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Economic integration agreements, border effects, and distance elasticities in the gravity equation

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ABSTRACT

Using a novel common econometric specification, we examine the measurement of three important effects in international trade that historically have been addressed largely separately: the (partial) effects on trade of economic integration agreements, international borders, and bilateral distance. First, recent studies focusing on precise and unbiased estimates of effects of economic integration agreements (EIAs) on members' trade may be biased upward owing to inadequate control for time-varying exogenous unobservable country-pair-specific changes in bilateral export costs (possibly decreasing the costs of international relative to intranational trade); we find evidence of this bias using a properly specified gravity equation. Second, our novel methodology yields statistically significant estimates of the declining effect of "international borders" on world trade, now accounting for endogenous EIA formations and unobserved country-pair heterogeneity in initial levels. Third, we confirm recent evidence providing a solution to the "distance-elasticity puzzle," but show that these estimates of the declining effect of distance on international trade are biased upward by not accounting for endogenous EIA formations and unobserved country-pair heterogeneity. We conclude our study with numerical general equilibrium comparative statics illustrating a substantive difference on trade effects of EIAs with and without allowance for the declining effects of international borders on world trade.

1. Introduction

It's a Small World After All…. (Walt Disney, New York World's Fair, 1964)

Using a novel common econometric specification, we examine the measurement of three important effects on international trade flows that have historically been addressed largely separately: the (partial) effects on trade of economic integration agreements (EIAs), international borders, and bilateral distance.[1] First, one of the most prominent aspects of the global economy over the past 20 years has been the proliferation of economic integration agreements (EIAs) – notably free

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[1] We are concerned primarily in this study with estimating partial (or direct) effects, not general equilibrium effects as in Anderson and van Wincoop (2003); Baier and Bergstrand (2009); Anderson and Yotov (2011), and Bergstrand et al. (2013). Nevertheless, general equilibrium effects hinge upon partial

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trade agreements but also some customs unions. Policy makers at national and supra-national government levels increasingly rely on *ex post* estimates of the (partial) effects of EIAs on trade flows based upon gravity equations to evaluate subsequently the welfare effects of EIAs.[2] Only recently have economists been able to provide more precise and unbiased *ex post* estimates of the effects of EIAs on members' international trade flows, in contrast to the highly variable and often economically implausible estimates generated over 45 years from 1962 to 2007.[3] Using panel data and accounting for the endogeneity of EIAs and prices and for unobserved country-pair heterogeneity, Baier and Bergstrand (2007), or BB, found using a sample spanning 1960–2000 and ordinary least squares (OLS) that a typical EIA increases two members' aggregate goods bilateral trade about 100 percent after 10–15years – five times the effect estimated using atheoretical gravity equations. Anderson and Yotov (2011) found similar results using the same BB specification (but using a Poisson quasi maximum likelihood (PQML) estimator) and showed the method also generated plausible, precise, and statistically significant effects for disaggregate trade flows. Eicher et al. (2012) use Bayesian Model Averaging (BMA) techniques to confirm the trade-creating effects of EIAs under model uncertainty. The key in BB, Anderson and Yotov (2011), and Eicher et al. (2012) was accounting for unobserved heterogeneity in exporters' and importers' time-varying multilateral influences (such as countries' prices and GDPs) and for unobserved heterogeneity in time-invariant bilateral influences. However, all of these studies failed to account for possible unobservable exogenous *time-varying* country-pair-specific changes in bilateral export costs (possibly decreasing the costs of international relative to intranational trade) that may have resulted in estimates of EIAs' effects being biased upward. The potential bias introduced by time-varying bilateral fixed export costs is especially important in light of their prominence in the "New New" trade theory, cf., Redding (2011) and Melitz and Redding (2014), and their empirical relevance, cf., Roberts and Tybout (1997) and Das et al. (2007). In this paper, we address this potentially important shortcoming using a properly specified gravity equation motivated by formal theoretical foundations. In doing so, we also contribute to two related literatures: the "(international) border puzzle" and the "distance-elasticity puzzle."

The "border puzzle" refers to the seminal estimate using traditional atheoretical gravity equations in McCallum (1995) that the Canada–U.S. international border caused Canadian inter-province trade to be 22 times – or 2100 percent – greater than province-state international trade in 1988, other things equal. This result implied that international borders imposed dramatic costs on international relative to intranational trade. This finding inspired an entire literature, including Anderson and van Wincoop's seminal (2003) paper formulating a new theoretical foundation for the gravity equation, building upon formal foundations in Anderson (1979) and Bergstrand (1985). While Anderson and van Wincoop (2003) addressed the importance of accounting properly for endogenous prices (in their terms, "multilateral resistances") in estimation and in general equilibrium comparative statics, to date estimates of the border effect are still very large. For instance, de Sousa et al. (2012) report that on average a country traded 493 times more intranationally than internationally in 1990 (cf., their Figure 1 for 1990 ($e^{6.2}=493$)), even dwarfing the McCallum estimate. Moreover, they estimate that on average this effect fell 63 percent to 181 in 2002 ($e^{5.2}=181$), that is, in only 12 years. However, using a time-series of cross-sections, they did not control for unobserved country-pair heterogeneity in border effects, did not account for endogenous EIAs as in BB, and, while recognizing multilateral prices in their estimation, did not account for the endogeneity of prices as addressed in Anderson and van Wincoop (2003). In this paper, we use an enhanced version of the BB panel-data methodology (and also an expansion of the data to include intranational trade flows) to provide consistent and precise estimates of the average declining effects of international borders on international trade, using a properly specified gravity equation accounting also for the effects of endogenous EIA formations, endogenous prices, and unobserved country-pair heterogeneity in initial border effects.

The "distance-elasticity puzzle" refers to the issue that – despite widespread anecdotal evidence that the effect of distance on international trade is declining over time, as suggested by Thomas Friedman's "flatter world" – systematic academic empirical evidence suggests that the distance elasticity of bilateral international trade has *not* declined, as established in the Disdier and Head (2008) meta analysis of the distance elasticity.[4] While some authors have offered alternative explanations, they have met mixed success (cf., footnote 1 in Yotov (2012) and our discussion later). However, Yotov (2012) recently provided a persuasive solution to the distance-elasticity puzzle by recognizing the importance of including *intranational*, alongside international, trade flows and bilateral distances in estimation (using OLS and PQML), a feature actually common to the "border effects" literature, cf., Wei (1996). By typically excluding intranational trade flows and intranational distances, gravity-equation estimates cannot identify the impact on international trade of international trade costs *relative to* intranational trade costs; previous studies of the distance-elasticity puzzle ignored this. However, Yotov (2012) suffered from two shortcomings. The study did not account for unobserved heterogeneity across country pairs and omitted controls for EIAs, potentially biasing upward his estimates of the declining effect of distance. Recently, Bosquet

(*footnote continued*)
effects, and we provide general equilibrium comparative statics of trade effects of EIAs with and without allowance for the declining effects of international borders on world trade at the end of the paper.

[2] See, for example, Berden et al. (2010) or, more recently, Head and Mayer (2014) and Costinot et al. (2014).

[3] In a meta-analysis of 1827 earlier studies (including several using flawed specifications), Cipollina and Salvatici (2010) find a range of estimates between 12 percent and 285 percent. Their mean effect is 80 percent and median effect is 46 percent.

[4] The international border puzzle differs from the distance-elasticity puzzle in the following respect. Typically, the border puzzle is associated with arguably economically implausible estimates of the *level* effect of an international border on international trade flows. By contrast, the distance-elasticity puzzle is only concerned with an absence of declines in the distance elasticity of international trade, not the average *level* of the distance elasticity *per se*.