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Are All Trade Agreements Equal?

The Role of Distance in Shaping the Effect of Economic Integration Agreements on Trade Flows

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Abstract

How does geographic distance affect the impact of trade agreements on bilateral exports, and through what channels? This paper examines this questions in a gravity model context for different types of goods for 185 countries over the period 1965–2010. Three stylized facts emerge. First, although economic integration agreements have a positive impact on trade flows, geographic distance significantly decreases their effect. Second, this phenomenon is in large part explained by the impact of economic integration agreements on distance-sensitive goods, in particular intermediates. These results hold when controlling for trade agreement depth, measured by the type of agreement and content of provisions, and economic similarity among trading partners. Third, this paper finds either no significant effect or a positive interaction between distance and economic integration agreements for final goods, suggesting that trade agreements among countries located far from each other help consumption patterns shift toward the most efficient producers.

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Are All Trade Agreements Equal? The Role of Distance in Shaping the Effect of Economic Integration Agreements on Trade Flows

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1. Introduction

How does geographic distance affect trade agreements' impact on bilateral exports, and through what channels? This question is key for international trade policy, as it has been widely shown that economic integration agreements (EIAs) are an effective means by which to increase trade volumes, both through intensive and extensive trade margins. Yet, while the international trade literature to date has examined the impact of trade agreements and distance on trade flows independently, surprisingly no studies have looked at how these variables interact. Given that trade integration has important implications for economic growth and volatility, understanding the subtleties of this missing link sheds light upon how policy can be used to either supplement or offset geography's naturally heterogeneous effects on trade flows.

We examine the role that geographic distance plays in determining the efficacy of trade agreements in a gravity model context for aggregate, intermediate, and non-intermediate goods for 185 countries over the period 1965-2010.[2] Three stylized facts emerge. First, we find reduced form evidence that the effectiveness of EIAs decreases with distance. Second, we show that this phenomenon is in large part explained by heterogeneous responses of different types of goods both to EIAs alone and the interaction between EIAs and distance. In particular, intermediate goods (as defined by the broad economic categories classification system) are both more distance-sensitive and EIA-sensitive than other goods categories. These results are strengthened when controlling for trade agreement depth, measured by the type of agreement and content of provisions, and economic proximity, measured by similarities in GDP per capita levels. Third, we find either no effect or a positive interaction between distance and EIAs for non-intermediate goods. Given that the bulk of non-intermediates are final goods, this result suggests that EIAs among distant countries help consumption patterns shift towards the best and most efficient producers, as timeliness is less of an issue.

These findings are especially relevant in today's policy climate as countries both nearby and far away seek to enter into bilateral, regional, and mega-regional accords. Our results suggest that EIAs among proximate countries have a reinforcing effect on two-way trade in intermediates, whereby this effect is not as strong for other (principally final) goods. As such, we offer insight into how countries can apply trade agreements to help achieve regional and extra-regional integration goals, tapping into both local and global production networks.

Our study contributes to the empirical trade literature which, to date, does not address the link between geography and important policy variables. Indeed, although most empirical trade literature has long emphasized the importance of measures associated with trade costs in determining gross trade flows, these analyses examine both natural and manmade characteristics independently from each other.

In terms of natural trade costs, several studies have focused on geographic proximity as an element that is negatively related to transport costs and other associated trade frictions. By now, it is widely accepted that geographic proximity is associated with higher levels of trade flows, especially through the extensive margin of trade. Head and Mayer (2014) perform a meta-analysis of papers

2 See Appendix 3 for a list of countries used in this analysis.

that use gravity model analysis to show that trade elasticities with respect to geographic distance hover around -1 for a century-worth of data.[3]

In line with advances in theoretical gravity modeling (e.g. Anderson and van Wincoop, 2003; Feenstra, 2004; and Redding and Venables, 2004), Hillberry and Hummels (2008) also show that distance (along with other natural trade frictions) acts to decrease trade flows, primarily through the variety (as opposed to the volume) of exported products. Chaney (2008); Bernard, Jensen, Redding, and Schott (2007); and Lawless (2010) also use industry-level gravity equations to show that distance dampens trade flows. They do not, however, explore how policy variables interact with distance.

In terms of policy-related factors, various types of EIAs (bilateral, regional, etc.) have received attention in the trade literature over the past decade both because of their well-known trade-creating impact and their potential to ease goods transport through means that go beyond tariff reduction. Importantly, EIAs have been shown to increase trade flows over time, coming into full effect 10 to 15 years after their entry into force (Baier and Bergstrand 2007). Similar results in regards to the static effects of EIAs on specific trade blocs are found by Baier, Bergstrand, Egger and McLaughlin (2008). Baier, Bergstrand, and Feng (2014), herein BBF, show that not only do EIAs induce higher levels of trade, but also that their short term effects on trade flows are concentrated at intensive goods margins while longer term effects take place through extensive goods margins.[4] However, these studies fail to account for the interplay between EIAs and natural trade cost variables. As such, this analysis is the first of its kind to apply frontier gravity model specifications to link the literature that addresses geography and trade and EIAs and trade.[5]

The rest of the paper is structured as follows. Section 2 presents the analytical framework, data sources, and econometric specifications used in our analysis. Results are shown and discussed in section three, along with reference to extensions and robustness checks. Section 4 concludes.

2. Analytical framework, data sources, and econometric specifications

The premise of our analysis lies on the assumption that trade costs do not enter the micro-founded gravity equation solely as a linear function of distance and trade agreements. This is unlike most reduced-form gravity studies that estimate the impact of EIAs on trade flows. Rather, we examine the interaction between geographic distance and EIAs, controlling for other bilateral, exporter-time, and importer-time factors that could affect bilateral trade flows.

Our choice to examine this interaction can be justified across two dimensions. First, a brief review of the theoretical gravity model points to why, from a modeling perspective, is it reasonable to

[3] More recently Bergstrand, Larch, and Yotov (2015) use intra-country and between-country trade find a decline in the effect of distance in recent years.

[4] Many other studies, including Baier and Bergstrand (2002, 2004, 2009); Magee (2003); and Egger, Egger, and Greenaway (2008) also examine the relationship between EIAs and gross trade flows. These authors were the first to highlight the inherent endogeneity of RTAs as an explanatory trade variable. The referenced papers coincide with advances in gravity estimation methodology and use differenced panel data and fixed effects to demonstrate that RTAs positively and statistically significantly impact trade flows.

[5] To be sure, Bergstrand, Larch, and Yotov (2015) study the border effect, the impact of distance, and the impact of FTAs in a gravity model that controls for each of these channels. However, they do not study the potential interaction between these three forces shaping international trade flows.

modify the form in which trade cost variables enter into reduced form gravity equations. Second, by observing the effect of trade costs (that enter independently into the gravity equation) on bilateral exports of various types of goods, it is easy to hypothesize why EIAs might interact with distance through the channel of intermediates in particular. As such, we briefly walk through the basic micro-founded gravity model and discuss the relationship between distance and bilateral exports of intermediate versus other types of goods.

2.1 De-linearizing trade costs in micro-founded gravity

A large literature, pioneered by Anderson and van Wincoop (2003), builds upon the simplistic adaptation of Newton's law of gravity to economics and explores the theoretical determinants behind the gravity equation.[6] In short, as nicely laid out in Baldwin and Taglioni (2006), micro-founded gravity is a simple extension of a standard expenditure equation with a market-clearing condition imposed. To see why it is reasonable to manipulate standard trade costs in a gravity context, we thus walk through the basic theoretical model.[7] In what follows, the subscript *i* refers to the exporting (origin) nation and the subscript *j* the importing (destination) nation.

In a first stage, the value of aggregate bilateral exports from *i* to *j* can be seen as the product of the number of symmetric varieties of products produced in country *i* (n_i), country *j*'s share of expenditure on imports from country *i*, and *j*'s expenditure on total traded goods (E_j):

$$X_{ij} = n_i (p_i \tau_{ij})^{1-\sigma} \frac{E_j}{P_j^{1-\sigma}} \tag{1}$$

where σ is a constant elasticity of substitution (CES) coefficient among all varieties, p_i is the exporter's producer prices, and P_j is the importer's CES price index, assuming all goods are traded. Trade costs, τ_{ij}, enter into the equation because they influence the price of goods sold abroad (as do production costs at home and a bilateral markup, which is assumed to be constant).

Summing over all markets (and assuming markets clear), total sales of *i*'s goods are thus equivalent to *i*'s total output, Y_i:

$$Y_i = n_i {p_i}^{1-\sigma} \sum_{j=1}^{T} \left(\tau_{ij}^{1-\sigma} \frac{E_j}{P_j^{1-\sigma}} \right) \tag{2}$$

where T is the total number of nations from which *j* imports (including itself). As such, the term $n_i {p_i}^{1-\sigma}$—for which data are rarely available—is equal to:

$$n_i {p_i}^{1-\sigma} = \frac{Y_i}{\Omega_i} \tag{3}$$

[6] On the theoretical determinants of gravity models and appropriate estimation strategies, see: Anderson and van Wincoop (2003); Baldwin and Taglioni (2006); Baier and Bergstrand (2009), and references therin.
[7] The following presentation is heavily based on Baldwin and Taglioni (2006). Readers are referred to their paper for a more in-depth breakdown.

where Ω_i is simply the second half of equation (2): $\sum_{j=1}^{T}\left(\tau_{ij}^{1-\sigma}\frac{E_j}{P_j^{1-\sigma}}\right)$. In words, Ω_i is a market openness index, which represents country *i*'s export orientation towards world markets. By substitution of equation (3) into (1), the micro-founded gravity equation can thus be expressed as:

$$X_{ij} = \tau_{ij}^{1-\sigma}\left(\frac{Y_i E_j}{\Omega_i P_j^{1-\sigma}}\right) \tag{4}$$

In gravity estimations, E_j is typically proxied by *j*'s GDP, as in equation (2) we are adding up over constraints on *j* and per Dixit-Stiglitz the number of varieties is proportional to GDP.

In this short recap of the micro-founded gravity model, it is important to note that, per equation (4), the term for trade costs, τ_{ij}, pops out quite nicely. In the international trade literature, it is typically asserted that τ_{ij} is a linear function of distance alone, or a linear function of distance and other *ij*-specific barriers to trade (such as contiguity, common language, etc.) whereby each trade cost variable enters into the gravity equation independently.

Yet there is no theoretical reason to believe that distance impacts the marginal cost of trade linearly or in isolation. On the contrary, if the distance between two countries doubles it is unlikely that it will be twice as expensive to ship goods between them as many of the fixed costs associated with exporting over any distance occur early on anyways. Also, in terms of trade agreements, it is not unreasonable to think that EIAs might affect the marginal cost of distance for trade for many reasons, leading to a reinforcing effect of these two variables.

Thus, in our analysis, we depart from the standard literature by asserting that τ_{ij} is a function of standard trade cost variables (including trade agreements) *in addition to* the interaction of trade agreements and distance. Mathematically, this assertion boils down to the following functional relationship:

$$\tau_{ij} = f(dist_{ij}, \text{other ij-specific factors}, EIA_{ijt}, EIA*dist_{ij}) \tag{5}$$

To unpack the channel through which distance and EIAs might interact, we note that closeness alone leads to a larger share of two-way trade (in intermediates/parts and components) than one-way trade (in final goods). We also note that EIAs alone impact the share of two-way trade more than one-way trade in final goods.[8] Thus, we explore whether the interaction between bilateral distance and EIAs has a multiplicative effect on intermediates in particular.

2.2 Data sources and variable definitions

Data for our analysis are drawn upon from various sources. Annual 4-digit SITC Rev. 2 data on bilateral trade flows—from NBER-UN and described in Feenstra *et al.* (2005)—were used in the aggregation of total trade statistics. In order to examine trade flows by type of good, we translated

[8] Regression results supporting these statements are in Table 1. We do not explicitly explore why EIAs might impact two-way more than one-way trade in this analysis, however note that this would be a useful extension to our paper.

the SITC data into standard System of National Accounts (SNA) categories of per the Broad Economic Categories (BEC) classification system.[9]

Data for EIAs come from two primary sources. We make use of the World Trade Institute Design of Trade Agreements (DESTA) dataset as a primary data source, which comprises information on 601 bilateral, regional, and multi-lateral agreements for the period 1961-2013. One of the advantages of this dataset is that it provides information on EIAs across several dimensions: type of agreement, depth of agreement,[10] and type of provisions referenced in the text of each agreement (partitioned into seven categories).[11] Our binary EIA variable is equal to unity if the agreement is a partial scope agreement, full FTA, customs union, or services agreement. We exclude framework agreements, as these are extremely shallow and do not contain any specific provisions. The DESTA variable for depth is an additive index that ranges from zero to seven where each bump up the index represents an additional category of substantive provisions that is included in the agreement.[12] We disaggregate this into seven dummy variables to be used as controls, where each dummy corresponds to a different category of provisions.

As a secondary dataset on EIAs and EIA depth, we also make use of an updated version of the BBF (2014) dataset. In short, this dataset provides an index of bilateral and regional EIAs for years 1960-2011, ranked from 1-6, where 1 represents the shallowest form of integration agreement (one-way preferential trade agreement) and 6 represents the deepest form of EIA (economic union). Our binary EIA variable used in this analysis is equal to unity if two countries have a two-way preferential trade agreement (TWPTA) or any deeper agreement, and zero otherwise. Results using this specification are presented in Appendix 1.

Data used to construct variables for economic proximity used in robustness checks and further defined below—namely the exporters' and importers' real GDP per capita at current PPPs—come from the Penn World Table version 8.1. Lastly, publically available data on bilateral geographic distance were downloaded from CEPII.

2.3 Main gravity specifications for aggregate and disaggregate exports

Log-linearizing equation (4) and applying exporter-time, importer-time and country-pair fixed effects to minimize the potential biases associated with omitted variables affecting trade and EIAs yields our baseline gravity equation. This approach closely follows that used in BBF, which relies on the well-documented fact that using a panel dataset is the most appropriate method to tease out the endogenous relationship between trade agreements and trade flows (see for example Baier and Bergstrand (2007) and references therein). As such, the baseline equation we estimate and use to verify the results in BBF is written as:

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[9] See Appendix 2 for further details about the BEC classification system and how SITC Rev. 2 4-digit products were mapped to BEC categories.

[10] The DESTA dataset includes two depth measures: a depth index and a depth variable based on explanatory factor analysis. Here, we rely on the depth index although both variables are highly correlated. There are also more than 601 bilateral agreements included in the full version of the dataset. Since we exclude very shallow framework agreements, we use 601 in our analysis.

[11] The first provision category covers whether the agreement reduces tariffs to zero. The remaining six categories of substantive provisions encompass: services; investments; standards; public procurement; competition; and intellectual property rights. Additional information can be found in Dür *et al.* (2014).

[12] This analysis does not explore which EIA provisions are the most trade-creating.

$$lnX_{ijt} = \beta_0 + \beta_1 EIA_{ijt} + \delta_{it} + \varphi_{jt} + \gamma_{ij} + \varepsilon_{ijt} \quad (6)$$

where $\boldsymbol{X_{ijt}}$ is a vector containing trade flows from country *i* to *j* in time *t* for total aggregate (X) bilateral trade flows as well as intermediates (Int), and other (Oth) goods categories, per the BEC classification breakdown. The category for other goods includes consumption goods, capital goods, and goods not specified elsewhere (Appendix 2). EIA_{ijt} is a time-variant binary variable (described in section 2.2) equal to 1 if exporting country *i* and importing country *j* have an EIA in force in year *t*. The EIA variable used in the specifications presented in this section was constructed from the DESTA dataset. The terms δ_{it} and φ_{jt} are exporter-time and importer-time fixed effects, respectively, that control for time-varying country-specific variables that include both bilateral trade costs and GDPs. Importantly, these controls include both "multilateral resistance" terms Ω_{it} and P_{jt} described in equation (4). Lastly, γ_{ij} is a country-pair fixed effect used to capture time-invariant factors influencing trade flows (and commonly used in gravity equations, such as common language among trading partners, contiguity, common colonizer, etc.).[13]

In addition to estimating this equation for disaggregated goods, our baseline specification differs from that in BBF in three key ways. First, whereas BBF estimate their version of equation (3) using five-year differenced data, we choose to estimate our gravity specifications in log-level form as in Baier and Bergstrand (2007). This implies that we are going to be looking at the effect of EIAs on trade volumes, instead of the growth rate of trade flows. Second, our country sample includes 89 additional countries beyond both Baier and Bergstrand (2007) and BBF. Third, whereas BBF examine the impact of agreement depth on trade flows, we use a binary EIA variable in order to keep the discussion focused around the effects of geographic proximity. We do follow the Baier and Bergstrand (2007) and BBF convention of using panel data over five-year intervals (1965, 1970, 1975, …, 2010) to isolate our results from year to year variability.

In our first pass at better understanding the interplay between closeness and EIAs we augment the baseline gravity specification with an interaction term between the CEPII capital city to capital city distance measure[14] and our EIA dummy from the DESTA dataset, as shown in equation (7):

$$lnX_{ijt} = \beta_0 + \beta_1 EIA_{ijt} + \beta_2 (EIA_{ijt} * lndist_{ij}) + \delta_{it} + \varphi_{jt} + \gamma_{ij} + \varepsilon_{ijt} \quad (7)$$

For robustness, we also add a vector of controls to account for trade agreement depth. This is pertinent, as distance and depth of agreement are correlated (see section 3.2). We thus estimate:

$$lnX_{ijt} = \beta_0 + \beta_1 EIA_{ijt} + \beta_2 (EIA_{ijt} * lndist_{ij}) + \beta_3 \boldsymbol{D_{ijt}} + \delta_{it} + \varphi_{jt} + \gamma_{ij} + \varepsilon_{ijt} \quad (8)$$

where $\boldsymbol{D_{ijt}}$ is a vector comprising the seven dummy variables for each provision category in the DESTA dataset, as described in section 2.2.

[13] This specification is equivalent to that used in BBF for aggregate trade flows only.
[14] CEPII provides various measures of bilateral distance. The most frequently used are simple distance, which measures distance from capital city to capital city, and population-weighted distance (both detailed in Mayer and Zignago (2011)). Regression results when using the two different measures were very similar (as was also found by Johnson and Noguera (2012)). Therefore, we report results using the simple distance measure since it is more commonly used in the gravity literature.

Lastly, we explore the interaction between distance and EIAs when controlling for "economic similarity" as measured by the absolute difference of the log of GDP per capita between trading partners. Like the case for trade agreement depth, this set of controls is important as EIAs are affected by similarity of countries, and nearby countries exhibit similar levels of GDP per capita.

The two specifications pertaining to this extension of our baseline equation are thus:

$$ln\boldsymbol{X_{ijt}} = \beta_0 + \beta_1 EIA_{ijt} + \beta_2(EIA_{ijt} * lndist_{ij}) + \beta_3 adiff\_lnGDPcap_{ijt} + \delta_{it} + \varphi_{jt} + \gamma_{ij} + \varepsilon_{ijt} \quad (9)$$

$$ln\boldsymbol{X_{ijt}} = \beta_0 + \beta_1 EIA_{ijt} + \beta_2(EIA_{ijt} * lndist_{ij}) + \beta_3 adiff_{lnGDPcap_{ijt}} + \beta_4(EIA_{ijt} * adiff\_lnGDPcap_{ijt}) + \delta_{it} + \varphi_{jt} + \gamma_{ij} + \varepsilon_{ijt} \quad (10)$$

where $adiff\_lnGDPcap_{ijt}$ represents the absolute difference in the log of country *i* and country *j*'s GDP per capita at time *t*.

3. Results

<u>*3.1 Main results*</u>

Table 2 presents the empirical results for our baseline specifications, corresponding to equations (6) and (7). We also show in columns (1a) – (1c) the effect of distance alone on total trade flows, intermediate goods, and non-intermediates. In line with the literature on trade agreements, our findings confirm (columns 2a-2c) that EIAs have a positive effect on bilateral trade flows.

Supporting our conjecture about disaggregate goods, we first observe that distance and EIAs, when looked at independently, have the largest effect on trade in intermediate goods (columns 1b and 2b). In terms of distance, this is easily explained by the necessity for two-way trade in intermediate inputs to take place in a timely manner for local supply and production networks to function efficiently. Timeliness, though still important, is less so for consumption or capital goods as consumers are willing to wait longer for the best goods they can afford. Non-intermediates also likely exhibit larger quality gaps, are more differentiated and represent more varieties. The story is similar in terms of EIAs: trade agreements likely reinforce trade in intermediate goods more than other types of goods because of their contribution to network effects and connectivity, thus boosting two-way trade in particular.

When looked at together, we observe that the effectiveness of EIAs decreases with bilateral distance (column 3a). This supports that the combined effect of EIAs and geographic proximity reinforce one another. Furthermore, this happens through the channel of intermediate goods (column 3b), for which the interaction term is more negative than for aggregate goods and highly significant. The coefficient on the interaction term for non-intermediates is close to zero and statistically insignificant, further supporting that intermediate goods are what lead the observed effect on overall trade flows.

Table 1. EIAs & bilateral distance: Baseline

5-year data, 1965-2010

Variables	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)	(3a)	(3b)	(3c)
	ln_X_{ijt}	ln_Int_{ijt}	ln_Oth_{ijt}	ln_X_{ijt}	ln_Int_{ijt}	ln_Oth_{ijt}	ln_X_{ijt}	ln_Int_{ijt}	ln_Oth_{ijt}
$lndist_{ij}$	-1.279***	-1.310***	-1.250***						
	(0.009)	(0.010)	(0.009)						
EIA_{ijt}				0.223***	0.243***	0.194***	1.106***	1.563***	0.028
				(0.020)	(0.022)	(0.022)	(0.158)	(0.170)	(0.166)
EIA_{ijt}*$lndist_{ij}$							-0.106***	-0.159***	0.020
							(0.019)	(0.021)	(0.020)
Fixed Effects									
(i, t-(t-5)); (j, t-(t-5))	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
(ij)	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
No. obs.	103,963	93,997	90,595	99,861	90,174	86,513	99,861	90,174	86,513
R^2	0.752	0.734	0.759	0.887	0.877	0.892	0.887	0.877	0.892

Notes: Columns (1a) – (1c) refer to the regression specification: $ln\_X_{ijt} = \beta_0 + \beta_1 lndist_{ij} + \delta_{it} + \varphi_{jt} + \varepsilon_{ijt}$. Columns (2a) – (2c) and (3a) – (3c) show the estimation results for equations (6) and (7), respectively. Robust standard errors are in parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1% levels, respectively, in two-tailed t-tests.

3.2 Robustness checks and extensions

The above results help shape the policy debate regarding the characteristics of country pairs that benefit most from trade agreements: they show that the benefits of extra-regional EIAs are likely smaller than for intra-regional EIAs in terms of spurring trade flows of intermediate goods. Yet, we also acknowledge that this effect may not be driven by distance alone. Our results might be biased by the omission of other factors which have been shown to influence trade agreements' impact and are correlated with distance. Two such factors are the depth of trade agreements[15] and how similar countries are in terms of their income levels.

To make this point more explicit, Figures 1 and 2 below show the relationship between geographic proximity and trade agreement depth and "economic proximity"[16] and trade agreement depth. Here, trade agreement depth is measured in two separate ways (per Baier and Bergstrand and DESTA). In Figure 1 (which relies upon the Baier and Bergstrand dataset), we observe that the log of bilateral geographic and economic distance decreases as trade agreements become deeper. Otherwise stated, closer and more similar countries have the deepest agreements. In this figure one-way preferential agreements are the shallowest agreement and economic unions the deepest.

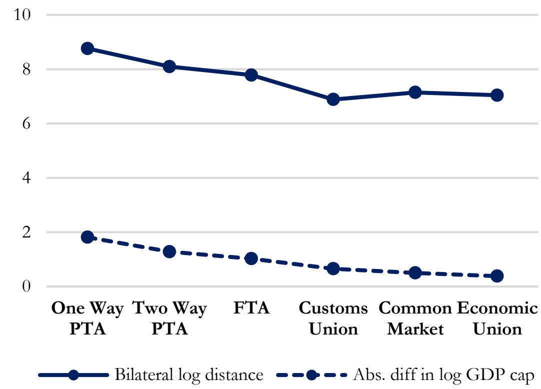
Figure 2 (which relies upon the DESTA dataset) shows that the log of bilateral distance decreases until four levels of provisions are included, after which it increases to roughly the same level as agreements with no provisions at all. Economic distance follows a similar trend, decreasing until five provisions are included and then increasing. Although the DESTA depth index rates a 7 as the deepest form of agreement, one possible explanation for the U shape observed in Figure 2 is that certain categories of provisions may divert rather than encourage trade. Two examples are provisions relating to intellectual property rights or competition policy.

[15] In their 2014 paper, BBF convincingly argue that the marginal impact of EIAs on bilateral gross exports is the highest for deepest agreements, both at intensive and extensive trade margins.

[16] Economic proximity is defined as the absolute value of the difference in log GDP per capita between bilateral trading partners.

Figure 1. Type of agreement and distance

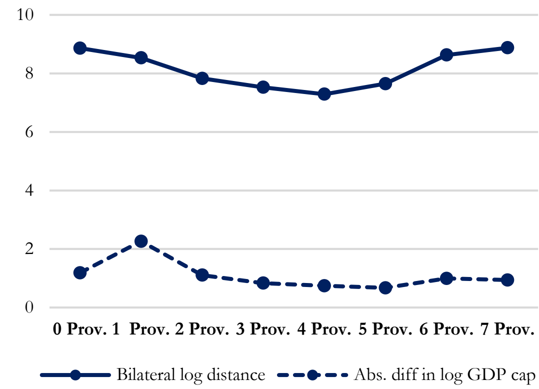
Average, 2005-2011



Source: CEPII and Baier and Bergstrand.

Figure 2. No. of provisions and distance

Average, 2005-2011



Source: CEPII and DESTA.

Taking this correlation between distance and depth into account, Table 3 presents results of equation (8), where the binary variables $Depth\_0_{ijt}$ through $Depth\_7_{ijt}$ correspond to those in Figure 2. Appendix 1 presents results of this same regression using binary variables corresponding to Figure 1 as controls.

Adding these controls strengthens our results: we continue to find evidence that the effectiveness of EIAs on bilateral aggregate trade flows decreases with distance (column 1a), and this finding is clearly led by the negative interaction between trade agreements and bilateral distance for intermediate goods (column 1b). These results further support that the principal channel through which EIAs and distance reinforce one another is through two-way trade in inputs, which likely are less differentiated and of more similar quality than other types of goods. Moreover, our variable of interest is both positive and statistically significant for other goods categories, lending evidence that EIAs help trading partners overcome the hurdle of distance when it comes to final goods for which the quality and variety is of paramount importance to consumers.

In terms of the coefficients on the controls for depth, we observe that—very much like in Figure 2—they tend to increase in magnitude until roughly four provisions, after which they decline to levels similar to zero provisions. This affirms our prior that certain provisions included in the DESTA depth index deter trade flows, and also that there might be an ordering to which provisions are added to agreements among proximate countries (i.e. agreements among proximate countries may include fewer provisions that negatively impact trade flows).

Table 2. EIAs & bilateral distance: Controlling for depth of agreement
5-year data, 1965-2010

Variables	(1a)	(1b)	(1c)
	ln_X_{ijt}	ln_Int_{ijt}	ln_Oth_{ijt}
EIA_{ijt}*$lndist_{ij}$	-0.066***	-0.110***	0.068***
	(0.020)	(0.022)	(0.022)
$Depth\_0_{ijt}$	0.776***	1.124***	-0.401**
	(0.176)	(0.190)	(0.184)
$Depth\_1_{ijt}$	0.724***	1.119***	-0.385**
	(0.172)	(0.186)	(0.181)
$Depth\_2_{ijt}$	0.739***	1.156***	-0.307*
	(0.164)	(0.177)	(0.173)
$Depth\_3_{ijt}$	0.705***	1.086***	-0.440**
	(0.171)	(0.184)	(0.179)
$Depth\_4_{ijt}$	1.188***	1.592***	-0.071
	(0.164)	(0.178)	(0.173)
$Depth\_5_{ijt}$	1.031***	1.426***	-0.150
	(0.164)	(0.178)	(0.173)
$Depth\_6_{ijt}$	0.664***	1.122***	-0.611***
	(0.192)	(0.209)	(0.198)
$Depth\_7_{ijt}$	0.614***	0.972***	-0.575***
	(0.192)	(0.206)	(0.201)
Fixed Effects *(i, t-(t-5)); (j, t-(t-5))*	Yes	Yes	Yes
No. obs.	99,861	90,174	86,513
R^2	0.887	0.877	0.893

Notes: This table shows the estimation results for equation (8). Robust standard errors are in parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1% levels, respectively, in two-tailed t-tests.

As highlighted in Figures (1) and (2), economic similarity as proxied by the absolute difference in the log of trading partners' GDP per capita increases with trade agreement depth. Additionally, GDP per capita is more similar among nearby countries in general. This motivates a further extension, whereby we control specifically for economic similarity among trading partners.

To this end, Table 3 presents the results of specifications (9) and (10). In columns (1a) – (1c) we control only for economic similarity. While this variable is negative and statistically significant for all three goods categories, it does not change our main result that the negative interaction between geographic distance and EIAs is driven by intermediate goods. Furthermore, the effect of the interaction between economic similarity and EIAs is close to zero (columns 2a – 2c), supporting the main results of our analysis.

Table 3. EIAs & bilateral distance: Controlling for economic similarity
5-year data, 1965-2010

Variables	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)
	ln_X$_{ijt}$	**ln_Int$_{ijt}$**	**ln_Oth$_{ijt}$**	**ln_X$_{ijt}$**	**ln_Int$_{ijt}$**	**ln_Oth$_{ijt}$**
EIA$_{ijt}$	0.830***	1.195***	-0.108	0.796***	1.161***	-0.117
	(0.164)	(0.177)	(0.173)	(0.165)	(0.177)	(0.174)
EIA$_{ijt}$*lndist$_{ij}$	-0.073***	-0.116***	0.036*	-0.060***	-0.103***	0.039*
	(0.020)	(0.021)	(0.021)	(0.020)	(0.022)	(0.022)
adiff_lnGDPcap$_{ijt}$	-0.236***	-0.238***	-0.250***	-0.218***	-0.222***	-0.246***
	(0.022)	(0.023)	(0.023)	(0.023)	(0.024)	(0.024)
EIA$_{ijt}$*adiff_lnGDPcap$_{ijt}$				-0.055***	-0.053***	-0.012
				(0.017)	(0.019)	(0.019)
Fixed Effects *(i, t-(t-5)); (j, t-(t-5))*	Yes	Yes	Yes	Yes	Yes	Yes
No. obs.	86,618	78,752	75,678	86,618	78,752	75,678
R^2	0.893	0.883	0.897	0.893	0.883	0.897

Notes: This table shows the estimation results for equations (9) and (10), respectively. Robust standard errors are in parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1% levels, respectively, in two-tailed t-tests.

4. Conclusion

This paper fills a void in the literature with regards to the link between geographic distance and the impact of economic integration agreements (EIAs) on trade flows. Through exploring the impact of the interaction of these two variables on total bilateral exports, we find evidence that the positive effect of trade agreements decreases in distance. Furthermore, when looking at trade flows disaggregated by broad economic category, we show that the primary channel through which this effect takes place is for intermediate goods. These results imply that EIAs reinforce supply and production networks among proximate countries that rely on timely, two-way trade in intermediate inputs that is more feasible when countries are close by.

In addition to a strong negative effect on our variable of interest for intermediate goods exports, we find no effect on the interaction between EIAs and distance for bilateral trade flows of other goods categories when using our baseline specification. When controlling for trade agreement depth, which is correlated with bilateral distance and has been shown to boost trade more than shallower agreements, the effect on non-intermediate goods becomes positive and significant. This result is the same when controlling for economic similarity (also correlated with trade agreement depth). As such, our findings provide evidence not only that EIAs and distance reinforce one another through the channel of intermediates, but also that EIAs allow for trade in final goods (which are differentiated both in terms of variety and quality) to be allocated to distant partners in function of who is the best producer.

Our findings are of particular policy relevance as the negotiation of bilateral, regional, and mega-regional accords is at a peak and contribute to the discussion about regional and global production networks, as we show that EIAs among proximate countries have a reinforcing effect on two-way trade in intermediate goods. As it relates to trade agreement depth, this paper does not explore the content of provisions in detail and whether certain categories are more trade-creating than others. This would be an interesting avenue for further research, as it is likely that the most trade-creating provisions are present in agreements among nearby countries.

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Appendix 1. Results using Baier and Bergstrand EIA dataset

This appendix presents results using the Baier and Bergstrand dataset for economic integration agreements. This dataset provides an index of bilateral and regional EIAs for years 1960-2011, ranked from 1-6, where 1 represents the shallowest form of integration agreement (one-way preferential trade agreement) and 6 represents the deepest form of EIA (economic union). Our binary EIA variable used in this analysis is equal to unity if two countries have a two-way preferential trade agreement (TWPTA) or any deeper agreement, and zero otherwise.

Results when using this dataset remain largely unchanged compared to when using the DESTA dataset (described in section 2).

Table A1.1 EIAs & bilateral distance: Baseline

5-year data, 1965-2010

Variables	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)	(3a)	(3b)	(3c)
	ln_X_{ijt}	ln_Int_{ijt}	ln_Oth_{ijt}	ln_X_{ijt}	ln_Int_{ijt}	ln_Oth_{ijt}	ln_X_{ijt}	ln_Int_{ijt}	ln_Oth_{ijt}
$lndist_{ij}$	-1.279***	-1.310***	-1.250***						
	(0.009)	(0.010)	(0.009)						
EIA_{ijt}				0.218***	0.260***	0.141***	1.891***	1.593***	0.733***
				(0.023)	(0.025)	(0.024)	(0.186)	(0.171)	(0.179)
EIA_{ijt}*$lndist_{ij}$							-0.207***	-0.174***	-0.075***
							(0.023)	(0.021)	(0.022)
Fixed Effects									
(i, t-(t-5)); (j, t-(t-5))	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
(ij)	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	103,963	93,997	90,595	99,304	89,660	86,072	89,660	99,304	86,072
R-squared	0.752	0.734	0.759	0.888	0.877	0.893	0.877	0.888	0.893

Notes: Columns (1a) – (1c) refer to the regression specification: $ln\_\mathbf{X}_{ijt} = \beta_0 + \beta_1 lndist_{ij} + \delta_{it} + \varphi_{jt} + \varepsilon_{ijt}$. Columns (2a) – (2c) and (3a) – (3c) show the estimation results for equations (6) and (7), respectively. All specifications use the BB dataset for the EIA variable. Robust standard errors are in parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1% levels, respectively, in two-tailed t-tests.

Table A1.2 EIAs & bilateral distance: Controlling for depth of agreement

5-year data, 1965-2010

Variables	(1a)	(1b)	(1c)
	ln_X_{ijt}	**ln_Int_{ijt}**	**ln_Oth_{ijt}**
EIA_{ijt}*$lndist_{ij}$	-0.109***	-0.125***	-0.049**
	(0.022)	(0.024)	(0.023)
$TWPTA_{ijt}$	1.014***	1.133***	0.546***
	(0.186)	(0.202)	(0.194)
FTA_{ijt}	1.091***	1.274***	0.481***
	(0.176)	(0.191)	(0.185)
CU_{ijt}	1.116***	1.253***	0.706***
	(0.179)	(0.194)	(0.189)
CM_{ijt}	1.639***	1.930***	0.806***
	(0.174)	(0.189)	(0.183)
EUN_{ijt}	1.539***	1.868***	0.722***
	(0.177)	(0.193)	(0.185)
Fixed Effects *(i, t-(t-5)); (j, t-(t-5))*	Yes	Yes	Yes
No. obs.	99,304	89,660	86,072
R^2	0.888	0.878	0.893

Notes: This table shows the estimation results for equation (8) using the BB dataset for the EIA variables. Robust standard errors are in parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1% levels, respectively, in two-tailed t-tests.

Table A1.3. EIAs & bilateral distance: Controlling for economic similarity
5-year data, 1965-2010

Variables	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)
	ln_X$_{ijt}$	**ln_Int$_{ijt}$**	**ln_Oth$_{ijt}$**	**ln_X$_{ijt}$**	**ln_Int$_{ijt}$**	**ln_Oth$_{ijt}$**
EIA$_{ijt}$	1.504***	1.744***	0.786***	1.412***	1.618***	0.761***
	(0.175)	(0.190)	(0.183)	(0.178)	(0.193)	(0.186)
EIA$_{ijt}$*lndist$_{ij}$	-0.168***	-0.195***	-0.085***	-0.145***	-0.163***	-0.079***
	(0.022)	(0.024)	(0.023)	(0.023)	(0.025)	(0.024)
adiff_lnGDPcap$_{ijt}$	-0.225***	-0.229***	-0.236***	-0.217***	-0.217***	-0.233***
	(0.022)	(0.023)	(0.023)	(0.022)	(0.024)	(0.024)
EIA$_{ijt}$*adiff_lnGDPcap$_{ijt}$				-0.079***	-0.115***	-0.023
				(0.024)	(0.027)	(0.025)
Fixed Effects *(i, t-(t-5)); (j, t-(t-5))*	Yes	Yes	Yes	Yes	Yes	Yes
No. obs.	86,575	78,714	75,641	86,575	78,714	75,641
R^2	0.893	0.883	0.897	0.893	0.883	0.897

Notes: This table shows the estimation results for equations (9) and (10), respectively, using the BB dataset for the EIA variables. Robust standard errors are in parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1% levels, respectively, in two-tailed t-tests.

Appendix 2. Broad economic categories classification system

Annual 4-digit SITC Rev. 2 data on bilateral trade flows—from NBER-UN and described in Feenstra *et al.* (2005)—were used in the aggregation of total trade statistics. In order to classify goods as intermediate, consumption, or final, we used a concordance (available from the United Nations website) to map SITC goods into BEC categories.

In the event that there was not a one-to-one match between SITC and BEC classification systems (i.e. if one SITC good mapped to two or multiple BEC categories), we resolved the problem by attributing a proportionate share of the SITC recorded flow to each BEC category. For instance, if the same SITC category (e.g. processed sunflower seed oil) maps to one BEC code for intermediate goods (121) *and* one BEC code for consumption goods (122), we will map one half of the bilateral trade flow to intermediate goods and one half to consumption goods. We chose to use this approach so that the sum of disaggregated goods would equal total trade.

Table A2 below contains the BEC breakdown by category of good used in this analysis.

Table A2. BEC breakdown

BEC Code	Description
Capital goods	
41	Capital goods (except transport equipment)
521	Transport equipment, industrial
Intermediate goods	
111	Food and beverages, primary, mainly for industry
121	Food and beverages, processed, mainly for industry
21	Industrial supplies not elsewhere specified, primary
22	Industrial supplies not elsewhere specified, processed
31	Fuels and lubricants, primary
322	Fuels and lubricants, processed (other than motor spirit)
42	Parts and accessories of capital goods (except transport equipment)
53	Parts and accessories of transport equipment
Consumption goods	
112	Food and beverages, primary, mainly for household consumption
122	Food and beverages, processed, mainly for household consumption
522	Transport equipment, non-industrial
61	Consumer goods not elsewhere specified, durable
62	Consumer goods not elsewhere specified, semi-durable
63	Consumer goods not elsewhere specified, non-durable

Appendix 3. List of countries used in analysis

Aruba
Afghanistan
Angola
Albania
Andorra
United Arab Emirates
Argentina
Armenia
Antigua and Barbuda
Australia
Austria
Azerbaijan
Burundi
Belgium
Benin
Burkina Faso
Bangladesh
Bulgaria
Bahrain
Bahamas
Bosnia and Herzegovina
Belarus
Belize
Bermuda
Bolivia
Brazil
Barbados
Bhutan
Botswana
Central African Republic
Canada
Switzerland
Chile
China
Côte d'Ivoire
Cameroon
Congo, Rep.
Congo, DRC
Colombia
Comoros
Cape Verde
Costa Rica
Cuba
Cyprus
Czech Republic
Germany
Djibouti
Dominica
Denmark
Dominican Republic
Algeria
Ecuador
Egypt, Arab Rep.
Spain
Estonia
Ethiopia
Finland
Fiji
France
Faeroe Islands
Gabon
United Kingdom
Georgia
Ghana
Guinea
Gambia
Guinea-Bissau
Greece
Grenada
Greenland
Guatemala
Guyana
Hong Kong SAR, China
Honduras
Croatia
Haiti
Hungary
Indonesia
India
Ireland
Iran, Islamic Rep.
Iraq
Iceland
Israel
Italy
Jamaica
Jordan
Japan
Kazakhstan
Kenya
Kyrgyz Republic
Cambodia
Kiribati
St. Kitts & Nevis
Korea, Rep.
Kuwait
Lao PDR
Lebanon
Liberia
Libya
St. Lucia
Sri Lanka
Lithuania
Luxembourg
Latvia
Macao
Morocco
Moldova
Madagascar
Maldives
Mexico
Macedonia
Mali
Malta
Myanmar
Mongolia

Mozambique
Mauritania
Mauritius
Malawi
Malaysia
Namibia
New Caledonia
Niger
Norfolk Island
Nicaragua
Netherlands
Norway
Nepal
New Zealand
Oman
Pakistan
Panama
Peru
Philippines
Papua New Guinea
Poland
Korea, Dem. People's Rep.
Portugal
Paraguay
Qatar
Romania
Russian Federation
Rwanda
Saudi Arabia
Sudan
Senegal
Singapore
Solomon Islands
Sierra Leone
El Salvador
Somalia
São Tomé and Príncipe
Suriname
Slovak Republic
Slovenia
Sweden
Swaziland
Seychelles
Syrian Arab Republic
Chad
Togo
Thailand
Tajikistan
Turkmenistan
Tonga
Trinidad and Tobago
Tunisia
Turkey
Taiwan, China
Tanzania
Uganda
Ukraine
Uruguay
United States
Uzbekistan
St. Vincent and the Grenadines
Venezuela, RB
Vietnam
Vanuatu
Samoa
Yemen
South Africa
Zambia
Zimbabwe