	0.085	5.252	26	GMM			C, egr, ar(1), ma(1) as extra vars; insts= eshare, mshare

Appendix Table A2: Estimates of Ω, the CET Elasticities

Country	Estimate and test				Model			
	Ω	Standard Error	t-statistic	NOB after adj	Method	Lag interval in VEC	C and trend structure in VEC	Additional specifications
Germany	1.821	0.258	7.064	42	VEC	1,6	C, T in CE, VAR	reduced eq of export system; dummy 1990 and after exogenous in CE and VAR
Ghana	0.587	0.289	2.032	45	VEC	1,3	C , T in CE; C in VAR	egr exogenous in CE; global demand and price ratios exogenous in VAR
Greece	1.583	0.532	2.973	48	GMM			T, ar(1), xgr as extra vars; inst= eshare
Greenland	1.300	0.612	2.125	48	FMOLS			deterministic regressors= C, T, dummy for 1970-1980, global demand and price ratios; additional deterministic regressors= T^2, lyx, eshare
Grenada	0.397	0.196	2.026	40	TSLS			factor demand (re-export) spec; xgr, ar(1), ma(1) as extra vars; inst= eshare
Guatemala	0.326	0.087	3.733	44	VEC	1,4	C in CE, VAR	dummy after 1985 exogenous in VAR
Guinea	0.808	0.321	2.518	32	FMOLS			CE deterministic regressors= C, T, global demand and price ratios; additional deterministic regressors= T^2, eshare
Guinea-Bissau	0.834	0.397	2.103	48	GMM			T, ar(1), egr as extra vars; insts= eshare, lyx
Guyana	0.474	0.055	8.540	44	VEC	1,4	C, T in CE, VAR	reduced eq of export system
Haiti	0.620	0.307	2.019	30	GMM			C, xgr, ar(1), lyx as extra vars; insts= T, eshare
Honduras	0.658	0.179	3.670	45	VEC	1,3	C, T in CE; C in VAR	dummy for 1992 and after exogenous in CE and VAR; global demand and price ratios exogenous in VAR
Hong Kong SAR, China	1.239	0.352	3.518	46	VEC	1,2	C in CE, VAR	factor demand (re-export) spec; reduced eq of export system; xgr exogenous in VAR
Hungary	1.706	0.217	7.847	25	VEC	1,2	C in CE	dummy after 2013 exogenous in CE; mshare exogenous in VAR
Iceland	1.787	0.580	3.081	45	VEC	1,3	C in CE	global demand ratio exogenous in CE; global price ratio exogenous in VAR
India	0.647	0.275	2.358	46	VEC	1,2	C, T in CE; C in VAR	reduced eq of export system; egr exogenous in CE; eshare exogenous in VAR
Indonesia	0.889	0.359	2.478	46	VEC	1,2		xgr as extra endogenous var; eshare exogenous in VAR
Iran, Islamic Rep.	0.746	0.293	2.544	45	VEC	1,3	C, T in CE, VAR	egr exogenous in CE and VAR; xgr exogenous in VAR
Iraq	0.853	0.152	5.604	46	VEC	1,2	C, T in CE, VAR	factor demand (re-export) spec; eshare exogenous in CE, VAR; egr exogenous in VAR
Ireland	1.541	0.255	6.045	46	VEC	1,2	C in CE	factor demand (re-export) spec; reduced eq of export system; mshare exogenous in CE, VAR
Israel	1.259	0.468	2.688	46	VEC	1,2	C in CE	reduced eq of export system
Italy	1.421	0.476	2.987	48	GMM			xgr, ar(1) as extra vars; inst= eshare
Jamaica	0.779	0.267	2.920	48	GMM			egr, ar(1) as extra vars; inst= eshare
Japan	2.010	0.087	23.194	45	VEC	1,3	C, T in CE; C in VAR	reduced eq of export system; eshare exogenous in VAR
Jordan	0.853	0.251	3.397	40	VEC	1,2	C, T in CE, VAR	reduced eq of export system; eshare exogenous in VAR
Kazakhstan	0.609	0.090	6.737	26	VEC	1,2	C, T in CE; C in VAR	
Kenya	0.577	0.208	2.769	46	VEC	1,2	C,T in CE, VAR	reduced eq of export system; egr as extra endogenous var
Kiribati	0.252	0.113	2.228	37	VEC	1,2	C in CE	xgr as additional endogenous var
Korea, Rep.	1.285	0.265	4.840	46	VEC	1,2	C in CE, VAR	reduced eq of export system; xgr as extra endogenous var in CE
Kosovo	0.738	0.306	2.407	26	VEC	1,2		xgr as extra endogenous var in CE; eshare exogenous in VAR
Kuwait	1.625	0.524	3.103	46	VEC	1,2		xgr exogenous in CE and VAR

Appendix Table A2: Estimates of Ω, the CET Elasticities

Country	Estimate and test				Model			
	Ω	Standard Error	t-statistic	NOB after adj	Method	Lag interval in VEC	C and trend structure in VEC	Additional specifications
Kyrgyz, Rep.	0.687	0.257	2.668	24	VEC	1,4	C in CE	reduced eq of export system; xgr exogenous in CE; egr exogenous in VAR
Lao PDR	0.372	0.122	3.051	31	GMM			ar(1), ma(1) as extra vars; insts= xgr, eshare
Latvia	0.736	0.254	2.896	28	FMOLS			CE deterministic regressors= C, T, xgr; additional deterministic regressors= T^2, eshare
Lebanon	0.892	0.396	2.254	28	FMOLS			CE deterministic regressors= C, xgr; additional deterministic regressors= T, T^2, eshare
Lesotho	0.747	0.044	16.816	46	VEC	1,2	C in C	reduced eq of export system
Liberia	0.585	0.157	3.730	48	FMOLS			CE deterministic regressors=C, egr; additional deterministic regressors= eshare
Libya	0.740	0.287	2.575	45	VEC	1,3	C in CE, VAR	factor demand (re-export) spec; xgr as additional endogenous var; global price ratio exogenous in VAR
Liechtenstein	1.815	0.491	3.700	48	GMM			C, T, ar(1) as additional vars; inst= eshare
Lithuania	1.032	0.294	3.507	28	FMOLS			deterministic regressors: C, T, T^2, mgr, lyx, dummy after 2009; additional deterministic regressors= eshare
Luxembourg	2.319	0.599	3.870	45	VEC	1,3	C in CE, VAR	factor demand (re-export) spec; reduced eq of export system; eshare exogenous in VAR
Macao SAR, China	1.156	0.141	8.180	36	FMOLS			factor demand (re-export) spec; deterministic regressors= C, T, xgr; additional deterministic regressors= T^2, eshare, global demand and price ratios
Madagascar	0.485	0.230	2.110	48	GMM			xgr, ar(1) as added vars; insts=eshare, global demand ratio
Malawi	0.303	0.112	2.707	48	GMM			egr, ar(1) as extra vars; insts= eshare, global demand ratio
Malaysia	0.736	0.302	2.437	48	GMM			factor demand (re-export) spec; C, xgr, T, T^2 as extra vars; insts= mshare, global demand ratio
Maldives	0.638	0.304	2.102	48	GMM			factor demand (re-export) spec; C, T, T^2, egr, ar(1) as extra vars; insts= eshare, mshare, xgr
Mali	0.931	0.422	2.204	48	GMM			T, ar(1) as extra vars; insts= eshare, xgr
Malta	1.074	0.328	3.275	45	VEC	1,3	C in CE, VAR	factor demand (re-export) spec; xgr as extra endogenous var; dummy 2000 and after exogenous in CE and VAR
Marshall Islands	0.402	0.112	3.587	48	FMOLS			CE deterministic regressors= C, T, egr, global demand and price ratios; additional deterministic regressors= T^2, eshare
Mauritania	0.568	0.278	2.042	47	GMM			egr, T, ar(1), ma(1) as extra vars; inst= eshare
Mauritius	0.908	0.390	2.329	37	VEC	1,5	C, T in CE, VAR	dummy 1990 and after exogenous in CE and VAR; global demand and price ratios exogenous in VAR
Mexico	0.665	0.116	5.748	48	GMM			egr, ar(1) as extra vars; inst= eshare
Moldova	0.760	0.117	6.508	20	VEC	1,3	C, T in CE, VAR	xgr exogenous in CE, VAR; global demand and price ratios exogenous in VAR
Mongolia	0.698	0.081	8.651	34	VEC	1,3	C, T in CE, VAR	reduced eq of export system; egr exogenous in VAR
Montenegro	0.732	0.666	1.099*	27	GMM			ar(1) and global demand ratio as extra vars; inst= eshare
Morocco	0.520	0.259	2.004	45	VEC	1,3	C, T in CE; C in VAR	global demand ratio exogenous in VAR
Mozambique	0.294	0.100	2.950	37	FMOLS			reduced eq of export system; CE deterministic regressor= C; additional deterministic regressors: T, mshare
Myanmar	0.221	0.071	3.099	48	GMM			C, T ar(1) as extra vars; insts= T^2, eshare
Namibia	0.595	0.151	3.944	36	VEC	1,2	C in CE	global demand and price ratios exogenous in VAR
Nauru	1.181	0.477	2.474	47	FMOLS			factor demand (re-export) spec; reduced eq of export system; CE deterministic regressors= C, T, xgr, dummy 2005 and after; additional deterministic regressors= T^2
Netherlands	2.092	0.302	6.926	42	VEC	1,6	C,T in CE; C in VAR	reduced eq of export system; dummy 2001 and after exogenous in CE; eshare exogenous in VAR

Appendix Table A2: Estimates of Ω, the CET Elasticities

Country	Ω	Standard Error	t-statistic	NOB after adj	Method	Lag interval in VEC	C and trend structure in VEC	Additional specifications
	Estimate and test				Model			
New Zealand	2.536	0.634	3.997	44	VEC	1,4	C in CE	reduced eq of export system; egr as extra endogenous var
Nicaragua	0.547	0.232	2.356	48	GMM			xgr, ar(1) as extra vars; inst= eshare
Niger	0.551	0.260	2.120	46	VEC	1,2	C, T in CE, VAR	egr exogenous in VAR
Nigeria	0.569	0.136	4.175	45	VEC	1,3	C, T in CE; C in VAR	dummy between 1981 and 1987 exogenous in CE and VAR; xgr exogenous in VAR
North Macedonia	0.498	0.083	5.982	26	VEC	1,2	C, T in CE, VAR	reduced eq of export system; mshare exogenous in VAR
Norway	2.507	0.627	3.997	46	VEC	1,2		dummy for 1990-2005 exogenous in CE and VAR; egr exogenous in VAR
Oman	0.896	0.268	3.341	44	VEC	1,4		dummy 1988 and after exogenous in CE; egr, eshare exogenous in VAR
Pakistan	0.633	0.185	3.422	42	VEC	1,6	C in CE, VAR	global demand ratio exogenous in VAR
Panama	0.536	0.173	3.101	46	VEC	1,2	C, T in CE; C in VAR	global demand and price ratios exogenous in VAR
Papua New Guinea	0.289	0.121	2.394	46	VEC	1,2	C in CE	global demand anr price ratios exogenous in VAR
Paraguay	0.447	0.123	3.630	45	VEC	1,3	C in CE, VAR	global demand anr price ratios exogenous in VAR
Peru	0.520	0.243	2.140	46	VEC	1,2	C, T in CE; C in VAR	mshare exogenous in CE; egr exogenous in VAR
Philippines	0.783	0.158	4.964	46	VEC	1,2	C in CE, VAR	egr, global demand and price ratios exogenous in VAR
Poland	0.986	0.118	8.358	26	VEC	1,2	C, T in CE, VAR	reduced eq of export system
Portugal	1.286	0.302	4.257	46	VEC	1,2	C, T in CE; C in VAR	
Puerto Rico	1.547	0.562	2.754	44	VEC	1,4	C in CE, VAR	xgr exogenous in CE; dummy after 2016 exogenous in VAR
Qatar	1.771	0.324	5.468	46	VEC	1,2	C, T in CE; C in VAR	factor demand (re-export) spec; dummy 1998 and after exogenous in CE; global demand ratio exogenous in VAR
Romania	0.943	0.239	3.953	24	VEC	1,4	C in CE, VAR	global demand ratio exogenous in VAR
Russian Federation	0.718	0.148	4.857	26	VEC	1,2	C, T in CE; C in VAR	
Rwanda	0.615	0.274	2.243	48	GMM			C, egr, ar(1) as extra vars; insts= eshare, global demand and price ratios
Samoa	0.222	0.067	3.335	46	VEC	1,2		dummy for 1985-1997 exogenous in CE and VAR; xgr exogenous in CE
San Marino	1.280	0.217	5.894	44	VEC	1,4	C, T in CE, VAR	factor demand (re-export) spec; reduced eq of export system; eshare exogenous in VAR
Sao Tome and Principe	0.799	0.139	5.756	46	VEC	1,2	C, T in CE; C in VAR	xgr exogenous in CE; global demand and price ratios exogenous in VAR
Saudi Arabia	1.128	0.170	6.620	48	FMOLS			CE deterministic regressors= C, dummy after 1973, xgr, global demand and price ratios; additional deterministic regressor= eshare
Senegal	0.421	0.158	2.654	48	FMOLS			CE deterministic regressors= C, T, global demand ratio; additional deterministic regressors= egr, eshare
Serbia	0.646	0.306	2.113	23	GMM			C, ar(1), global demand ratio as extra vars; insts= T^2, eshare
Seychelles	1.240	0.076	16.372	39	VEC	1,3	C,T in CE; C in VAR	factor demand (re-export) spec; global demand and price ratios exogenous in VAR
Sierra Leone	0.571	0.125	4.579	45	VEC	1,3	C, T in CE, VAR	reduced eq of export system; egr, eshare exogenous in VAR
Singapore	1.070	0.227	4.713	48	GMM			factor demand (re-export) spec; C, xgr, T, T^2, ar(1) as extra vars; insts= mshare, global demand and price ratios
Slovak Republic	0.943	0.319	2.952	28	GMM			ar(1), dummy 2010 and after, T, T^2 as extra vars; insts= eshare, lyx
Slovenia	0.738	0.223	3.310	28	FMOLS			CE deterministic regressors= C, T, global demand and price ratios

Appendix Table A2: Estimates of Ω, the CET Elasticities

Country	Estimate and test				Model			
	Ω	Standard Error	t-statistic	NOB after adj	Method	Lag interval in VEC	C and trend structure in VEC	Additional specifications
Solomon Islands	0.482	0.173	2.790	38	GMM			C, ar(1) as extra vars; inst= eshare
South Africa	0.858	0.190	4.521	46	VEC	1,2		dummy 1991 and after exogenous in CE and VAR; eshare exogenous in CE; xgr exogenous in VAR
Spain	1.800	0.617	2.917	48	GMM			ar(1) as extra var; inst= egr, global demand and price ratios
Sri Lanka	0.535	0.213	2.515	46	VEC	1,2	C, T in CE, VAR	xgr, global demand and price ratios exogenous in VAR
St. Kitts and Nevis	1.225	0.350	3.502	46	VEC	1,2	C in CE	egr, global demand and price ratios exogenous in VAR
St. Lucia	0.334	0.162	2.065	42	VEC	1,6	C in CE, VAR	dummy 1980 and after exogenous in CE and VAR; xgr exognous in VAR
St. Vincent and the Grenadines	0.370	0.175	2.114	48	GMM			ar(1), C,egr, global demand and price ratios as extra vars; insts= T, T^2, eshare
Sweden	1.145	0.371	3.087	48	GMM			C, T, ar(1) as extra vars; inst= eshare
Switzerland	1.709	0.355	4.809	48	GMM			C, ar(1) as extra vars; inst= eshare
Syrian Arab Republic	0.842	0.194	4.329	48	GMM			ar(1), egr, lyx, T^2 as extra vars; insts= mgr, T, eshare
Tajikistan	0.355	0.122	2.914	26	VEC	1,2	C, T in CE; C in VAR	factor demand spec; reduced eq of export system
Tanzania	0.766	0.365	2.097	28	FMOLS			deterministic regressors= C, egr, dummy 1998 and after; additional deterministic regressor= T, eshare
Thailand	0.490	0.214	2.292	47	GMM			egr, ar(1), ma(1) as extra vars; insts= eshare, global demand and price ratios
Timor-Leste	0.418	0.132	3.168	25	VEC	1,3	C, T in CE, VAR	reduced eq of export system; dummy 2000 and after exogenous in CE; xgr exogenous in VAR
Togo	0.542	0.257	2.104	46	FMOLS			CE deterministic regressors= C, global demand and price ratios; additional deterministic regressors= T, egr, eshare
Tonga	0.823	0.327	2.519	40	VEC	1,3	C, T in CE, VAR	global demand and price ratios exogenous in VAR
Trinidad and Tobago	0.790	0.384	2.055	48	GMM			ar(1) and dummy after 1986 as extra vars; inst= eshare
Tunisia	0.520	0.168	3.094	48	GMM			C, ar(1) as extra vars; insts= T, eshare
Türkiye	0.703	0.266	2.641	48	GMM			xgr, ar(1) as extra vars; inst= eshare
Turkmenistan	0.472	0.082	5.743	26	VEC	1,2	C, T in CE; C in VAR	xge exogenous in CE
Tuvalu	0.719	0.234	3.070	45	VEC	1,3		dummy 1995 and after exogenous in CE and VAR; eshare exogenous in VAR
Uganda	0.782	0.333	2.347	46	VEC	1,2	C in CE	reduce eq of export system
Ukraine	0.717	0.175	4.094	27	VEC	1,1	C in CE	factor demand (re-export) spec; reduced eq of export system; egr exogenous in CE; eshare exogenous in VAR
United Arab Emirates	1.580	0.485	3.255	45	VEC	1,3	C in CE	factor demand (re-export) spec; reduced eq of export system; eshare exogenous in CE; dummy 1986 and after exogenous in VAR
United Kingdom	2.026	0.381	5.322	46	VEC	1,2	C in CE	reduce eq of export system; lyx exogenous in CE; eshare exogenous in VAR
United States	2.248	0.658	3.415	45	VEC	1,3	C, T in CE; C in VAR	mgr as extra endognous var; lyx exogenous in CE
Uruguay	1.418	0.307	4.616	40	VEC	1,8		lyx exogenous in CE; eshare exogenous in VAR
Uzbekistan	0.755	0.292	2.589	24	VEC	1,4		egr exogenous in CE; dummy 2008 and after exogenous in VAR
Vanuatu	0.477	0.214	2.230	38	GMM			egr, ar(1) as extra vars; insts= T, eshare, global price ratio
Venezuela	0.474	0.095	4.986	48	GMM			factor demand (re-export) spec; xgr, ar(1), dummy 2008 and after as extra vars; insts= T, eshare
Vietnam	0.849	0.076	11.181	30	VEC	1,2	C in CE	factor demand (re-export) spec; reduced eq of export system
West Bank and Gaza	0.527	0.188	2.806	21	VEC	1,3	C, T in CE; C in VAR	reduced eq of export system

Appendix Table A2: Estimates of Ω, the CET Elasticities

Country	Estimate and test				Model			
	Ω	Standard Error	t-statistic	NOB after adj	Method	Lag interval in VEC	C and trend structure in VEC	Additional specifications
Yemen	0.669	0.243	2.756	25	VEC	1,3		factor demand (re-export) spec; dummy before 1994 and dummy after 2005 exogenous in CE and VAR; xgr exogenous in VAR
Zambia	0.232	0.063	3.709	47	GMM			C, T, ar(1), ma(1) as extra vars; insts=xgr, eshare, global demand ratio
Zimbabwe	0.462	0.163	2.831	46	VEC	1,2	C, T in CE; C in VAR	global demand and price ratios exogenous in VAR

Source: Authors' calculations
Notes:
* = low t-test, insignificant at prob=0.05.
C = constant
CE = cointegration equation
dummy = dummy variable
egr = growth rate of real exports
eshare = exports/GDP
FMOLS = fully modified OLS for cointegration regression
global demand and price ratios = variables in equation 9
GMM = generalized method of moments
inst(s) = instrument variable(s)
LIML = limited information maximum likelihood
lyx = log of output (real GDP) index
mgr = growth rate of real imports
mshare = imports/GDP
NOB = number of observations after adjustments
T = linear trend
T^2 = quadratic trend
reduced eq of export system = equation 9
VEC = vector error correction
VAR = error correction part in VEC or vector autoregression
xgr = growth of output (real GDP)

Appendix Table A3: Data

Country		Source and coverage	
Country Name	**WDI Country Code**	**Source**	**Period Covered (before estimation adj.)**
Albania	ALB	WDI & UN	1991-2018
Algeria	DZA	WDI	1970-2018
Angola	AGO	WDI & UN	1980-2018
Antigua and Barbuda	ATG	WDI & UN	1977-2018
Argentina	ARG	WDI	1970-2018
Armenia	ARM	WDI & UN	1990-2018
Aruba	ABW	WDI & UN	1995-2018
Australia	AUS	WDI	1970-2018
Austria	AUT	WDI	1970-2018
Azerbaijan	AZE	WDI	1992-2018
Bahamas, The	BHS	WDI	1989-2018
Bahrain	BHR	WDI & UN	1970-2018
Bangladesh	BGD	WDI	1970-2018
Barbados	BRB	WDI & UN	1970-2018
Belarus	BLR	WDI	1990-2018
Belgium	BEL	WDI	1970-2018
Belize	BLZ	WDI	1980-2018
Benin	BEN	WDI	1970-2018
Bermuda	BMU	UN	1970-2018
Bhutan	BTN	WDI & UN	1980-2018
Bolivia	BOL	WDI	1970-2018
Bosnia and Herzegovina	BIH	WDI & UN	1992-2018
Botswana	BWA	WDI & UN	1970-2018
Brazil	BRA	WDI	1970-2018
Brunei Darussalam	BRN	WDI	1989-2018
Bulgaria	BGR	WDI	1990-2018
Burkina Faso	BFA	WDI	1970-2018
Burundi	BDI	WDI & UN	1970-2018
Cabo Verde	CPV	WDI & UN	1980-2018
Cambodia	KHM	WDI	1993-2018
Cameroon	CMR	WDI	1970-2018
Canada	CAN	WDI & UN	1970-2018
Central African Rep.	CAF	WDI & UN	1970-2018
Chad	TCD	WDI & UN	1970-2018
Chile	CHL	WDI	1970-2018
China	CHN	WDI & UN	1970-2018
Colombia	COL	WDI	1970-2018
Comoros	COM	WDI	1980-2018

Appendix Table A3: Data

Country		Source and coverage	
Congo, Dem. Rep.	COD	WDI & UN	1970-2018
Congo, Rep.	COG	WDI & UN	1970-2018
Cook Islands		UN	1970-2018
Costa Rica	CRI	WDI	1970-2018
Cote d'Ivoire	CIV	WDI & UN	1970-2018
Croatia	HRV	WDI	1995-2018
Cuba	CUB	WDI	1970-2018
Cyprus	CYP	WDI	1975-2018
Czech Rep.	CZE	WDI	1990-2018
Denmark	DNK	WDI	1970-2018
Djibouti	DJI	UN	1980-2018
Dominican Rep.	DOM	WDI	1970-2018
Ecuador	ECU	WDI	1970-2018
Egypt, Arab Rep.	EGY	WDI	1970-2018
El Salvador	SLV	WDI	1970-2018
Equatorial Guinea	GNQ	WDI & UN	1980-2018
Eritrea	ERI	UN	1990-2018
Estonia	EST	WDI & UN	1993-2018
Eswatini	SWZ	WDI	1970-2018
Ethiopia	ETH	WDI & UN	1990-2018
Fiji	FJI	WDI & UN	1970-2018
Finland	FIN	WDI	1970-2018
France	FRA	WDI	1970-2018
French Polynesia	PYF	UN	1970-2018
Gabon	GAB	WDI	1970-2018
Gambia, The	GMB	WDI & UN	1970-2018
Georgia	GEO	WDI & UN	1990-2018
Germany	DEU	WDI	1970-2018
Ghana	GHA	WDI & UN	1970-2018
Greece	GRC	WDI	1970-2018
Greenland	GRL	WDI & UN	1970-2018
Grenada	GRD	WDI & UN	1977-2018
Guatemala	GTM	WDI	1970-2018
Guinea	GIN	WDI & UN	1986-2018
Guinea-Bissau	GNB	WDI & UN	1970-2018
Guyana	GUY	WDI & UN	1970-2018
Haiti	HTI	WDI	1988-2018
Honduras	HDN	WDI	1970-2018
Hong Kong SAR, China	HKG	WDI	1970-2018
Hungary	HUN	WDI	1991-2018
Iceland	ISL	WDI & UN	1970-2018
India	IND	WDI	1970-2018

Appendix Table A3: Data

Country		Source and coverage	
Indonesia	IDN	WDI	1970-2018
Iran, Islamic Rep.	IRN	WDI & UN	1970-2018
Iraq	IRQ	WDI & UN	1970-2018
Ireland	IRL	WDI	1970-2018
Israel	ISR	WDI & UN	1970-2018
Italy	ITA	WDI	1970-2018
Jamaica	JAM	WDI & UN	1970-2018
Japan	JPN	WDI	1970-2018
Jordan	JOR	WDI	1976-2018
Kazakhstan	KAZ	WDI & UN	1990-2018
Kenya	KEN	WDI	1970-2018
Kiribati	KIR	WDI & UN	1979-2018
Korea, Rep.	KOR	WDI	1970-2018
Kosovo	XKX	WDI & UN	1990-2018
Kuwait	KWT	WDI & UN	1970-2018
Kyrgyz, Rep.	KGZ	WDI & UN	1990-2018
Lao PDR	LAO	WDI & UN	1985-2018
Latvia	LVA	WDI & UN	1990-2018
Lebanon	LBN	WDI	1990-2018
Lesotho	LSO	WDI	1970-2018
Liberia	LBR	WDI & UN	1970-2018
Libya	LBY	WDI & UN	1970-2018
Liechtenstein	LIE	UN	1970-2018
Lithuania	LTU	WDI & UN	1990-2018
Luxembourg	LUX	WDI	1970-2018
Macao SAR, China	MAC	WDI	1982-2018
Madagascar	MDG	WDI	1970-2018
Malawi	MWI	UN	1970-2018
Malaysia	MYS	WDI	1970-2018
Maldives	MDV	UN	1970-2018
Mali	MLI	WDI	1970-2018
Malta	MLT	WDI & UN	1970-2018
Marshall Islands	MHL	WDI & UN	1970-2018
Mauritania	MRT	WDI	1970-2018
Mauritius	MUS	WDI	1976-2018
Mexico	MEX	WDI	1970-2018
Moldova	MDA	WDI	1995-2018
Mongolia	MNG	WDI & UN	1981-2018
Montenegro	MNE	WDI & UN	1991-2018
Morocco	MAR	WDI	1970-2018
Mozambique	MOZ	WDI & UN	1981-2018
Myanmar	MMR	WDI & UN	1970-2018

Appendix Table A3: Data

Country		Source and coverage	
Namibia	NAM	WDI	1980-2018
Nauru	NRU	WDI & UN	1970-2018
Netherlands	NLD	WDI	1970-2018
New Zealand	NZL	WDI & UN	1970-2018
Nicaragua	NIC	WDI	1970-2018
Niger	NER	WDI & UN	1970-2018
Nigeria	NGA	WDI & UN	1970-2018
North Macedonia	MKD	WDI	1990-2018
Norway	NOR	WDI	1970-2018
Oman	OMN	WDI & UN	1970-2018
Pakistan	PAK	WDI	1970-2018
Panama	PAN	WDI	1970-2018
Papua New Guinea	PNG	UN	1970-2018
Paraguay	PRY	WDI	1970-2018
Peru	PER	WDI	1970-2018
Philippines	PHL	WDI & UN	1970-2018
Poland	POL	WDI & UN	1990-2018
Portugal	PRT	WDI	1970-2018
Puerto Rico	PRI	WDI & UN	1970-2018
Qatar	QAT	WDI & UN	1970-2018
Romania	ROU	WDI	1990-2018
Russian Federation	RUS	WDI	1990-2018
Rwanda	RWA	WDI	1970-2018
Samoa	WSM	WDI & UN	1970-2018
San Marino	SMR	WDI & UN	1970-2018
Sao Tome and Principe	STP	UN	1970-2018
Saudi Arabia	SAU	WDI & UN	1970-2018
Senegal	SEN	WDI	1970-2018
Serbia	SRB	WDI	1995-2018
Seychelles	SYC	WDI	1976-2018
Sierra Leone	SLE	WDI	1970-2018
Singapore	SGP	WDI	1970-2018
Slovak Republic	SVK	WDI & UN	1990-2018
Slovenia	SVN	WDI & UN	1990-2018
Solomon Islands	SLB	WDI	1980-2018
South Africa	ZAF	WDI	1970-2018
Spain	ESP	WDI	1970-2018
Sri Lanka	LKA	WDI	1970-2018
St. Kitts and Nevis	KNA	UN	1970-2018
St. Lucia	LCA	UN	1970-2018
St. Vincent and the Grenadines	VCT	UN	1970-2018
Sweden	SWE	WDI	1970-2018

Appendix Table A3: Data

Country		Source and coverage	
Switzerland	CHE	WDI & UN	1970-2018
Syrian Arab Republic	SYR	WDI	1970-2018
Tajikistan	TJK	UN	1990-2018
Tanzania	TZA	WDI	1990-2018
Thailand	THA	WDI	1970-2018
Timor-Leste	TLS	WDI & UN	1990-2018
Togo	TGO	WDI	1970-2018
Tonga	TON	WDI & UN	1975-2018
Trinidad and Tobago	TTO	UN	1970-2018
Tunisia	TUN	WDI	1970-2018
Türkiye	TUR	WDI & UN	1970-2018
Turkmenistan	TKM	WDI & UN	1990-2018
Tuvalu	TUV	UN	1970-2018
Uganda	UGA	WDI & UN	1970-2018
Ukraine	UKR	WDI	1990-2018
United Arab Emirates	ARE	WDI & UN	1970-2018
United Kingdom	GBR	WDI	1970-2018
United States	USA	WDI	1970-2018
Uruguay	URY	WDI	1970-2018
Uzbekistan	UZB	WDI & UN	1990-2018
Vanuatu	VUT	WDI & UN	1980-2018
Venezuela	VEN	UN	1970-2018
Vietnam	VNM	WDI & UN	1986-2018
West Bank and Gaza	PSE	WDI	1994-2018
Yemen	YEM	WDI & UN	1990-2018
Zambia	ZMB	WDI & UN	1970-2018
Zimbabwe	ZWE	WDI & UN	1970-2018

Data sources:
World Bank WDI: https://databank.worldbank.org/source/world-development-indicators
United Nations national accounts: https://unstats.un.org/unsd/snaama/Index
Notes:
UN = United Nations
WDI = World Development Indicators