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Terms of trade and global efficiency effects of free trade agreements, 1990–2002☆

James E. Anderson [a,*], Yoto V. Yotov [b,c]

[a] Department of Economics, Boston College, Chestnut Hill, MA 02467, USA
[b] School of Economics, Drexel University, Philadelphia, PA 19104, USA
[c] Economic Research Institute, Bulgarian Academy of Sciences, Sofia, Bulgaria

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ABSTRACT

This paper infers the terms of trade effects of free trade agreements (FTAs) implemented in the 1990s. We estimate large FTA effects on bilateral trade volume in 2 digit manufacturing goods from 1990–2002, using panel data gravity methods to resolve two way causality. The terms of trade changes implied by these volume effects are deduced for 40 countries plus a rest-of-the-world aggregate using an endowments general equilibrium model. Some countries gain over 5% of real manufacturing income, some lose less than 0.3%. Global efficiency of manufactures trade rises 0.9% based on a distance function measure of iceberg melting.

1. Introduction

The proliferation of free trade agreements (FTAs) in the 1990s alarmed many trade policy analysts and popular observers. Trade diverted from non-partners harms their terms of trade. Losses to non-partners could even outweigh the gains to partners, reducing the efficiency of the world trading system. This paper estimates the effects of trade agreements implemented in the 1990s on manufacturing real incomes using the gravity model. Large inferred volume effects of FTAs are attributed to non-tariff cost reductions, since they exceed reasonable attribution to tariff changes. Terms of trade changes inclusive of such effects measure national gains. For the world as a whole, global efficiency is equal to the change in how much of the iceberg melts, a natural interpretation in the gravity context. The results are reassuring: FTAs delivered benefits while negligibly harming outsiders. Some countries gain over 5%, a few lose less than 0.3% and global efficiency rises 0.9%.

Theory gives prominence to the terms of trade effects of trade agreements and simulation models provide numerical measures of terms of trade changes due to tariff changes induced by particular FTAs. In contrast, there is little empirical evidence on the effect of trade agreements on the terms of trade, because terms of trade are notoriously hard to measure and causation faces difficult inference problems.[1] Our

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* Corresponding author at: National Bureau of Economic Research, Cambridge, MA 02138, USA.

[1] Feenstra (2004, pp. 197–99) reviews the literature. Studies using prices directly are quite limited in scope due to the difficulties in assembling comparable price data across a wide range of countries as well as inferring the effect of FTAs on prices. Chang and Winters (2002) address both problems using export unit values at the 6 digit Harmonized System level for Brazil. See their footnote 5, pp. 891–2, for discussion of the severe limitations. They treat prices as set by a foreign and domestic firm in a duopoly pricing game that avoids general equilibrium considerations. Clausing (2001) uses a partial equilibrium model disaggregated by sector that links import volume changes to tariff changes for Canada, and does not go on to link them to price changes. Romalis (2007) simulates the equilibrium price changes induced by the Canada–US Free Trade Agreement (CUSFTA) and the North American Free Trade Agreement (NAFTA) tariff changes using detailed demand elasticities estimated with a "difference in differences based estimation technique to identify demand elasticities that focuses on where each of the NAFTA partners sources its imports of almost 5000 6-digit Harmonized System (HS-6) commodities and comparing this to the source of European Union (EU) imports of the same commodities. The technique enables identification of NAFTAs effects on trade volumes even when countries' production costs shift." Caliendo and Parro (2015) calculate what proportion of NAFTA members trade changes can be accounted for by the tariff changes using the Eaton and Kortum (2002) version of the gravity model.

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empirical approach is to estimate the volume effects of the FTAs implemented in the 90s using the gravity model with panel data methods to deal with two way causality, and then use the estimated volume effects to simulate the terms of trade implications of a hypothetical FTA implementation in 1990.

Our estimation methods extend an empirical gravity literature on the trade volume effects of FTAs. Notable studies include Frankel (1997), Magee (2003) and Baier and Bergstrand (2002, 2004, 2007). Early findings on the effects of FTAs and trading blocs on bilateral trade flows were mixed,[2] but recent developments deal effectively with two way causality and show that trading blocs and FTAs have large direct effects on aggregate bilateral trade between member countries relative to non-member countries. Baier and Bergstrand (2007) find that, on average, a FTA induces approximately a 100% increase in bilateral trade between member relative to non-member countries within ten years from their inception. Volume changes like these, larger than explicable by tariff changes, are plausible because FTAs typically induce unobservable actions that effectively reduce trade costs. Various regulatory policy barriers typically fall between FTA partners[3] while the enhanced security of bilateral trade induces relationship-specific investment in trade with partner counter-parties.

We infer the volume effects of FTAs implemented between 1990 and 2002 for 40 separate countries and an aggregate region consisting of 24 additional nations (none of which entered FTAs). The inference is drawn from estimated gravity equations at the 2 digit ISIC level in manufacturing, a disaggregation that contrasts with the aggregate trade focus of much of the empirical gravity literature. We find large volume effects comparable to the aggregate estimates of Baier and Bergstrand (2007) but varying across sectors. We further extend the original specification of Baier and Bergstrand (2007) to allow for differential FTA effects depending on whether an agreement was formed between countries with low most-favored-nation (MFN) tariffs or between countries with high MFN tariffs. We find that FTA effects are much stronger for country pairs with high MFN tariffs.

We then calculate the terms of trade changes implied by hypothetically implementing all the FTAs of the 90s in the 1990 base year. Our simulation approach belongs to the family of recent small scale computable general equilibrium models based on structural gravity. See the survey by Costinot and Rodriguez-Clare (2014). In contrast to papers based on the Eaton and Kortum (2002) extension of the Ricardian model (Caliendo and Parro, 2015 and Ossa, 2014), we use an endowments model of manufacturing sectors[4] extending the Anderson and van Wincoop (2003) one good model (used also by Egger et al., 2011). The Ricardian approach imposes infinite elasticity of transformation between tradable goods sectors while the endowments approach imposes zero elasticity. Either simplification avoids the complexity of data, specification and parameter estimation requirements of large scale computable general equilibrium models.[5] The two approaches share a common gravity structure of trade flows with its robust fit to data. In contrast to the simulation literature using tariff changes (e.g., the NAFTA studies of Romalis, 2007, and Caliendo and Parro, 2015), our approach focuses on volume changes induced by FTA effects that include more than tariffs while treating the entire set of FTAs and countries simultaneously.

Equilibrium sellers' prices are calculated from market clearance equations for each national variety in each sector. Intermediate input demand is given by a two level Cobb–Douglas/CES system. Sectoral CES demand systems are consistent with a gravity model for each sector while the upper level Cobb–Douglas aggregator is a common simplification in the literature referenced in the preceding paragraph. Supply is assumed fixed in each sector and country, a simplification that implies the results are (quasi-) general equilibrium measures of impact effects. A technical Appendix A explains how manufacturing demand and supply endowments are related to other sectors by embedment in national GDP functions with more sectors.

National gains are measured by the terms of trade. The numerator is a fixed weight sellers' price index of the equilibrium sellers prices. The denominator is a Cobb–Douglas/CES buyers' price index of equilibrium buyers' prices, where buyers' prices equal sellers' prices times trade cost factors modeled as iceberg costs (this definition of the terms of trade as the ratio of sellers' price index to buyers' price index differs slightly from the standard one because it includes internal trade in both numerator and denominator. Ours is the relevant concept in the gravity model).

The results show that the 1990s FTAs significantly increased real manufacturing income of most economies in the world. 8 out of the 40 countries had terms of trade gains greater than 5% and 3 of those countries enjoyed gains greater than 9%, including Mexico with gains of close to 15%.[6] Losses were smaller than −0.3% and confined to countries that did not enter into FTAs: Australia, China, Korea and Japan (and the rest of the world aggregate), and Iceland.

The national gains measure in the benchmark case does not allow for rents in the trade costs. The no rents assumption avoids measuring and modeling many unobservable rents on inward and outward trade and their division between buyers and sellers. Terms of trade effects are one component of the full national gains. Our main conclusions are robust to the alternative extreme assumption that the only rents are tariffs and all tariff revenues are fully rebated locally. National gains on balance remain for almost all partners.[7] Some big gains remain (e.g. Poland) and some other big gains are considerably reduced (e.g., Mexico). This robustness is because tariff revenue changes are a very small part of the income changes because tariffs are generally low.

The global efficiency effect of FTAs is naturally quantified as the change in how much of the iceberg melts due to FTAs. The basis is an application of the distance function (Deaton, 1979; itself an application of Debreu's coefficient of resource utilization, 1951) to the gravity model. It provides intuitive and consistent aggregation of gains across countries and sectors, a feature that seems useful for many trade policy applications. In our FTA case, global efficiency rises in each manufacturing sector (ranging from 0.42% for Paper to 2.1% for Textiles) with an overall efficiency gain of 0.9%.

Global efficiency is also equal to the utilitarian aggregator of national real income changes measure by terms of trade changes. Its positive sum contrasts with the usual zero-sum implication of terms of trade effects in simple trade policy theory. The non-zero sum property of the global efficiency measure arises for two reasons. Directly, less of the iceberg melts in bilateral shipments between FTA partners due to a reduction in border frictions. Indirectly, general equilibrium forces change inward and outward multilateral resistance for each country, respectively changing the denominator and the numerator of the terms of trade. In

[2] For example, Bergstrand (1985) found insignificant European Community (EC) effects on bilateral member's trade and Frankel et al. (1995) supported his findings. Frankel (1997) found significant Mercosur effects on trade flows but even negative EC effects on trade in certain years. Frankel (1997) also provides a summary of coefficient estimates of the FTA effects from different studies. Ghosh and Yamarik (2004) perform extreme-bounds analysis to support the claim that the FTA effects on trade flows are fragile and unstable.

[3] For example, Canadian support for the CUSFTA was based primarily on its provision for bi-national review of US antidumping procedures, a benefit not measurable by reduction of already low tariffs.

[4] Non-manufacturing is suppressed because our methods require internationally comparable sales and expenditure data that is only available for manufacturing.

[5] An alternative 'intermediate' model with finite substitution within manufacturing or for substitution between manufacturing and non-manufacturing could shift calculated terms of trade effects in either direction due to offsetting effects. On the one hand, standard implications of maximizing behavior with substitution imply that for given price changes, our estimates are lower bounds of the real income gains from FTAs due to terms of trade effects. On the other hand, substitution presumptively reduces the size of price changes. These opposing effects may even cancel out.

[6] A counter-factual experiment reveals that large benefit to Mexico is mostly due to NAFTA. Most of Mexico's gains disappear if NAFTA is switched off, while without NAFTA the US and Canada still gain due to the Canada–US agreement.

[7] We only find three cases, Morocco, Ireland, and Tunisia, where revenue losses can potentially outweigh terms of trade gains. The explanation is a combination of relatively small manufacturing base, large tariffs, and potentially missing terms of trade gains that presumably accrue in other industries.

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