



# The elasticity of trade: Estimates and evidence<sup>☆</sup>

Ina Simonovska<sup>a,b,\*</sup>, Michael E. Waugh<sup>c</sup>

<sup>a</sup> University of California, Davis, United States

<sup>b</sup> NBER, United States

<sup>c</sup> New York University, United States

## ARTICLE INFO

### Article history:

Received 4 March 2013

Received in revised form 4 October 2013

Accepted 5 October 2013

Available online 16 October 2013

### JEL classification:

F10

F11

F14

F17

### Keywords:

Elasticity of trade

Bilateral

Gravity

Price dispersion

Indirect inference

## ABSTRACT

Quantitative results from a large class of structural gravity models of international trade depend critically on the elasticity of trade with respect to trade frictions. We develop a new simulated method of moments estimator to estimate this elasticity from disaggregate price and trade-flow data and we use it within Eaton and Kortum's (2002) Ricardian model. We apply our estimator to disaggregate price and trade-flow data for 123 countries in the year 2004. Our method yields a trade elasticity of roughly four, nearly fifty percent lower than Eaton and Kortum's (2002) approach. This difference doubles the welfare gains from international trade.

© 2013 Elsevier B.V. All rights reserved.

## 1. Introduction

Quantitative results from a large class of structural gravity models of international trade depend critically on the elasticity of trade with respect to trade frictions.<sup>1</sup> To illustrate how important this parameter is, consider two examples: First, for any pair of countries, the estimate of the tariff equivalent of a border effect is inversely proportional to

the assumed elasticity of trade with respect to trade frictions. Thus, observed reductions in tariffs across countries can explain almost all or none of the growth in world trade, depending on this elasticity. Second, the trade elasticity is one of only two statistics needed to measure the welfare cost of autarky in a large and important class of structural gravity models of international trade. Therefore, this elasticity is key to understanding the size of the frictions to trade, the response of trade to changes in tariffs, and the welfare gains or losses from trade.

Estimating this parameter is difficult because quantitative trade models can rationalize small trade flows with either large trade frictions and small elasticities, or small trade frictions and large elasticities. Thus, one needs satisfactory measures of trade frictions *independent* of trade flows to estimate this elasticity. Using their Ricardian model of trade, Eaton and Kortum (2002) (henceforth EK) provide an innovative and simple solution to this problem by arguing that, with product-level price data, one could use the maximum price difference across goods between countries as a proxy for bilateral trade frictions. The maximum price difference between two countries is meaningful because it is bounded by the trade friction between the two countries via simple no-arbitrage arguments.

We develop a new simulated method of moments estimator for the elasticity of trade incorporating EK's intuition. Our argument for a new estimator is that EK's method understates the true trade friction and results in estimates of the trade elasticity that are biased upward

<sup>☆</sup> We are grateful to the World Bank for providing us with the price data from the 2003–2005 ICP round. We thank George Alessandria, Alexander Aue, Dave Donaldson, Robert Feenstra, Timothy Kehoe, Matthias Lux, B. Ravikumar, seminar participants at CUHK, Tsinghua, UC San Diego, Syracuse, ETH/KOF, Princeton, Uppsala, Oslo, San Francisco Fed, UC Berkeley, NYU and participants at the CESifo Area Conference on Global Economy 2011, NBER ITI Program Meeting Winter 2010, 2010 International Trade Workshop at the Philadelphia Fed, Conference on Microeconomic Sources of Real Exchange Rate Behavior at Vanderbilt, Midwest International Trade Meeting Fall 2010, SED 2010, WEAI 2010, Conference on Trade Costs and International Trade Integration: Past, Present and Future in Venice, International Comparisons Conference at Oxford, North American Winter Meeting of the Econometric Society 2010, AEA 2010 for their feedback. Ina Simonovska thanks Princeton University for their hospitality and financial support through the Peter B. Kenen fellowship.

\* Corresponding author at: Department of Economics, University of California, Davis One Shields Ave Davis, CA 95616.

E-mail addresses: [inasimonovska@ucdavis.edu](mailto:inasimonovska@ucdavis.edu) (I. Simonovska), [mwaugh@stern.nyu.edu](mailto:mwaugh@stern.nyu.edu) (M.E. Waugh).

<sup>1</sup> The class of models includes Armington as articulated in Anderson (1979), Krugman (1980), Eaton and Kortum, (2002), and Melitz (2003) as articulated in (Chaney, 2008), which all generate log-linear relationships between bilateral trade flows and trade frictions.

by economically significant magnitudes. Thus, we propose a new methodology, which is subject to the same data requirements as EK's approach, and we use it within EK's Ricardian model in order to correct the bias and arrive at a new estimate for the elasticity of trade.

We apply our estimator to disaggregate price and trade-flow data for the year 2004, which span 123 countries that account for 98% of world GDP. Our benchmark estimate for the elasticity of trade is 4.14, rather than approximately eight, as EK's estimation strategy suggests. This difference doubles the measured welfare gains from trade.

Since the elasticity of trade plays a key role in quantifying the welfare gains from trade, it is important to understand why our estimates of the parameter differ substantially from EK's. We show that the reason behind the difference is that their estimator is biased in finite samples of price data. The bias arises because the model's equilibrium no-arbitrage conditions imply that the maximum operator over a finite sample of prices underestimates the trade cost with positive probability and overestimates the trade cost with zero probability. Consequently, the maximum price difference lies strictly below the true trade cost, in expectation. This implies that EK's estimator delivers an elasticity of trade that lies strictly above the true parameter, in expectation. As the sample size grows to infinity, EK's estimator can uncover the true elasticity of trade, which necessarily implies that the bias in the estimates of the parameter is eliminated.

Quantitatively, the bias is substantial. To illustrate its severity, we discretize EK's model, simulate trade flows and product-level prices under an assumed elasticity of trade, and apply their estimating approach on artificial data. Assuming a trade elasticity of 8.28 – EK's preferred estimate for 19 OECD countries in 1990 – EK's procedure yields an elasticity estimate of 12.5, which is nearly 50% higher than originally postulated. Moreover, in practice, the true parameter can be recovered when 50,000 goods are sampled across the 19 economies, which constitutes an extreme data requirement to produce unbiased estimates of the elasticity of trade.

Based on these arguments, we propose an estimator that is applicable when the sample size of prices is small. Our approach builds on our insight that one can use observed bilateral trade flows to recover all sufficient parameters to simulate EK's model and to obtain trade flows and prices as functions of the parameter of interest. This insight then suggests a simulated method of moments estimator that minimizes the distance between the moments obtained by applying EK's approach on real and artificial data. We explore the properties of this estimator numerically using simulated data and we show that it can uncover the true elasticity of trade.

Applying our estimator to alternative data sets and conducting several robustness exercises allows us to establish a range for the elasticity of trade between 2.79 and 4.46. In contrast, EK's approach would have found a range of 4.17 to 9.6. Thus, our method finds elasticities that are roughly half the size of EK's approach. Because the inverse of this elasticity linearly controls changes in real income necessary to compensate a representative consumer for going to autarky, our estimates double the measured welfare gains from trade relative to previous findings.

The contribution of this paper is threefold. First, we provide a precise point estimate of the trade elasticity in the context of EK's Ricardian model that doubles the welfare gains from trade predicted by EK's estimation. Since EK's model is a canonical model of international trade and it is widely used in quantitative trade studies, providing a precise point estimate of the trade elasticity in the context of this model is important. Moreover, our findings suggest a range for the trade elasticity of 2.79 to 4.46, which is both lower and narrower relative to EK's estimates of 3.6 to 12.8. In particular, our critique also applies to EK's estimate of 12.8, which was obtained using an alternative approach. After correcting for biases in EK's alternative approach, we obtain an estimate of 4.4, which is nearly the same as our benchmark finding. Thus, we provide a lower and narrower range of 2.79 to 4.46, relative to EK's wide range of estimates.

Second, we develop a methodology that is applicable to a wide class of trade models. The method and the moments that we use to estimate the trade elasticity within EK's Ricardian framework can be derived for other structural gravity models of trade. In *Simonovska and Waugh (2013)*, we show how the new estimation strategy applies to models with product differentiation such as Armington as articulated in *Anderson (1979)* and *Krugman (1980)*, variable mark-ups such as *Bernard et al. (2003)*, and models that build on the monopolistic-competition structure of *Melitz (2003)* as articulated in *Chaney (2008)*. Thus, while we focus on the particulars of EK's Ricardian model and our method's relationship with EK's approach, our methodology contributes to the estimation of trade elasticities above and beyond a particular model.

Third, the estimates that we obtain using the newly-developed methodology contribute to a large and important literature that aims to measure the trade elasticity. *Anderson and van Wincoop (2004)* survey the literature that estimates the trade elasticity using various approaches and they establish a range between five and ten. One set of estimates that *Anderson and van Wincoop (2004)* report is obtained using *Feenstra's (1994)* method. However, in heterogeneous frameworks with constant-elasticity-of-substitution (CES) preferences, such as EK's Ricardian model, *Feenstra's (1994)* method recovers the preference parameter that controls the elasticity of substitution across goods. This parameter plays no role in determining aggregate trade flows and welfare gains from trade in EK's Ricardian model with micro-level heterogeneity.

Another set of estimates that *Anderson and van Wincoop (2004)* document relies on time-series and cross-industry variation in tariffs and trade flows during trade liberalization episodes as in *Head and Ries (2001)* and *Romalis (2007)*, or time-series and cross-country variation in tariffs and trade flows for developed economies during the post-war period as in *Baier and Bergstrand (2001)*. Recently, *Caliendo and Parro (2012)* build on these approaches and estimate sectoral trade elasticities from cross-sectional variations in trade flows and tariffs. The methods that rely on variations in tariffs and trade flows in order to identify the trade elasticity are applicable to a variety of structural gravity models, including EK's Ricardian model. Hence, the estimates obtained using these methods are comparable to our estimates of the trade elasticity.

Admittedly, there are two outstanding issues in our analysis. First, there is a difference between the low values of the elasticity that our approach yields and the high values typically obtained using tariff data. In particular, *Head and Ries (2001)*, *Romalis (2007)*, and *Baier and Bergstrand (2001)* find values in the range of five to ten, while our benchmark estimates center around four. The corollary is that the low values of the elasticity we find imply large deviations between observed trade frictions (tariffs, transportation costs, etc.) and those inferred from trade flows.

However, there are two pieces of evidence in support of the values that we find. First, *Parro (2013)* uses the tariff based approach of *Caliendo and Parro (2012)* to estimate an aggregate trade elasticity for capital goods and non-capital, traded goods. He finds estimates of 4.6 and 5.2 which are only modestly larger than ours. Second, our results compare favorably with alternative estimates of the shape parameter of the productivity distribution, which governs the trade elasticity in models with micro-level heterogeneity, that are not obtained from gravity-based estimators. For example, estimates of the shape parameter from firm-level sales data, as in *Bernard et al. (2003)* and *Eaton et al. (2011)*, are in the range of 3.6 to 4.8—exactly in the range of values that we find. Identification of the parameter in these papers comes from firm-level data, which suggest that there is a lot of variation in firm productivity. The data in our paper are telling a similar story: price variation (once properly corrected) suggests that there is a lot of variation in productivity implying a relatively low trade elasticity.

Second, there are concerns about the quality of the price data that we use in our analysis and we address them to the best of our ability within the scope of the paper. As in EK, we use cross-country micro-level price data from the International Comparison Program (ICP).

Download English Version:

<https://daneshyari.com/en/article/962466>

Download Persian Version:

<https://daneshyari.com/article/962466>

[Daneshyari.com](https://daneshyari.com)