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Trade Agreements in a Broader Context - Analyzing Drivers of Trade beyond Cuts in Tariffs and Non-Tariff Barriers

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Abstract

The prevalence of preferential trade agreements (PTAs) continues to grow and to gain greater prominence as the agreements advance in terms of focus and reach, reflecting global changes in international trade and the world economy. Analyses of the impact of PTAs are quite frequent in academic literature, often identifying a positive impact of PTAs on trade flows, which follows economic intuition. However, there have been several papers that suggest strikingly high estimates of trade creation, predicting increases in trade flows up to 100% or more for countries entering PTAs. When trying to explain these estimated impacts on bilateral trade, most studies focus on the reduction of tariffs and the abolition of non-tariff barriers (NTBs). This paper, in contrast, ventures beyond these two drivers. Given the high estimates, there are likely additional factors at force that affect and facilitate trade, because entering into PTAs is not only likely to reduce trade costs but often also opens up new perspectives and opportunities. Employing gravity equations, this paper finds empirical evidence for the existence of additional trade stimulating factors. While controlling for tariffs and NTBs the estimates still suggest increase in bilateral trade of 16% to 42%. For identifying what some of these trade stimulating factors could be, this thesis concentrates on capital and labor. We find that both migration and FDI are driven by PTA membership. Further, foreign direct investments (FDI) are likely to be part of the trade stimulating factors, while the role of migration cannot be clearly determined.

Keywords: International trade, Gravity equation, Preferential trade agreements, FDI, Migration

JEL classification: F13, F14, F15, F21, F22

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List of Abbreviations

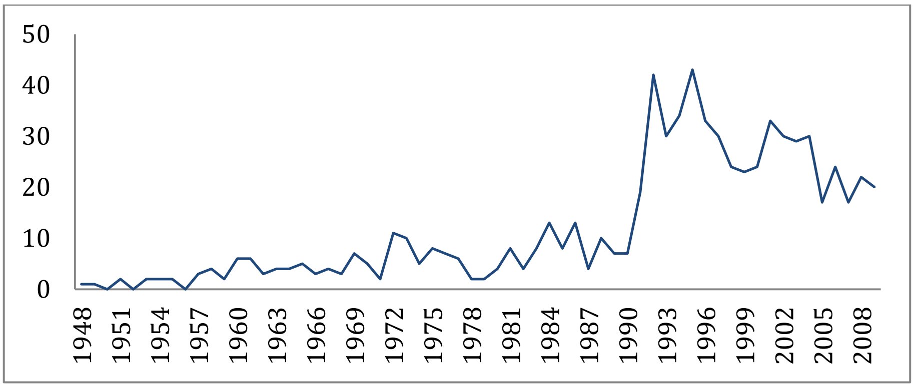
ATE	Average treatment effect
ATT	Average treatment effect on the treated
AVE	Ad-valorem equivalent
BIT	Bilateral investment treaty
CEPII	Centre d'Etudes Prospectives et d'Informations Internationales
CGE	Computable general equilibrium
CU	Custom union
DESTA	Design of Trade Agreements
EIA	Economic integrated area
EU	European Union
FE	Fixed effects
FDI	Foreign direct investment
FTA	Free trade agreement
FDI	Foreign direct investment
GATS	General Agreement on Trade in Services
GDP	Gross domestic product
GLS	Generalized least squares
GSP	General System of Preferences
HS6	6-digit harmonized system
ISIC 3	International standard industry code, Revision 3
IV	Instrumental variable
M&A	Mergers and acquisitions
MRT	Multilateral resistance term
NTB	Non-tariff barrier
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary least squares regression
OVB	Omitted variable bias
PPML	Pseudo Poisson maximum likelihood
PTA	Preferential trade agreement
RE	Random effects
SE	Standard error
TAFTA	Transatlantic Free Trade Agreement
TTIP	Transatlantic Trade and Investment Partnership
UNCTAD	United Nations Conference on Trade and Development
USA	United States of America

USD	US Dollar
WITS	World Integrated Trade Solution
WTO	World Trade Organization

1. Introduction

Preferential trade agreements[1] (PTAs) have played a central role in international trade relations for decades and they continue to gain importance. PTAs are not only prominently discussed in the recent academic literature but are also popularly covered in the international press. The recent negotiations on the Transatlantic Trade and Investment Partnership (TTIP) between the EU and the USA are a vivid example for the latest evolvement of PTAs. Over the last decades two significant trends have emerged (WTO, 2011): First, PTAs continue to grow and to gain greater prominence among international trade policies. To date, there are around 700 established agreements and this number is expected to increase further (Dür et al., 2014). Second, the agreements continue to advance in terms of focus and reach as their content evolves and deepens, reflecting global changes in international trade and the world economy.

Figure 1: Number of agreements signed per year



Source: Design of Trade Agreements (DESTA) Database, Dür et al. (2014)

Analyses of the impact of PTAs are quite frequent in academic literature and they often identify a positive impact of PTAs on trade flows. This seems to be in line with economic intuition, where trade between two countries should increase when these countries enter into an agreement to abolish trade barriers. There have been several papers that provide statistical evidence for this hypothesis. Baier and Bergstrand (2009b), for instance, show that country pairs with a PTA trade more on average than those country pairs without a PTA. Even though these simple descriptive statistics do not mean that PTAs necessarily cause more trade, they provide a rationale for further econometric analysis. Papers by Magee (2003), Baier and Bergstrand (2007) or Egger et al. (2011) yield further support for these findings, suggesting strikingly high estimates of trade creation when comparing country pairs with and without PTAs.

[1] The expression *preferential trade agreements* is used throughout the entire thesis as a general term for any kind of bilateral and multilateral agreements that aim at facilitating trade in some form. It includes free trade agreements (FTAs), custom unions (CUs), and economic integrated areas (EIAs).

Table 1: Estimated trade effects in literature

Trade effects estimated by	
Magee (2003)	+ 275%
Baier and Bergstrand (2007)	+ 86%
Baier and Bergstrand (2009b)	+ 100%
Egger et al. (2011)	+ 67%

Note: Figures represent estimated percentage increase in trade flows associated with PTA membership

In trying to explain the estimated impacts of PTAs on bilateral trade, most studies focus on the reduction of trade costs. Traditionally, PTAs were motivated by the political desire to diminish high tariffs (WTO, 2011). Over recent decades, however, tariff rates have decreased significantly and therefore offer increasingly less motivation for entering into new PTAs. Consequently, the focus has shifted towards non-tariff barriers (NTBs), i.e. those barriers to trade that include all kinds of measures hindering trade other than tariffs, such as differences in standards or technology. These too are likely to have an economic effect on international trade as they influence both the market access and the conditions for competition (Malouche et al., 2013). Previous literature has frequently focused only on either of these two drivers, the reduction of tariffs and the abolition of NTBs.

This paper, in contrast, ventures beyond these two aforementioned drivers. Given the high estimates of trade creation from PTAs in the literature, there might well be additional factors at force that affect and facilitate trade. Entering into PTAs is not only likely to reduce trade costs but often also opens up new perspectives and opportunities. For example, PTAs may indirectly promote bilateral relations when the expectations of growing trade and business relations create incentives for specialization. People in participating countries may familiarize themselves with the cultural characteristics of the partner countries, such as their preferences, habits, language, or legal system. This in turn could improve trade and business relations between countries by itself if they increase specialization, lower information costs, or improve the infrastructure between the two countries, all in all representing indirect consequences of the PTAs.

Given that PTAs have started covering an increasing range of content, their effects should be studied in a broader context. Therefore, this paper focuses on finding empirical evidence for additional factors driven by PTAs other than reductions in tariffs and NTBs. In a first step, this thesis investigates whether trade stimulating factors exist beyond the decreases in trade costs. To this end, we use a gravity equation with control variables for both tariffs and NTBs and find significant, positive coefficients for PTAs. Having thus provided evidence for the existence of additional drivers of trade that are associated with PTAs, the second part of this paper focuses on identifying what some of these trade stimulating factors could be. More specifically, we concentrate on the movement of production factors, in particular capital and labor, by analyzing the relations between PTAs and investments and migration. Employing additional gravity equations, we find that both foreign direct investments (FDI) and migration are likely influenced by PTAs. Combining these findings with our initial model, the results further suggest that in particular foreign direct investments (FDI) are likely to also have a positive impact on trade flows. Migration, however, does not seem to be one of the trade stimulating factors.

The remainder of this paper is structured as follows: Section 2 summarizes previous literature in this field and provides the link to this thesis. Section 3 investigates the empirical evidence for additional trade facilitating factors, covering data description, methods, results and robustness checks. Section 4 turns towards the additional trade facilitating factors and discusses which factors might have an effect on trade flows. Section 5 then first addresses FDI as a potential driver whilst Section 6 assesses migration flows and Section 7 concludes.

2. Previous Literature

The quantitative evaluation of the effect of PTAs on bilateral international trade is widely present in academic literature. With the rise of such agreements the econometric estimation has received increasing attention and continues to do so. In the course of this development, two predominant approaches have emerged. Either, the effects are evaluated from an *ex ante* perspective through simulations, or the impacts of PTAs are estimated from data of existing agreements, i.e. the so called *ex post* approach.

2.1. Ex ante approach

In an *ex ante* approach the effects of trade policy changes are estimated before the policies are actually implemented. Through simulation tools, the impacts of PTAs can be predicted in advance. The standard model for this approach is the computable general equilibrium (CGE) model which uses a system of simultaneous equations to describe the economy. The underlying idea is a general equilibrium in which all different markets, agents and interdependencies are in balance. With input of real economic data this system can then predict how an economy might react to policy changes or other external factors. More recently the CGE approach has frequently been adopted to estimate the potential effects of a free trade agreement (FTA) between the European Union and the US. Francois et al. (2013), for example, provide estimates for the economy-wide impact of such an agreement. The estimates are derived by using a CGE model which accounts for the reduction of both tariffs and NTBs. The results suggest positive and significant gains for both economies. There are numerous studies evaluating the impact of other PTAs, such as an agreement between the EU and Turkey (Harrison et al., 1997) or in the North Atlantic region (Baldwin and Francois, 1997). The research employing a CGE model, however, often focuses on particular agreements and analyzes the impacts on the respective members and third countries. Furthermore, these approaches are criticized due to limitations of their applicability. The models are simplified replications of the real world and are thus not able to capture the entire complexity. Additionally, the systems require input of certain parameters which are determined exogenously and thus may be arbitrary.

2.2. Ex post approach

In contrast to the specific focus of *ex ante* approaches, studies from *ex post* perspectives rather assess trade policies more generally and globally. Based on data with already existing agreements, the *ex post* approach considers the formation of PTAs as a treatment for the respective countries. These treatment variables are then included in gravity equations for estimating the agreements' effects. Gravity equations as a reduced form of a general equilibrium model have emerged as the empirical workhorse in international trade to study the impact of trade policies (Head and Mayer, 2013). They typically examine the cross-sectional and time series variation in bilateral trade flows in terms of country- and dyad-specific characteristics (Baier and Bergstrand, 2009b). Besides controlling for the presence or absence of PTAs, the equation usually includes attributes such as the countries' economic size, bilateral distance, shared language, shared border, or common history in colonial aspects.

One of the earliest studies for the quantitative estimation of PTA effects on bilateral trade was published by Nobel laureate Tinbergen (1962). By including an FTA dummy variable in a standard gravity equation, he evaluates the effect of FTAs on bilateral trade. His estimates indicate a positive, but fairly weak impact of FTAs on trade flows of around 5%. Even though his estimates were not statistically significant, they provided stimulus for further research. His paper was followed, inter alia, by studies from Linnemann (1966), Aitken (1973), Anderson (1979) and Sapir (1981). However, they yielded mixed results, both positive and negative impacts of PTAs, probably due to lacking theoretical foundation. The main criticism for these papers was that prices were generally ignored which is likely to have resulted in misspecifications of the gravity equation due to omitted variables (Bergstrand, 1985). This issue was addressed in subsequent research as it became clear that those previous naive approaches led to biased results (Head and Mayer, 2013). In particular, Eaton and Kortum (2002) and Anderson and van Wincoop (2003) advance the initial gravity equation by taking price terms and remoteness into account, represented in the so called multilateral resistance terms (MRTs). This is taken even a step further by Feenstra (2003), who shows that importer and exporter fixed effects can substitute the MRTs in the gravity equation and still lead to consistent estimates.

Another essential issue for the estimation of the impacts of PTAs is the endogeneity of the agreement formation. Traditionally, it was assumed that country pairs entered PTAs randomly rather than self-selected themselves into PTAs (Egger et al., 2008). In the past decades, researchers have addressed and investigated this problem. In general, studies have verified the hypothesis and concluded that trade policies such as the formations of PTAs are indeed not exogenous and should be treated endogenously in econometric analyses (cf. Magee, 2003, or Baier and Bergstrand, 2002). Studies such as Baier and Bergstrand (2007) have shown that ignoring the endogeneity of PTAs systematically yields underestimated effects. Hence, even if the problem of endogeneity is not perfectly eliminated in those studies, the results in particular serve as support for the strikingly high estimates of trade creation as the respective coefficients are potentially under- but most likely not overestimated.

As a result of the continued progress in its theoretical foundation, the gravity equation is now an essential part of trade policy analysis: the combination of being consistent with theory and quite easy to execute makes it a popular approach in empirical research (Head and Mayer, 2013). Given the context of our thesis, we too will employ a gravity equation while being cautious with regard to the above mentioned issues. In contrast to the *ex ante* approach, the *ex post* analysis further enables us to examine all actual impacts of PTAs which is in turn essential for finding additional trade stimulating factors.

2.3. Impacts of PTAs on trade flows

There are several recent studies that build on the theoretical foundation summarized above and that analyze the impact of PTAs on bilateral trade flows. Most of the studies have in common that they yield high estimates for the PTAs' impact on trade flows. While Magee (2003) actually focuses on investigating the driving factors for the formation of PTAs, he also measures the impact of PTAs on bilateral trade flows. Taking the endogeneity of the PTA variable into account, the results suggest a trade increase of 275% as a consequence from entering into a PTA. Baier and Bergstrand (2002, 2007, and 2009b) assess this topic in several studies. Similar to Magee (2003), they all have in common that they find strikingly high estimates, ranging from 86% (Baier and Bergstrand, 2007) to 100% (Baier and Bergstrand, 2009b). All these results build on an interpretation of the average treatment effect (ATE) of a PTA on bilateral trade flows while varying the specific method employed. In the first paper, Baier and Bergstrand (2002) address and investigate potential biases harming the validity of the traditionally used gravity equation. They suggest that measurement errors, simultaneity, and omitted variable bias the relevant coefficient estimates as a result of the endogeneity problem. They find evidence for all of these problems, and in addition suggest a potential for biases from self-selection. They conclude that the estimates may be even higher, for instance in their case an increase in bilateral trade flows of considerable 92%, as the effects of PTAs have been systematically underestimated in less sophisticated approaches. In subsequent studies, Baier and Bergstrand (2007) continue to explicitly focus on the endogeneity assumption for PTAs in their gravity equation, employing various methods to address the endogeneity. As instrumental variable (IV) or control function approaches have not succeeded to equally eliminate the endogeneity problem, they conclude that panel data techniques work best. In a subsequent paper, Baier and Bergstrand (2009b) derive estimates of the long run effects of PTAs by using nonparametric matching econometrics – another approach to finding the effects of PTAs while taking into account potential biases, in particular selection biases. As their results (100% increase in trade flows) are fairly close to the estimates derived through their gravity equation approach, Baier and Bergstrand (2009b) conclude that gravity equations may still provide consistent estimates for the impact of trade policies. Egger et al. (2008) find similar estimates for the impact of PTAs on trade flows. Even though their paper focuses on the origin of trade creation, i.e. whether gains are driven by specialization or by economies of scale, their results further confirm that PTAs, on average, foster bilateral trade when controlling for endogeneity. In a later and widely acknowledged study, Egger et al. (2011) build on their earlier findings and employ structural new trade theory models in order to estimate PTA effects. The pioneering feature of their model is how it simultaneously takes into account the general equilibrium, the problem of endogeneity, and the existence of zero trade flows. Considered as one of the current state-of-the-art papers within this field, their results indicate as well significantly high estimates of trade creation, indicating a 67% increase in trade flows.

2.4. Implications for this paper

The above are just some examples of the wide literature that focuses on the quantification of PTA effects. Analyses of driving factors for the strikingly high results, however, have been less in the focus of academic research. Those high estimates particularly foster our hypothesis that there might be additional trade stimulating factors, which have only been sparsely covered in previous literature. While focusing on the rationale for economic partnership agreements and their particular influence on developing countries, Curran at el. (2008) also elaborate on non trade aspects of PTAs such as regulatory frameworks, investments, or infrastructure. However, they do not consider their effects on trade flows. On the contrary, Dee and Gali (2005) examine the effects of trade and nontrade provisions of PTAs on trade and FDI flows. To this end, they first inspect the breadth of coverage of PTAs by using indices that represent the depth of agreements. The indices are derived in an additive nature, covering several dimensions of trade and non-trade provisions in the respective agreements. Dee and Gali (2005) then assess the effects on trade and investment flows both theoretically and empirically. For the empirical part, the indices are included in the gravity equation to measure more accurately the impact of PTAs than previously done by the binary dummy variables used in other papers. Their paper is one illustrative example of the increasing interest for the impacts of PTAs on issues other than trade costs. Yet it still differs in focus and method from our thesis. To our knowledge, therefore, no literature has been published to date that investigates additional drivers of trade creation induced by PTAs other than direct trade costs. The remainder of this paper therefore focuses on providing an explanation for the puzzle of the high estimates for the effect of PTAs on trade flows in previous literature.

3. Do PTAs have an impact on trade flows beyond cuts in direct trade costs?

Acknowledging the strikingly high estimates of trade creation in previous literature, this section focuses on finding empirical evidence for additional driving factors of PTAs besides the reductions in tariffs and NTBs. As discussed in Section 2.3, the gravity equation will serve as the econometric tool in our investigation on the existence of additional trade stimulating factors. We do employ various empirical analyses and alter our approaches in order to increase the robustness of our findings.

3.1. Model specification

As demonstrated by previous literature the gravity equation has emerged as the workhorse for analyzing trade flows and trade policies. In particular, it has proven to be the standard tool when assessing the impacts of PTAs from the *ex post* perspective and is likely providing consistent estimates (cf. section 2.3). Gravity equations typically examine the cross-sectional variation in bilateral trade flows in terms of country- and dyad-specific characteristics (Baier and Bergstrand, 2009b). Besides controlling for the presence or absence of PTAs, the equation usually includes attributes such as the countries' economic size, bilateral distance, shared language, shared border, or common history in colonial aspects. As concluded by Head and Mayer (2013) several theory-consistent estimation methods have emerged that can be used to receive valid findings according to present literature.

As the standard gravity equation is derived in a multiplicative nature, the empirical analyses usually employ the natural logarithms of the variables. The simple gravity equation is thus represented in the following equation (Head and Mayer, 2013):

$$(1) \quad \ln X_{ijp} = \alpha + \beta_0 \ln S_i + \beta_1 \ln M_j + \beta_2 \ln \phi_{ijp} + \varepsilon_{ijp}$$

where the index notation defines i for the exporting country, j for the importing, and p for the product. X_{ijp} denotes the value of export of product p from country i to country j. While S_i includes all exporter-specific characteristics, the variable M_j comprises all importer-specific factors. Traditionally, the exporter- or importer-specific factors were represented just by the economic size of countries, mostly in terms of GDP. The factor ϕ_{ijp} is an indicator of the general market access for exporter i to the import market j, such as the distance or general trade costs. In order to make this approach consistent with theory, recent research has adjusted the use and specification of variables. The most essential modification was derived by Anderson and van Wincoop (2003) who introduced the concept of relative trade costs and remoteness. They show that bilateral trade flows are not only determined by the traditional factors such as the countries' economic size or distance, but also by both bilateral and multilateral trade resistance. The resistance refers to trade barriers which the countries face with all their other trading partners (Adam and Cobham, 2007). Subsequently, they develop the theoretical foundation for such MRTs, representing the remoteness of countries and thus a substitutability of trade with different partners. As these terms are correlated with trade costs they need to be included in the gravity equation in order to receive results that are consistent with theory (Baldwin and Taglioni, 2006). Unfortunately, MRTs are not easy to include in the gravity equation as they are not directly observable. Feenstra (2003), however, establishes an alternative for MRTs by including exporter and importer fixed effects as control variables (φ_i and φ_j). Those control variables do not only proxy relative prices but also capture all other country-specific factors so that economic size, welfare, population, or other potential control variables can be left out as they are already captured. These findings lead to the following adjusted form:

$$(2) \quad \ln X_{ijp} = \alpha + \beta_0 \varphi_i + \beta_1 \varphi_j + \beta_2 \ln \phi_{ijp} + \varepsilon_{ijp}$$

The general trade costs ϕ_{ijp} typically comprise several variables in order to capture all cost related factors. Traditionally, the distance between two countries was used as a proxy for their bilateral trade costs. In more recent literature this simple proxy for trade costs was complemented by further trade costs which can broadly be categorized in two groups. First, costs related to the actual transport, represented in dummies for common borders, being landlocked, or being an island. Secondly, various costs induced by cultural differences, including dummies for common language ($lang_{ij}$), adjacency ($bord_{ij}$) or other relevant cultural features such as common history, e.g. a colonial connection (col_{ij}, $comcol_{ij}$) (WTO, 2012). As these variables are all expected to be correlated with international trade flows, they are an essential part of the employed gravity equation. Other factors influencing the trade costs are $tariff_{ijp}$ and non-tariff barriers (NTB_{jp}). As this paper aims at investigating the impact on PTAs beyond trade costs, it is necessary to also embed these two variables into the equation. The specification of trade costs thus results in the following equation:

$$(3) \quad \phi_{ijp} = d_{ij}^{\delta_1} * tariff_{ijp}^{\delta_2} * NTB_{jp}^{\delta_3} * \exp\left(\delta_4 * bord_{ij} + \delta_5 * lang_{ij} + \delta_6 * \mathrm{col_{ij}} + \delta_7 * \mathrm{comcol_{ij}} + \delta_8 * \mathrm{PTA_{ij}}\right)$$

The selection of these variables follows the findings of previous literature. An extensive example was published by Rose (2004) who augments the gravity equation by including a broad range of trade cost proxies. His intention was to account for as many factors as possible, adding up to 15 control variables. In contrast to his model, many variables, namely all importer- and exporter-specific factors, are absorbed by the fixed effects in our equation. Consequently, our specification choice does not comprise as many control variables as Rose's equation but is still analogous to existing literature. In addition, we try to include various fixed effects throughout all our regressions in order to capture potential further biases and thus increase the validity of our estimates. Besides importer and exporter fixed effects we generally include dummies for the sectors accounting for the wide range of sectors with specific characteristics such as likelihood of export in general and global barriers to trade due to sensitivity of the product such as agricultural goods.

As it is assumed that the control variables do not capture all country pair characteristics, we need to control for this kind of fixed effects (FE). For our regressions, we use the Generalized Least Squares (GLS) model that allows to control for random effects (RE), a special case of FE. Our assumption is that these country pair characteristics are independent from all explanatory variables in all time periods. Hence, the model helps to overcome serial correlation in the error term. It is quasi-demeaning so it can include time-invariant variables. Thus and in contrast to the FE, it does not capture any time-invariant characteristics such as cultural relationships and also PTA membership, which is rather constant once a country pair has established a trade agreement. By conducting Hausman tests for each model the consistency of the GLS model has been confirmed.

Regarding the focus of this analysis, a PTA variable is included in order to capture the effect of PTAs beyond the decreases in tariffs and trade costs. Based on the hypothesis, the respective coefficient is expected to be positive, representing the existence of additional trade stimulating factors induced by PTAs. This leads to the specification of the gravity equation:

$$(2)\quad \ln X_{ijp} = \alpha + \beta_0 \varphi_i + \beta_1 \varphi_j + \beta_2\, \varphi_p + \beta_3 \ln \phi_{ijp} + \varepsilon_{ijp}$$

$$(3)\quad \phi_{ijp} = d_{ij}^{\delta_1} * tariff_{ijp}^{\delta_2} * NTB_{ijp}^{\delta_3} * \exp\,(\delta_4 * bord_{ij} + \delta_5 * lang_{ij} + \delta_6 * \mathrm{col}_{\mathrm{ij}} + \delta_7 * \mathrm{comcol}_{\mathrm{ij}} + \delta_8 * \mathrm{PTA}_{\mathrm{ij}})$$

Including the following variables:

X_{ijp}	Value of bilateral trade flows
φ_i and φ_j	Country dummies to control for country fixed effects
φ_p	Sector dummies to control for sector fixed effects
ϕ_{ijp}	Trade costs, driven by:
$tariff_{ijp}$	Effectively applied tariff on sectoral level
NTB_{jp}	AVEs of NTBs on sectoral level
d_{ij}	Bilateral distance between countries
$bord_{ij}$	Dummy for common border
$lang_{ij}$	Dummy for common language of trade partners

col_{ij}	Dummy for colonial link
$comcol_{ij}$	Dummy for common colonizer after 1945
PTA_{ij}	Dummy for common membership in PTA

Even though several issues have already been addressed, the estimation still faces further econometric challenges. One major problem refers to zero trade flows for certain products between specific countries and how to deal with them. Given the logarithmic nature of the chosen equation, zero trade flows would be ignored in the estimation as $\ln(0)$ is not defined. These zero trade flows, however, are of particular importance in this context, as they might reflect cases of intolerably high trade barriers. Different approaches have emerged in the literature to cope with this issue. As dropping observations with zero trade flows would not be acceptable for the aforementioned reason, one simplest approach is to add insignificantly small values to all trade flows prior to taking the logarithm (WTO, 2012). As this approach though lacks theoretical foundation and may lead to inconsistent estimates, we further employ a Pseudo Poisson Maximum Likelihood (PPML) estimator. This method does not require the trade value to be the logarithm value, but can use its absolute value, and thereby allows us to avoid having to manipulate or to ignore data points with zero trade flows. Moreover, the PPML approach still yields robust results when facing heteroscedasticity which is quite frequent in trade data (Silva and Tenreyro, 2006). The PPML approach yields the following equation, including the above mentioned controls for trade costs.

$$(4) \quad X_{ijp} = \exp\left(\alpha + \beta_0 \varphi_i + \beta_1 \varphi_j + \beta_3 \ln \phi_{ijp}\right) \varepsilon_{ijp}$$

Having addressed the issue of zero trade flows, the problem of endogeneity needs to be considered. The exogeneity assumption of PTA membership is likely problematic as countries presumably enter into partnerships as a partial consequence of specific circumstances, such as high trade flows or geographic proximity. If not accounted for methodically, reverse causality is thus likely to affect the regression and to yield inconsistent estimates. Although the IV approach could act as a potentially suitable solution, no proper IVs have been identified in the literature that could accurately meet the requirements, in particular the need for strong correlation with the existence of PTAs while being uncorrelated with trade flows. Baier and Bergstrand (2007) test different approaches to address the endogeneity of FTAs and conclude that panel data techniques work best to adjust for this problem. If, however, endogeneity is not controlled for at all, the estimates for the impact of PTAs on trade flows are likely to be considerably underestimated (Baier and Bergstrand, 2007). Hence, even if we cannot completely eliminate the problem of endogeneity, the results may still serve as valid indications for the existence of additional trade stimulating factors, especially in light of the respective coefficients being potentially under- but most likely not overestimated.

Based on the discussion above, our subsequent empirical analysis mainly uses data on PTAs that have been in existence for more than 10 years. The rationale behind this is that the formation of PTAs or the entry into PTA memberships might be driven by high previous trade flows. To eliminate this kind of influence on present trade flows we exclude younger PTAs and thus try to cure simultaneity bias. After 10 years trade flows are assumed to have adjusted and their level can be considered a consequence of and not the reason for PTA membership. Furthermore, this adjustment enables the estimates to capture long-term effects rather than short- or medium-term impacts. Baier and Bergstrand (2009b) have shown that PTAs require phase-in periods of a couple of years before leading to persistent effects.

Due to limitations in the underlying data we are not able to increase the robustness by analyzing panel data. Only the year 2004 can be considered in this analysis. Hence, dynamic effects of PTAs cannot be observed, which would be desirable. Fortunately, we can assume the year 2004 not to be a particular outlier compared to other years as it was not part of the global crisis or other outstanding macroeconomic events. However, to receive alternative results, a matching technique will also be employed to increase the robustness of our findings.

3.2. Underlying Data

The primary data for this empirical analysis are bilateral trade flows, denoted by X_{ijp}, on a disaggregated product level. The BACI database, covering trade flows of more than 200 countries over time, serves as the main source. It provides monetary values and quantities of bilateral trade flows at a 6-digit harmonized system (HS6) product disaggregation level based on revised data in which the declarations of exporters and importers were reconciled (Gaulier and Zignago, 2009). Given this harmonization procedure, the BACI database is considered to be the most comprehensive source for trade flows and thus strives for being as complete as possible. However, this dataset only consists of strictly positive trade flows, so that we append the data by adding zero trade flows. It is assumed that a country exporting one specific product to at least one country could also export it to all other countries and thus complement the dataset with these zero trade flows. This implies that zero trade flows are only added if an exporter is in general able to produce the product so that the data is not skewed by impossibilities such as Sweden exporting bananas. Moreover, the BACI dataset also enables us to avoid another issue, the so called *silver medal mistake*, whereby trade flows between two countries should be considered separately in the two directions (Baldwin and Taglioni, 2006). The results may further be skewed if the regression uses trade flows on a disaggregated product level. When entering into PTAs the trade flows may change in two dimensions. First, countries may trade more or less different products, representing the effects on the extensive margin. Second, the volumes of products traded may change, corresponding to the effects on the intensive margin. If the regression employs disaggregated trade flows, the estimates are likely skewed as the regression is not able to capture interdependent effects. We thus aggregate the trade flows to the sectoral level based on concordance to the International Standard Industry Code Revision 3 (ISIC 3) in order to account for this issue.

The trade flows are complemented by several country pair factors representing the control variables in the gravity equation. All country-specific variables are omitted as they are captured in the country fixed effects, φ_i and φ_j. Regarding the dyad-specific factors, an extensive dataset was published by the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) containing most of our control variables (Mayer and Zignago, 2011). The bilateral distance d_{ij} is based on the simple geodesic distance between two countries, reflecting the distance between the countries' most important agglomerations in terms of population (Mayer and Zignago, 2011). While the contiguity variable $bord_{ij}$ indicates whether two countries share a border, the language variable $lang_{ij}$ refers to a common official language. The variables col_{ij} and $comcol_{ij}$ capture the common history in colonial aspects. First, whether two countries have a colonial link, and second, whether two countries had a common colonizer after 1945 (Mayer and Zignago, 2011).

The tariff rates are provided by the World Integrated Trade Solution (WITS) database at ISIC3 sector aggregation (WITS, 2014). In contrast to NTBs, information and data on tariffs is well available and more reliable. The WITS database offers bilateral tariff rates which are adjusted for most favored nation (MFN) clauses, trade agreements and other rules. Furthermore, the effectively applied tariff rates also include ad-valorem equivalents (AVEs) of non-ad-valorem tariffs such as quotas or the like. Given the various calculations and definitions of tariff rates, a decision needs to be made which tariff rate should be used. One major decision is concerned with calculating the average tariff rate, either simple average or weighted average. On the one hand, the simple average includes all tariff lines with the same weight. Hence, tariffs on economically meaningless goods could bias averages, either downward or upward. On the other hand, the weighted average takes into account the different importance of tariffs in terms of affected trade volumes. This, however, leads to the elimination of tariffs on zero trade flows. It further induces the problem that those imports which are subject to high tariffs are likely to be small and thus not well represented in the weighted average. Considering this trade-off, both rates, $tariff\_s_{ijp}$ and $tariff\_w_{ijp}$, will be alternately used in the regressions in order to serve as a robustness test.

As tariffs in general have already reached a relatively low level in the past decades, the occurrence and importance of NTBs have progressively increased in the field of international trade. NTBs comprise all policy measures, other than tariffs, that can potentially have an economic effect on international trade, both direct and indirect. Given the diversity and potential complexity of these measures, Cadot and Malouche (2012) declare them as the *new frontier* of trade policy. Even though progress has been made in NTB transparency, information on NTBs and reliable data are not easily accessible and available sources are scarce. The database of the Market Access Map (MAcMap) database provides information on bilateral NTBs at the product level. As the database does not provide quantified measures, this information could only be used by including dummy variables in the gravity equation. This, however, would not capture the profoundness of the respective NTBs. Employing quantified estimates is more precise compared to dummy variables and is thus preferable. The quantification of NTBs and estimation of AVEs, however, is itself the basis for a wide set of literature and research. The paper of Kee et al. (2009) has emerged as an influential work within this field. Employing a Heckman two-stage approach they derive AVEs in two steps. First, they run a probit regression to derive the inverse mills ratio, and second, they conduct a non-linear regression on trade flows in which they control, among other things, for tariffs, relative factor endowments, and the inverse mills ratios. This procedure is executed for each product and eventually yields importer-specific AVEs on the product level for the year 2004, based on the derived coefficient and the price elasticity of the specific product in each country. We borrow these estimates for our regression as they offer a more precise consideration of NTBs. In combination with country pair RE we believe that this is the most valid proxy for NTBs that is currently available.

The last variable we require is information on the existence of PTAs between two countries. Given the context of this thesis, the PTA variable is the most important independent variable in the regression. The underlying data is provided by DESTA, a project for the design of trade agreements which systematically collects data on all types of PTAs, including Free Trade Agreements (FTAs), Custom Unions (CUs) and Economic Integrated Areas (EIAs) (Dür et al., 2014). Having created measurements for the depth of such agreements, this database provides not only dummy variables for PTAs but also indices of their depth and coverage. The index is derived in an additive nature, capturing whether seven key provisions are included in a certain agreement or not. The index thus ranges from 0 to 7 and represents how many key provisions are covered. The key provisions considered are dimensions of trade cost reduction, trade in services, investments, standards, public procurement, competition, and intellectual property rights (Dür et al., 2014). Furthermore, the data provides information about the date of entry into the PTAs by countries, which is particularly important as we intend to approach the problem of reverse causality (cf. section 3.1.). The formation of PTAs cannot be considered to be exogenous without caution. A first attempt to circumvent this problem is to also consider trade agreements that were established at least 10 years ago.

Consequently, our dataset for 2004 covers a total of around 900,000 observations comprising trade flows between 92 countries and around 145 product groups.

Table 2: Overview of variables for main gravity equation

Variable	Definition	Unit	Source
X_{ijp}	Value of bilateral trade flows	'000 USD	BACI
d_{ij}	Bilateral distance between countries	km	CEPII
$bord_{ij}$	Dummy for common border	Dummy	CEPII
$lang_{ij}$	Dummy for common language of trade partners	Dummy	CEPII
col_{ij}	Dummy for colonial link of trade partners	Dummy	CEPII
$comcol_{ij}$	Dummy for common colonizer after 1945	Dummy	CEPII
$tariff_{ijp}$	Effectively applied tariff ISIC 3 sector level	Percentage	WITS
NTB_AVE_{jp}	AVEs of NTBs on ISIC 3 sector level	Percentage	Kee at al. (2009)
PTA (DESTA)	Dummy for common membership in PTA	Dummy	DESTA
PTA index	Index for bilateral PTA coverage	Index	DESTA
PTA (10 years)	10 year lagged dummy for common membership in PTA	Dummy	DESTA
PTA index (10 years)	10 year lagged index for bilateral PTA coverage	Index	DESTA

3.3. Empirical findings

Using the above described cross-sectional data the regression estimates the relationship between trade flows and PTAs. The estimations of our model specifications overall yield econometrically significant and meaningful results (Table 3 to 5). The coefficients of the control variables are almost all highly significant and comparable to findings in previous literature (cf. Head and Mayer, 2013, or Baier and Bergstrand, 2009b). In particular, the signs of the coefficients are in line with economic theory. The estimates indicate that trade impeding variables such as tariffs or distance have a negative influence on trade flows. Trade facilitating factors, by contrast, have positive coefficients. More specifically, countries which share cultural aspects such as common language or historical links trade on average more as do countries that share a common border, which is consistent with economic intuition. Importantly, the estimation yields significant, positive coefficients for PTAs despite the separate controls for both tariffs and NTBs. Hence, these results suggest that PTAs have an impact on bilateral trade flows beyond the effects from tariffs and NTBs.

Table 3: Regression results of gravity equation with 10 year lagged PTA dummy

Variables	(1) $\ln(X_{ijp} + 1)$	(2) $\ln(X_{ijp} + 1)$	(3) X_{ijp}	(4) X_{ijp}
PTA (10 years)	0.147***	0.148***	0.350***	0.353***
	(0.0532)	*(0.0532)*	*(0.129)*	*(0.128)*
$\ln(1 + tariff\_s_{ijp})$	-0.786***		-2.208***	
	(0.0507)		*(0.461)*	
$\ln(1 + tariff\_w_{ijp})$		-0.455***		-1.718***
		(0.0450)		*(0.505)*
$\ln(1 + NTB_{jp})$	0.0289	0.0330	0.0364	0.0541
	(0.0319)	*(0.0320)*	*(0.159)*	*(0.159)*
$\ln(d_{ij})$	-0.649***	-0.649***	-0.290***	-0.291***
	(0.0514)	*(0.0514)*	*(0.0570)*	*(0.0569)*
$bord_{ij}$	2.131***	2.135***	1.092***	1.089***
	(0.123)	*(0.123)*	*(0.134)*	*(0.133)*
$lang_{ij}$	0.590***	0.592***	0.449***	0.449***
	(0.0553)	*(0.0553)*	*(0.104)*	*(0.103)*
col_{ij}	0.843***	0.841***	0.139	0.142
	(0.123)	*(0.123)*	*(0.119)*	*(0.118)*
$comcol_{ij}$	0.544***	0.543***	0.492**	0.490**
	(0.0626)	*(0.0627)*	*(0.199)*	*(0.199)*
Constant	6.148***	6.112***	4.888***	4.822***
	(0.517)	*(0.517)*	*(0.880)*	*(0.881)*
Observations	890,664	890,664	890,664	890,664
Method	GLS	GLS	PPML	PPML
Country FE	YES	YES	YES	YES
Sector FE	YES	YES	YES	YES
Country pair RE	YES	YES	NO	NO
R-squared	0.563	0.563	0.281	0.282

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3 shows the regression results from the gravity equation which includes the 10 year lagged PTA dummy. The estimates suggest that, ceteris paribus, the PTA membership on average increases trade flows by around 16% (Column 1 and 2). The PPML estimates are even higher, indicating an increase of 42% (Column 3 and 4), but both estimates have in common that the coefficients are statistically highly significant. When considering the latest PTA dummy instead of the 10 year lagged variable (cf. Table A 2 in the Appendix), the estimates indicate higher effects for the impact on trade flows, ranging from 34% (GLS) to 46% (PPML). As Dür et al. (2014) have pointed out, the number and reach of PTAs have particularly increased over the past decades. A lag of 10 years can thus likely make a significant difference, which might explain the divergence of the estimates.

Comparing the alternative tariff specifications, the results show that the estimates for the weighted tariff rate, $\ln(1 + \text{tariff\_w}_{ijp})$ are, in absolute terms, generally smaller than the ones for the simple average, , $\ln(1 + \text{tariff\_s}_{ijp})$. This may be traced back to differences between the simple average and the weighted average of tariffs in the underlying dataset. Given that these differences are, however, fairly small it is surprising that the coefficients diverge so strongly.

Considering the NTBs, the regression yields positive, but insignificant estimates. We assume that the effects of NTBs may be captured by the sector FE, as NTBs are, in particular, likely to be more restrictive in certain industries. Further, the included country pair RE capture differences in the restrictions of the NTBs, which are importer-specific in the dataset and thus cannot be represented. However, they might in fact be more relevant and harder to circumvent for some exporters than for others. Consequently, this dyad-specific relationship is not reflected in the NTB variable and its coefficient.

Overall, these first estimations yield significant results and suggest a positive impact of PTAs despite the separate controls for both tariffs and NTBs. There is, however, a chance that the above mentioned estimates could be skewed due to one dummy variable subsuming all different forms of PTAs. To reduce the potential effect, the next set of regressions (Table 4) includes the PTA index provided by DESTA, representing a proxy for the depth of PTAs (Dür et al., 2014). Though lower, the estimations still yield significant and positive coefficients for the PTA index, confirming its likely influence.

Table 4: Regression results of gravity equation with 10 year lagged PTA index

Variables	(1) ln (X_{ijp}+1)	(2) ln (X_{ijp}+1)	(3) X_{ijp}	(4) X_{ijp}
PTA index (10 years)	0.0937***	0.0939***	0.0591	0.0599
	(0.0168)	*(0.0168)*	*(0.0384)*	*(0.0383)*
ln (1 + tariff_s_{ijp})	-0.786***		-2.231***	
	(0.0507)		*(0.457)*	
ln (1 + tariff_w_{ijp})		-0.455***		-1.723***
		(0.0450)		*(0.507)*
ln (1 + NTB_{jp})	0.0289	0.0330	0.0373	0.0557
	(0.0319)	*(0.0320)*	*(0.160)*	*(0.159)*
ln (d_{ij})	-0.642***	-0.642***	-0.318***	-0.319***
	(0.0505)	*(0.0505)*	*(0.0533)*	*(0.0532)*
$bord_{ij}$	2.142***	2.146***	1.073***	1.070***
	(0.123)	*(0.123)*	*(0.135)*	*(0.134)*
$lang_{ij}$	0.598***	0.599***	0.466***	0.467***
	(0.0550)	*(0.0551)*	*(0.105)*	*(0.104)*
col_{ij}	0.864***	0.862***	0.140	0.142
	(0.122)	*(0.122)*	*(0.119)*	*(0.118)*
$comcol_{ij}$	0.539***	0.538***	0.504***	0.503***
	(0.0626)	*(0.0627)*	*(0.183)*	*(0.184)*
Constant	6.118***	6.083***	5.309***	5.245***
	(0.503)	*(0.503)*	*(0.839)*	*(0.840)*
Observations	890,664	890,664	890,664	890,664
Method	OLS	OLS	PPML	PPML
Country FE	YES	YES	YES	YES
Sector FE	YES	YES	YES	YES
Country pair RE	YES	YES	NO	NO
R-squared	0.564	0.563	0.277	0.278

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4 presents the regression results from the gravity equation which includes the 10 year lagged PTA index, taking the depth of the agreements into account. The GLS estimates suggest that the trade flows increase by 10% per unit increase in the PTA index, holding everything else constant. The estimates are generally lower compared to the first set of regressions which is in line with intuition as the PTA index goes up to 7 instead of being only a binary variable as the PTA dummy. Besides that, the results for all other control variables are fairly similar to estimates with the PTA dummy (cf. Table 3).

So far the regression specifications were based on the assumption that the effect of PTAs on trade flows is independent from other control variables. However, it might well be the case that the PTA variable correlates with tariffs or NTBs. Interaction terms should then be included in the equation in order to capture the effect of these dependencies. Even though the underlying dataset includes preferential rates, it does not suggest very strong correlation between

PTA or $PTAindex$ and other control variables. One reason for that is that there are preferential tariff rates which are based on unilateral concessions, rather than being a consequence of a PTA membership. Those unilateral provisions such as, for example, general systems of preferences (GSP), are not represented in the PTA variable, but do still result in lower tariff rates. Nevertheless, we added the interactions terms in a separate regression set in order to assess their impact. Altogether, the coefficients of the stand-alone PTA variables slightly decrease compared to the regressions above, but remain significant in most specifications.

Table 5: Regression results of gravity equation with interaction terms

Variables	(1) ln (X_{ijp}+1)	(2) ln (X_{ijp}+1)	(3) X_{ijp}	(4) X_{ijp}
PTA (10 years)	0.134**		0.352***	
	(0.0547)		*(0.135)*	
PTA index (10 years)		0.0906***		0.0460
		(0.0174)		*(0.0438)*
$\ln(1 + tariff\_s_{ijp})$	-0.723***	-0.766***	-2.423***	-2.668***
	(0.0539)	*(0.0531)*	*(0.551)*	*(0.554)*
PTA (10 years) $* \ln(1 + tariff\_s_{ijp})$	-0.370***		0.662	
	(0.126)		*(0.994)*	
PTA index (10 years) $* \ln(1 + tariff\_s_{ijp})$		-0.0497		0.453*
		(0.0421)		*(0.270)*
$\ln(1 + NTB_{jp})$	-0.0412	0.00230	0.105	0.0493
	(0.0345)	*(0.0337)*	*(0.175)*	*(0.170)*
PTA (10 years) $* \ln(1 + NTB_{jp})$	0.367***		-0.272	
	(0.0741)		*(0.239)*	
PTA index (10 years) $* \ln(1 + NTB_{jp})$		0.0611**		-0.0175
		(0.0266)		*(0.0737)*
$\ln(d_{ij})$	-0.649***	-0.642***	-0.290***	-0.318***
	(0.0514)	*(0.0505)*	*(0.0570)*	*(0.0531)*
$bord_{ij}$	2.130***	2.146***	1.093***	1.075***
	(0.123)	*(0.123)*	*(0.134)*	*(0.135)*
$lang_{ij}$	0.593***	0.600***	0.448***	0.462***
	(0.0553)	*(0.0551)*	*(0.104)*	*(0.106)*
col_{ij}	0.843***	0.862***	0.138	0.138
	(0.123)	*(0.122)*	*(0.118)*	*(0.119)*
$comcol_{ij}$	0.544***	0.538***	0.499**	0.501***
	(0.0627)	*(0.0627)*	*(0.195)*	*(0.183)*
Constant	6.162***	6.119***	4.890***	5.355***
	(0.517)	*(0.503)*	*(0.878)*	*(0.834)*
Observations	890,664	890,664	890,664	890,664
Method	GLS	GLS	PPML	PPML
Country FE	YES	YES	YES	YES
Sector FE	YES	YES	YES	YES
Country pair RE	YES	YES	NO	NO
R-squared	0.563	0.565	0.281	0.278

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As the estimates for the impact of PTAs remain positive and mainly highly significant, they are still in line with our expectations. The estimates for the interaction terms are, however, not clearly informative. Half of the interaction terms are, however, statistically significant given the results of the techniques used. This may be traced back to the rather weak correlation as mentioned above.

In conjunction, all these findings rather support our initial hypothesis that PTAs have an influence on trade beyond their impact on tariffs and NTBs. The significant and positive coefficients of the PTA variables suggest that additional trade stimulating factors are likely to exist which are driven by countries' memberships in PTAs.

3.4. Robustness check

Before expanding on the above results and looking into what these other trade stimulating factors could be, this section assesses the robustness of the preceding analysis. As Head and Mayer (2013) argue, finding empirical evidence should not rely on a single model, but rather be based on several specifications and methods.

Several previous studies have found empirical evidence that countries who share certain characteristics are more likely to have PTAs. Entering into PTAs seems to depend on certain circumstances, so that self selection might be a problem when analyzing the effects of PTAs. Baier and Bergstrand (2004), for instance, show that countries are more likely to enter into an agreement if they are larger in economic size, more similar in economic characteristics, closer in distance, and more remote from other countries. Given this non-random selection into PTAs, the estimates for the impacts of PTAs might be biased (Baier and Bergstrand, 2009b). In order to assess this issue, we next employ matching methods in estimating the treatment effects of PTAs. This is an alternative method to using instrumental variable approaches in dealing with selection biases (cf. our discussion in section 2.3 for more details). The main idea of matching algorithms is to find the closest comparable observations for the treatment group among the non-treated. In order to construct comparable counterparts, each treated participant is matched with one or more non-treated participant based on similar characteristics. The matching assumptions are selected with the objective of ensuring that the only remaining difference between the two groups is the treatment. In our context, the treatment is represented by the membership in a common PTA and the specification of the control group is based on those economic characteristics that influence trade and the formation of PTAs. The key factors that are likely to influence whether a country becomes party to a PTA include the control variables from above and in addition the countries' economic size in terms of GDP, the sum of logs of GDP in order to control for economic similarity, and remoteness. In contrast to our model specification above, we cannot employ importer and exporter fixed effects, so that we need to add these control variables for the matching approach. For the remoteness terms, we borrow the equations from Baier and Bergstrand (2009b) in order to approximate the MRTs exogenously:

$$(5) \quad BV\_d_{ij} = \ln d_{ij} - \frac{1}{N}\sum_{j=1}^{N} \ln d_{ij} - \frac{1}{N}\sum_{i=1}^{N} \ln d_{ij} + \frac{1}{N^2}\sum_{j=1}^{N}\sum_{i=1}^{N} \ln d_{ij}$$

$$(6)\quad BV\_bord_{ij} = \ln bord_{ij} - \frac{1}{N}\sum_{j=1}^{N} \ln bord_{ij} - \frac{1}{N}\sum_{i=1}^{N} \ln bord_{ij} + \frac{1}{N^2}\sum_{j=1}^{N}\sum_{i=1}^{N} \ln bord_{ij}$$

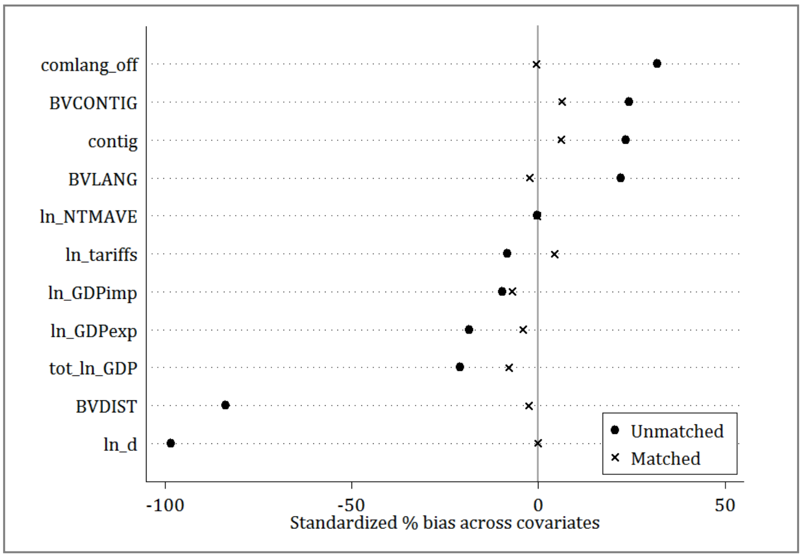
$$(7)\quad BV\_lang_{ij} = \ln lang_{ij} - \frac{1}{N}\sum_{j=1}^{N} \ln lang_{ij} - \frac{1}{N}\sum_{i=1}^{N} \ln lang_{ij} + \frac{1}{N^2}\sum_{j=1}^{N}\sum_{i=1}^{N} \ln lang_{ij}$$

Moreover, this method now employs aggregated data instead of sector data in order to allow for adequate matching and to ensure that the estimates are not skewed due to sector or industry specific effects. Based on these characteristics a propensity score is calculated in order to receive a matching condition. Using the probit regression consequently yields estimates for the likelihood of a common PTA for a certain country pair. Even though this implies that the characteristics are reduced to one dimension and the matching procedure is less precise, Baier and Bergstrand (2009b) conclude that it is still able to serve as a useful robustness check.

Based on this dyad-specific propensity score the treated observations, i.e. the country pairs having a PTA, are matched to their nearest neighbors, more specifically to four untreated observations in our case. Due to a greater number of country pairs without a PTA, we match the treated observations to more than one neighbor as it yields good balancing of the variables. Furthermore, we only consider observations whose propensity score is in the range of the common overlap of the treated and control variables, so that extreme outliers are excluded and thus may improve the quality of matches.

Within the matched group, almost all variables are not significantly different between the treated and the control group and the standard biases are relatively small (cf Table A 4 in Appendix). Figure 2 shows the standard biases of both groups, unmatched and matched, and reveals that the biases of the matched group are in general smaller.

Figure 2: Standardized % bias across covariates



Given this matching procedure the estimation yields the average treatment effect on the treated (ATT), which is in our case statistically significant on a 10% level (cf. Table 6) . Specifically, the ATT in Table 6 suggests that country pairs with PTAs on average trade 34% more, further supporting our hypothesis that PTAs may have an influence on trade beyond their impact on tariffs and NTBs.

Table 6: Results from nearest neighbor matching

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
$\ln(X_{ijp}+1)$	Unmatched	8.982	8.480	.5025	.1178	4.27
	ATT	9.073	8.780	.2939	.1573	1.87

Even though the matching procedure yields significant results, it has some weak points regarding its validity. In contrast to the regressions above, this estimation does not employ sector data, but instead uses aggregated country data, so that effects of different sectors may be offset by each other. Furthermore, this method is partly based on observables and may thus suffer from omitted variable bias. In light of the fewer fixed effects compared to the specification above, this issue might be even more likely to occur. Moreover, matching in the context of estimating the PTA impact is in general not a perfect method as it not based on perfect pre-treatment conditions. This approach needs to include all relevant covariates that influence trade and thus includes variables that do not represent the pre-treatment conditions (cf. Baier and Bergstrand, 2009b). Nevertheless, we believe that this still serves as a useful robustness check as the treatment group is fairly well matched. Hence, it provides further support for our hypothesis that additional trade stimulating factors exist.

4. Extension of the model – Additional trade stimulating factors

The preceding analysis has shown that PTA membership has effects on trade other than changes in tariffs and NTBs can explain by themselves. The coefficient of the PTA dummy is still positive and significant even when controlling for different trade costs for each country pair. The intention of the remainder of this paper is to provide some indications as to which factors might be captured by the PTA dummy variable. The question is complex in so far as two conditions need to be met by such factors: They need to be driven by PTAs while also boosting trade.

Because of the heterogeneous nature of trade agreements, in terms of both design and purpose, the economic and political elements that are potentially affected by PTAs are numerous. Countries might have geopolitical intentions and might therefore include provisions aimed at political stability, peace and security (see e.g. Moravcsik, 1998; Mansfield and Pevehouse, 2000) or threats such as terrorism and organized crime (Dür and Elsig, 2014). Hafner-Burton (2005) suggests that social factors such as human rights and labor standards are also affected by PTAs.

Of course PTAs are frequently and to large parts designed from an economic perspective, in particular to foster the free trade of goods and services. Chase (2005) points out that firms might lobby for the establishment of PTAs in an effort to gain economies of scale when entering a foreign market. Curran et al. (2008) suggest big opportunities for trade and business development if economies manage to credibly communicate their intentions. In other cases governments might intend to credibly commit to economically sound policies. Once their intentions are fixed in international contracts, voters as well as investors might take them more seriously. Allee and Elsig (2014) come to the conclusion that provisions on dispute settlement mechanisms are more important than previously acknowledged as they increase investors' confidence. Consequently, trade flows might also increase as investing firms trade their intermediate goods. Further, governments might commit to opening up government procurement to foreign vendors. Rickard (2014), however, finds that procurements rules are not effective and are primarily used by governments to justify foreign buying when it becomes necessary. Moreover, business efficiency and consequently trade flows are determined by the predictability of the business environment in general. Countries may adopt certain quality, marketing or sanitary standards that in turn can result in higher trade flows. Dee and Gali (2005) discuss several other kinds of provisions in PTA contracts that might stimulate bilateral trade such as domestic competition policies and the protection of intellectual property rights. According to Büthe and Bradford (2014) it is, however, not clear if such provisions actually support free trade objectives or merely serve as substitutes for other trade barriers. Agreements also frequently focus on investment and labor market policies. Liberal investment rules as well as articles on temporary and permanent migration permissions can lead to increased predictability and openness (Dee and Gali, 2005). Such measures could boost trade if appropriately applied and might thus help to explain some of the PTA effects analyzed in the previous chapter.

In addition to particular contract provisions, there might be other factors at play stimulating trade that cannot directly be linked to PTAs. Intuitively, all the control variables included in our gravity equations that have a positive coefficient, such as cultural similarities, are possible drivers of trade. Another example is improvements in infrastructure as suggested by Curran et al. (2008). The transport of goods is hampered by logistical problems in facilities and equipment and reductions therein have a statistically significant effect on trade as estimates by Hummels and Schaur (2013) show. These particular trade stimulating factors are not further considered below as their direct relationship with PTAs and hence their influence on bilateral trade cannot be adequately quantified. Improvements in infrastructure serve to facilitate trade in general so specific PTA effects cannot be filtered separately.

As the economic integration through trade agreements might well interact with the relocation of production factors, the following two chapters focus exclusively on these particular relationships. The three basic production factors consist of land, capital, and labor. We focus our analysis on movements in capital and labor, which are assumed to be mobile in contrast to land. When countries establish a trade agreement, trade costs widely decrease and so do information costs, which makes the partner country more attractive for both investments and migration. As shown above, trade flows increase and the PTA partner becomes more important to and more closely connected to the economy. We further discuss whether migration and FDI are working as complements to or substitutes for trade flows in order to determine whether they could be part of the additional trade stimulating factors. They might be complements due to the international division of production processes (Helpman, 1984) and shifting preferences in international societies (Felbermayr and Toubal, 2012), whereas they might be substitutes as suggested by the Heckscher-Ohlin model (Mundell, 1957).

These two specific factors provide several advantages for the analysis of the impact of PTAs on trade. First, changes in population and production facilities also influence the demand for imports and potential intermediate goods. Second, both factors are easily quantifiable compared to other changes, e.g. alignments in legal systems or the construction of infrastructure for the purpose of trade with a specific other country. Third, the potential speed of adjustment after the PTA establishment makes an econometric analysis more precise and meaningful.

In the next sections we investigate whether PTA membership has an effect on FDI and migration. As this is the case, FDI and migration are consequently included as control variables in the main gravity equation. Comparing the coefficient of the PTA dummy in the main gravity with and without the controls confirms FDI as a driver of trade initiated by PTA membership in addition to the cuts in tariffs and NTBs as the coefficient of the PTA dummy changes in magnitude. The PTA coefficient still being significant leads to the impression that there is apparently something else going on. In the case of migration, however, the effects are not that clear. Even though the coefficient of migration flows is positive and significant, the PTA coefficient does not decrease. Hence, migration cannot clearly be determined as one of the trade stimulating factors of PTAs.

5. Capital movement as a possible trade facilitating factor

In this chapter we investigate the triangle relationship between PTA membership, FDI flows and trade. As movement of capital across borders in terms of FDI is not included in our data on trade flows, it allows us to separate out the effects. After we show that PTA memberships have an impact on FDI, we conduct further empirical analysis to find that FDI flows also boost trade.

5.1. Does PTA membership affect FDI flows?

Rationale

To understand how PTA membership can influence FDI flows, it is important to recognize why investors consider foreign markets for their investment decisions. On the one hand, there are portfolio investors, who buy a certain amount of shares in foreign companies and profit from dividends and stock price gains before selling their shares again. They usually intend to benefit from diversifying their portfolio across different markets, products and sectors. On the other hand, FDI may come from direct investors through horizontal and vertical FDI. Horizontal FDI means that firms invest in foreign countries in order to serve the specific market, while firms expanding their global value chains engage in vertical FDI.

One of the most relevant factors for investors' investment decision, is likely their return after transaction costs. PTAs therefore are probably determinants of FDI flows as such agreements are often associated with higher sales and cheaper production as a consequence of more trade volumes. Serving foreign markets provides sales opportunities for the firm through horizontal FDI (Horstmann and Markusen, 1992).

Moreover, PTAs can decrease risks as well as costs for investors. Especially in developing countries fear from later expropriation can hinder investments. PTAs offer the opportunity to make credible commitments towards sound economic policies in order to attract potential investors (Buethe and Milner, 2008).

PTAs also offer new opportunities to build global value chains through the inclusion of investment provisions and guarantees in the treaties. These provisions foster the installation of international production networks by supporting the competitive edge of multinational firms (Helpman, 1984; Markusen, 1984). They also include human capital as well as intellectual property. Hence, PTAs contribute to the globalization of production when countries extend national treatment to foreign investors or provide private investors with the right to engage in dispute settlements (WTO, 2011).

The core intention of many PTAs, besides increasing investor confidence, remains however a reduction of trade costs through their focus on tariffs and NTBs. As a result, firms can trade their intermediate goods among their production sites more easily and safely and also at a lower cost. Naturally, multinational firms are likely to welcome this, with chances increasing that they would favor opening new production facilities in partner countries than in comparable non-PTA countries. Firms can thus take advantage of the best production possibilities and become more productive. Hence, overall trade flows of the PTA countries should increase as these productive firms will further engage in export as, for example, suggested by the model described in Melitz (2003).

In accordance with the above theoretical considerations, Buethe and Milner (2008) find empirical evidence that investments are indeed affected by PTA membership of the receiving country. Findings are similarly confirmed by Medvedev (2012). These models are limited by two important constraints though. First, they only consider developing countries so that no conclusion for developed economies can be derived. Second, they use overall FDI inflows instead of considering bilateral investment flows and the number of PTA memberships is employed as one of the control variables. Hence, the variable simply reflects overall integration in PTAs but it does not give any information whether the FDI actually comes from partner countries.

In contrast to all these reasons why PTA memberships could increase FDI flows, some would argue differently. First, investment guarantees are not always explicitly mentioned in the agreement contracts. Thus, investors would have to assume that their risk of expropriation is lowered, which is quite different to credible promises. Peinhardt and Allee (2012) conclude that PTA partner countries might have too high expectations from joining the agreement. In their analysis of all PTAs to which the United States are a party, they find that the increase of investment flows from the US to partner countries is relatively low. An analysis of PTA contracts by Kotschwar (2009), however, reveals that PTAs have generally become deeper over time also including provisions for investments.

Second, many countries have signed bilateral investment treaties (BITs) over the past 20 years that might have to be accounted. The United Nations Conference on Trade and Development (UNCTAD, 2010) reports 385 BITs in 1989 and 2,750 by the end of 2009, while at the same time PTAs have increased from about 200 to over 700 in the same time period (Dür et al., 2014). Linking the increase in FDI flows directly to PTAs while ignoring the existence of BITs might therefore yield misleading results. DiMascio and Pauwely (2008) point out that even though PTAs and BITs are separate contracts, they serve the complementary objectives of facilitating trade and investments. To capture the whole impact of investment commitments on FDI flows, one would need to include BITs in the regression as well. Kotschwar (2009) lists key elements of investment provisions in PTAs showing similarities between PTAs and BITs, in particular that both of them facilitate the spread of international production networks. The estimated coefficient is therefore downward biased if one would like to see the whole effect of investment clauses on FDI flows.

Model specification

In contrast to Buethe and Milner (2008) but in line with prevalent gravity models, we use bilateral data in our regressions. Bilateral gross FDI flows for the years between 1985 and 2006 are provided by the OECD ranging from -45 (USA to Australia in 2005) to 172 Billion USD (Germany to Great Britain in 2000), 60% of the data being zero and negative values representing disinvestments in assets or discharges of liabilities (OECD, 2014a). Further, information on bilateral transactions of mergers and acquisitions (M&A) is retrieved from Julian DiGiovanni (2005). The number of annual bilateral M&A transactions ranges between 0 and 393. The value of transferred capital has a minimum of -11.6 Mio. USD (Repulic of Korea to Romania in 1998) and a maximum of 7.6 Million USD (Germany to Great Britain in 1999), while less than 1% of the values are zero. Data on M&A deals are limited to the years 1990 to 1999. As in our previous gravity models, we employ geographic dyad-specific controls from CEPII (Mayer and Zignago, 2011).

Our model specification is based on a gravity model on FDI that has been applied in several other papers, including Head and Ries (2008). Similar to the gravity model on trade it has proven to be successful in explaining a great part of the variation in FDI flows. Head and Ries (2008) regress distance, dummies for common language and colonial relationship on FDI flows while controlling for country fixed effects and country pair random effects. The country pair characteristics φ_{ij} are expected to be highly correlated with the error term. Pair-wise random effects and a GLS approach are therefore used to take care of this econometric issue. Further, the estimator is consistent as confirmed by the Hausman test and to compensate for heteroscedasticity, robust standard errors (SE) are employed.

We add further control variables to arrive at the following equation:

$$(9) \quad F_{ij} = \exp\left[-\theta_0 PTA_{ij} + \theta_1 \ln\left(d_{ij}\right) + \theta_2 lang_{ij} + \theta_3 ToColy_{ij} + \theta_4 FromColy_{ij} + \varphi_t + \varphi_i + \varphi_j + \varphi_{it} + \varphi_{jt} + \left(\theta_5 \varphi_{ij} + \ln\left(\eta_{ij}\right)\right)\right]$$

The following table provides an explanation of the variables in the model.

Table 7: Overview of variables for gravity equation on FDI

Variable	Definition	Unit	Source
F_{ijt}	Value of bilateral FDI flows	Million USD	OECD
PTA_{ijt}	Dummy for common membership in PTA	Dummy	WTO
d_{ij}	Bilateral distance between countries	km	CEPII
$lang_{ij}$	Dummy for common language of trade partners	Dummy	CEPII
$ToColy_{ij}$	Dummy for FDI from colonizer to colony	Dummy	CEPII
$FromColy_{ij}$	Dummy for FDI from colony to colonizer	Dummy	CEPII
φ_i and φ_j	Dummies for exporter/importer	Dummy	
φ_{it} and φ_{jt}	Dummies for exporter/importer in certain time period	Dummy	
φ_t	Dummies for years	Dummy	
φ_{ij}	Dummies for country pair characteristics	Dummy	
ε_{ijt}	Error term		

Following Anderson and van Wincoop (2003) and Feenstra (2003) and similar to the model above, our gravity equation on FDI controls for inward and outward multilateral resistance terms by including country-time fixed effects. In addition, we include year-fixed effects to control for macroeconomic changes. Finally, trade flows are included as a control variable to capture the interaction between trade and investments. The relationship needs to be interpreted with caution as these two factors are interdependent and cause endogeneity problems. Hence, the coefficient cannot be interpreted as indicating the causal impact of trade flows on FDI flows.

Another econometric issue arises due to the prevalence of zero trade flows. Similar to the previous regressions, an insignificant small value (1 USD) is added to the FDI flows before taking the logarithm in the GLS specification. Similar to the regressions above, several versions of the PTA variable are included. In addition to the simple PTA dummy, the PTA index and the 10-year lagged PTA dummy, there are also 5-year lagged PTA dummies, and one for CUs and EIAs. Reason to include the first one is that the results between the usual PTA dummy and the 10-year lagged PTA dummy shall be compared and the 5-year lagged dummy might be helpful for the interpretation. To investigate if depth of integration is relevant for the effect, the highest degrees of integration, i.e. CU and EIA, shall also be analyzed separately. As a robustness check the PPML (Silva and Tenreyro, 2006) estimator is employed as well and both estimations are compared. Following Head and Ries (2008) standard errors are clustered at the country pair level in these estimations to account for serial correlation between the observations of the same country pair over years.

One possible issue in this analysis is that it cannot take into account observations with negative flows that represent 11 % of the data and which in turn could be a source for potential bias in the estimates. It is not clear how strong this bias is as it might stand for different developments. On the one hand, negative FDI flows might stand for disinvestments due to lack of success, distrust in the economy or political stability. These problems could be curtailed by PTA establishments as economies might be able to make credible commitments (Buethe and Milner, 2008). If a lack of trust is the reason for negative FDI flows, the PTA dummy would be strongly downward biased. On the other hand, negative FDI flows could represent payments from the assets or subsidiaries towards the investors or holding company which are higher than the previous investments of the parental firm (OECD, 2014a). There might be several business reasons such as inter-company loans or short-term trade credit for doing so, which might not necessarily be related to PTA membership and hence do not cause a bias in the PTA coefficient. When negative FDI flows actually reflect distrust of investors who take out their money, important information is left out of the regression. As explained above, investors' confidence might be an essential factor that is affected by PTA membership. Hence, the ignorance of capital outflows causes a downward bias of the coefficient and hence inclines the empirical findings in this analysis. Thus, the results need to be considered with caution.

Empirical findings and conclusion

The results below are all based on the country pair random effects (GLS) model similar to the one applied by Head and Ries (2008). To analyze the differences among the extended versions of the models, the other regression results are presented in the appendix.

In the table below, the coefficients of the five variations of the dummy representing the trade agreement are positive and highly significant. Signing a PTA treaty is associated with an increase of 190% in FDI flows in this model. Interpreting the coefficient of the PTA index is more complex than for the simple dummy variable. Here, the step between not engaging in an agreement at all and signing the simplest contract is considered to be equivalent to reaching one further step in integration is allocated the same coefficient. The coefficient is insignificant, which might be due to the lacking accuracy of the measure. Specific clauses on investment protection are probably more important than taking additional integration steps which are not directly related to investments. The coefficient of the 10 year lagged PTA dummy is the highest, which confirms our assumption of reduced endogeneity. It comes as a surprise that both the normal PTA and the 5-year lagged PTA dummy are larger than the one for CU and EIA. The 5-year lagged dummy represents a phase-in period of five years, which might be more effective than the higher degree of integration. There is no obvious explanation for the higher magnitude of the normal PTA dummy coefficient though. Regarding the control variables, all coefficients are larger than the ones shown by Head and Ries (2008).

In the appendix, the version of this specification extended by including country-time and year fixed effects as control variables is presented. Coefficients are smaller when adding country-period fixed effects and year fixed effects to the version shown below. In this specification only the coefficient of the 5-year old PTAs is significant and represents an increase of 104% in FDI flows five years after establishing a PTA. When additionally controlling for trade flows, all coefficients lose their significance, indicating an important relationship between trade and investment. Due to endogeneity the coefficient of trade flows might be highly inflated capturing the PTA effects.

Looking at the country pair random effects model similar to Head and Ries (2008), one gets the impression that PTA membership indeed has an effect on FDI flows. Further, PTA effects seem to require some time to unroll their full effect. When economies sign a trade agreement, they converge to a new steady state which might well include a new arrangement of capital and labor. As Baier and Bergstrand (2009b) point out economies might need a phase-in period in order to reach sustainable effects of the agreements. This partly explains the significant coefficients for the 5-year old PTAs in the model controlling for country, country-period and year fixed effects as well as country pair random effects. Further, the lagged PTA dummy suffers less from the downwards bias because of reduced endogeneity.

Table 8: Regression results of gravity equation on FDI (GLS, country FE)

Variables	(1) ln (F_{ijt})	(2) ln (F_{ijt})	(3) ln (F_{ijt})	(4) ln (F_{ijt})	(5) ln (F_{ijt})
PTA (WTO)	1.065***				
	(0.287)				
PTA index		0.00858			
		(0.0620)			
PTA (CU or EIA)			0.919***		
			(0.306)		
PTA (5 years)				1.061***	
				(0.377)	
PTA (10 years)					1.161**
					(0.499)
ln (d_{ij})	-2.556***	-2.669***	-2.618***	-2.575***	-2.584***
	(0.145)	(0.149)	(0.145)	(0.144)	(0.147)
$lang_{ij}$	1.798***	1.788***	1.790***	1.783***	1.778***
	(0.334)	(0.333)	(0.334)	(0.333)	(0.333)
$ToColy_{ij}$	3.451***	3.395***	3.426***	3.447***	3.436***
	(0.517)	(0.523)	(0.523)	(0.517)	(0.516)
$FromColy_{ij}$	3.519***	3.497***	3.539***	3.502***	3.495***
	(0.717)	(0.728)	(0.722)	(0.719)	(0.719)
Constant	-0.0847	0.854	0.490	0.0695	0.139
	(2.617)	(2.652)	(2.616)	(2.613)	(2.624)
Observations	12,928	12,928	12,928	12,928	12,928
Number of id	2,769	2,769	2,769	2,769	2,769
Country FE	YES	YES	YES	YES	YES
Country pair RE	YES	YES	YES	YES	YES
Country-period FE	NO	NO	NO	NO	NO
Year FE	NO	NO	NO	NO	NO
Pseudo R-squared	0.584	0.584	0.584	0.584	0.583

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As a robustness check, similar regressions using the PPML estimator as suggested by Head and Ries (2008) are provided in the appendix. The coefficients for the PTA dummies are not significant in these regressions. Hence, according to this model, PTAs might not have an impact of FDI flows. These results need to be interpreted with caution though. First, Head and Ries (2008), also found mostly insignificant coefficients for their independent variables so the model might not be well defined to explain changes in FDI flows. Second, as explained above, part of the problem could be that negative flows need to be left out for this type of regression and thus cause a downward bias of the coefficient. Third, Head and Mayer (2013) state that the PPML estimator tends to underestimate the magnitude of the PTA effect. Similarly, the coefficients of each variation of the PTA dummy in the regression on M&A flows are not significant. According to these estimations, PTA membership thus does not have an influence on M&A deals. The results might be biased due to similar reasons as the PPML regression on FDI though.

Overall the regression results indicate that PTA membership might have a positive effect on FDI flows even though this relationship is not confirmed by all regression specifications. Considering potential biases in these estimations with insignificant PTA coefficients though, one might still come to the conclusion that FDI could be one of the additional trade stimulating factors of PTAs. In the next step, it is further analyzed if FDI flows also increase trade flows.

5.2. Is FDI part of the trade stimulating factors of PTAs?

Rationale

In order to attribute trade increases to FDI, PTAs must not only drive FDI, but FDI must also boost trade. While we have shown in the previous section that the first seems to be the case, the latter requirement is analogous to the widely discussed question whether trade and FDI are substitutes or complements.

To be a complement to trade, FDI would have to play a major role in intensifying the trade relationship between two countries. From a theoretical point of view, it seems plausible that global value chains lead to higher trade flows between two countries as intermediate goods are sent towards the factory contributing to the next step in the production process. Vertical FDI firms are able to divide their production process into segments depending on the production factor intensity of certain steps, such that factor abundance becomes decisive for the factory location (Helpman, 1984). Especially in the case of a common PTA, this effect would be expected to be reinforced as trade costs are reduced. Empirical studies have shown that trade in parts and product components is evidently higher between countries with PTAs and may even have been one of the major motivations for establishing the latest generation of PTAs (WTO, 2011). Intra-firm trade might even contribute to the design of PTAs. Hicks and Kim (2012) provide empirical evidence that production networks can partly explain the depth and design of PTAs. Further, Fontagné (1999) reveals that FDI has indeed fostered trade after the mid-1980s.

In contrast to the theory of complements, advocates of a substitutionary relationship usually rely on the Heckscher-Ohlin model (cf. e.g. Mundell, 1957). According to their model, economies sell capital-intensive (labor-intensive) goods if they are capital-abundant (labor-abundant) and therefore indirectly export the production factor. Thus, FDI would not be required as economies can specialize and then import the goods they do not produce themselves. More recently, theories on the location of firms have come to a similar conclusion (Horstmann and Markusen, 1992). They argue that horizontal FDI replaces trade as firms install a new subsidiary in the partner country instead of transporting the goods between the countries in order to avoid tariffs and other trade costs. As a trade-off, however, firms face higher fixed costs from the new production site. Helpman et al. (2004) argue that intra-industry firm heterogeneity matters in explaining the decision between exporting to and horizontal FDI in a foreign country, as only the most productive firms actually invest. Consequently, trade and FDI could be regarded as substitutes for a firm that has achieved the highest productivity status.

Overall, it remains unclear whether trade and FDI are complements or substitutes. Theory thus offers no clear guidance for our expectations for the sign of the coefficient of the FDI variable in our gravity equations. Taking the recent developments of globalized production networks into account (UNCTAD, 2013), it seems plausible that vertical FDI has been dominant and that the coefficient would be positive for a dataset over the past decades.

Empirical analysis

All data sources are the same as in the previous gravity equation on trade. The variations of the model generally remain the same as in section 3 but they are complemented with FDI flows (OECD, 2014a) as control variables.

The regression results derived from the extended gravity model on trade indicate that FDI might be one of the additional trade stimulating effects. Table 9 below shows different versions of the GLS model replicating the gravity model on trade shown above. Here, only the data for which FDI flows are also available are used so the changes in the coefficients when including FDI flows as a control variable can be observed. The first two PTA coefficients (columns 1 to 4) decrease when FDI flows are added indicating that part of the PTA effects are captured by this control variable. All coefficients for FDI flows are positive and highly significant, leading to the impression of a positive and therefore complementary relationship between trade and investments. As the two factors are probably interdependent, the coefficient needs to be interpreted with caution due to endogeneity issues. It is important to see that also the coefficients of the control variables change, which might be due to the inflation of the FDI coefficient but could also be a sign that FDI does not only capture parts of the PTA effect. In line with this observation, the two PTA coefficients for the normal PTA dummy and the CU or EIA dummy do not change in the same difference in magnitude as the coefficient of the FDI flows suggests. Furthermore, the coefficient of the 10-year lagged PTA dummy increases when FDI flows are included. Instead the coefficients for common language and the two dummies for colonial relationship decrease indicating multicollinearity problems among the independent variables. Besides that it needs to be considered that the coefficient of the 10-year lagged dummy variable is slightly larger than the one estimated in section 3 (which was 0.147) as a different dataset is used. This smaller dataset might be biased due to the selection of specific country pairs for which FDI data was available.

The coefficients of the PTA dummies still being positive and highly significant can be interpreted as a sign there is probably something else going on. This result does not come as a surprise, as several factors are possibly driving trade flows between PTA partner countries as discussed above.

Table 9: Regression results of gravity equation on trade controlling for FDI

VARIABLES	(1) $\ln(1 + X_{ijp})$	(2) $\ln(1 + X_{ijp})$	(3) $\ln(1 + X_{ijp})$	(4) $\ln(1 + X_{ijp})$	(5) $\ln(1 + X_{ijp})$	(6) $\ln(1 + X_{ijp})$
PTA (WTO)	0.146**	0.141***				
	(0.0576)	(0.0544)				
PTA (CU or EIA)			0.193***	0.181***		
			(0.0747)	(0.0701)		
PTA (10 years)					0.178**	0.196***
					(0.0760)	(0.0699)
$\ln(F_{ij})$		0.0425***		0.0425***		0.0427***
		(0.00300)		(0.00300)		(0.00301)
$\ln(1 + tariff_{ijp})$	-0.930***	-0.930***	-0.930***	-0.930***	-0.931***	-0.930***
	(0.101)	(0.101)	(0.101)	(0.101)	(0.101)	(0.101)
$\ln(NTM_{jp})$	0.0990	0.0989	0.0991	0.0990	0.0990	0.0989
	(0.0633)	(0.0633)	(0.0633)	(0.0633)	(0.0633)	(0.0633)
$\ln(d_{ij})$	-1.307***	-1.201***	-1.308***	-1.202***	-1.312***	-1.204***
	(0.0329)	(0.0323)	(0.0327)	(0.0320)	(0.0325)	(0.0320)
$bord_{ij}$	0.809***	0.840***	0.806***	0.837***	0.794***	0.825***
	(0.142)	(0.125)	(0.142)	(0.125)	(0.142)	(0.126)
$lang_{ij}$	0.503***	0.387***	0.508***	0.392***	0.510***	0.394***
	(0.0855)	(0.0804)	(0.0854)	(0.0804)	(0.0854)	(0.0804)
col_{ij}	0.910***	0.772***	0.912***	0.774***	0.911***	0.773***
	(0.113)	(0.104)	(0.113)	(0.104)	(0.113)	(0.104)
$comcol_{ij}$	1.825***	1.426***	1.823***	1.424***	1.816***	1.416***
	(0.318)	(0.316)	(0.318)	(0.316)	(0.318)	(0.318)
Constant	10.62***	10.65***	10.64***	10.67***	10.64***	10.67***
	(0.453)	(0.449)	(0.453)	(0.448)	(0.453)	(0.448)
Observations	295,725	295,725	295,725	295,725	295,725	295,725
Number of id	2,397	2,397	2,397	2,397	2,397	2,397
Sector FE	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES
Country pair RE	YES	YES	YES	YES	YES	YES
Pseudo R-squared	0.659	0.662	0.659	0.662	0.659	0.662

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

6. Labor movement as a possible trade facilitating factor

In order to evaluate whether migration may also be part of the trade stimulating drivers of PTAs, two main steps need to be taken similar to the analysis of FDI. In the first place, it needs to be shown that PTAs actually influence migration so that a further connection would be thinkable. In the second step, it needs to be considered if migration potentially affects trade flows so that the indirect link could be drawn.

6.1. Does PTA membership affect migration flows?

To determine whether PTA membership has an influence on migration flows, we are going to make use of a theoretical as well as an empirical approach.

Rationale

General observations indicate that both PTA prevalence and migration flows have increased over time. More specifically, global migrant stocks increased from 106 million to 167 million between 1970 and 2000 (Özden et al., 2011). As mentioned above the number of PTAs has strongly increased as well in the past decades (WTO, 2011). Even though this does not necessarily imply causality, it is still plausible that these developments are interlinked. In fact, PTA contracts themselves sometimes go beyond tariff reductions by including migration related provisions, e.g. visa and asylum or labor market related agreements (Horn et al., 2010). These measures help migrants from PTA members to reduce non-monetary migration costs by improving access to information or simplifying the procedures to obtain a visa or a job. Generally, migration is more legally constrained than trade in goods as voters are usually more open towards trade than migration (Mayda, 2008). Policymakers can take advantage of the public support towards a trade agreement and integrate visa and asylum or labor market provisions in these treaties in order to take care of e.g. labor shortage. Due to the former restrictions developments in migration flows might be even stronger compared to effects on trade when constraints are relaxed (Orefice, 2012). As the WTO Report 2011 points out, firms also appreciate free movement of their corporate personnel, so migration policies might also be designed to attract multinational firms.

To see if PTA and migration could in fact be related, it is essential to understand possible drivers of migration. A potential migrant deliberates about financial opportunities when moving to another country and whether they exceed migration costs. Financial opportunities are influenced by *push* factors from the country of origin and *pull* factors from the destination country driven by differences in income, income opportunities and inequalities. Migration costs, on the other hand, are deduced from cost of travel, information about the potential destination country and personal or emotional costs of leaving one's social life behind. The information and personal costs could be potentially lowered by migrant networks. Another hypothesis raised by Orefice (2012) is that PTAs actually lower information costs as countries' ties increase. The author provides further details on the direction of specific PTAs. His regressions show even higher coefficients, when the PTA variable is more specified in terms of labor market related contents. Apart from permanent migration, temporary movement permissions are essential for many multinational firms (WTO, 2011). Countries have the opportunity to make credible commitments towards openness if they agree on liberal labor market provisions, which consequently gain the attention of multinational firms. Moreover, temporary migrants who join business networks in the destination country are more likely to stay if visa and job procedures are more flexible.

Even though it seems plausible and also has been show empirically, there are still some reasons why PTAs might actually not boost migration. First, the General Agreement on Trade in Services (GATS) provisions should take care of temporary migrants and hence lead to the aforementioned results but Orefice (2012) does not find empirical evidence for this reasoning. Second, the effect might mostly depend on the explicit provisions written down in the treaty. As a results if no specific labor market provisions are included, restrictions do not change but only information flows might increase. It is not clear if the effect would be strong enough and if migration flows change in this case.

An empirical analysis using the gravity equation for bilateral migration flows shall give further insights on this question. Controlling for commonly used gravity variables to capture the previously discussed *push* and *pull* factors, PTA membership is also included as an independent variable in the equation. The model mainly follows current finding in gravity research as it can be found in Anderson and van Wincoop (2003) and is closely following the model including a PTA variable used by Orefice (2012) but considers different datasets and time horizons.

Model specification

An empirical analysis using the gravity equation for bilateral migration flows shall give further insights on this question. Controlling for commonly used gravity variables to capture the previously discussed *push* and *pull* factors, PTA membership is also included as an explanatory variable in the equation. The model follows current findings in gravity research. It is alike to Anderson and van Wincoop (2003) and Anderson (2011) and closely follows the model used by

Orefice (2012), as we too work with a PTA dummy variable. We do, however, use different time horizons.

The dependent variable in our model is bilateral migration flows. The underlying data is retrieved from the OECD database (OECD, 2014b) and covers gross inflows of foreign-born population in the years 1990 to 2011. The data ranges from zero to 946,167 people migrating (maximum from Mexico to the United States in 1991). Zero flows represent approximately 60% of the data, so that missing values can be interpreted as actually missing and the PPML estimation can be used. Data on population and GDP per capita comes from the World Development Indicators provided by the Worldbank (2014). Besides that an additional PTA dummy variable based on the PTA database by the WTO (2014) is introduced as DESTA does not consider migration provisions as one of the seven key provisions but only services.

The following equation resembles the interconnection of the various factors influencing migration flows M_{ij} on the left-hand side:

$$(10)\quad M_{ij} = \frac{L_i N_j}{N} * \frac{\frac{1}{c_{ij}}}{\Omega_i \Psi_j}$$

L_i and N_j represent the total population living in country *i* and *j*. The second ratio expresses the migration costs, with Ω_i being the inward migration resistance term and Ψ_j being the outward migration resistance term. Migration costs are represented by c_{ij}. Transformed into an empirical model form with log-linearized variables, the regression looks as follows:

$$(11)\quad \ln(M_{ijt}) = \alpha + \beta_0 * \ln(L_{it}) + \beta_1 * \ln(N_{jt}) + \beta_2 * PTA_{ijt} + \beta_3 * \mathrm{Z}_{ijt} + \varphi_t + \varphi_i + \varphi_j + \varphi_{ij} + \varphi_{it} + \varphi_{jt} + \varepsilon_{ijt}$$

Table 10: Overview of variables for gravity equation on migration

Variable	Definition	Unit	Source
M_{ijt}	Value of bilateral migration flows	'000 People	OECD
L_{it} / N_{jt}	Population in home and host country	'000 People	Worldbank
PTA_{ijt}	Dummy for common membership in PTA	Dummy	WTO
inc_{it} / inc_{jt}	GDP per capita in home and host country	USD	Worldbank
$diff\_inc_{ij}$	Difference in GDP per capita in both countries	USD	Worldbank
$diff\_inc\_2_{ij}$	Square of difference in GDP per capita		Worldbank
Z_{ijt}	Vector of control variables		
φ_i and φ_j	Dummies for exporter/ importer	Dummy	
φ_{it} and φ_{jt}	Dummies for exporter/importer in a time period t	Dummy	
φ_t	Dummies for years	Dummy	
φ_{ij}	Dummies for country pair characteristics	Dummy	
ε_{ijt}	Error term		

Controls Z_{ijt} include logarithms of per capita GDP in both countries and the difference between the logarithms of per capita GDP and their square. Assuming that income differences become more relevant the higher they are, this specification captures differences in income between countries of origin and destination countries in their non-linear form. Further, these factors serve to capture differences in factor endowments and therefore the inward and outward migration resistance terms. One important control, especially in light of our overall research question, is the log of lagged imports in order to retrieve the pure effect of the PTA on migration and controlling for the influence of high trade flows between two countries.

As discussed in Orefice (2012), there are some econometric issues to be accounted for. First, if migration flows affect income levels reversal causality would be an issue. To mitigate this risk, we included lagged values of per capita GDP and simultaneously use the lagged *PTA* dummy variable Second, the lack of a control for bilateral migration policies can cause omitted variable bias. Similar to the models on trade flows and FDI flows, country fixed effects are included in order to control for this. Third, PTAs might have been a response to social pressure, which could also lead to reversal causality problems. We control for these two endogeneity issues by including country pair random effects. Finally, the prevalence of zero migration flows is once more a problem as we again use a log-linearized model. However, there are two ways to solve this problem as explained above: Adding one unit to each migration flow and using the PPML estimation.

In addition, country-time fixed effects are included to capture all inward and outward multilateral resistance terms that are not captured by other control variables. Moreover, year fixed effects take into account macroeconomic differences over time. In contrast to Orefice (2012) we use country pair random effects as we assume serial correlation in the error term. The Hausman test suggests that this estimator is consistent.

Empirical findings and conclusion

Table 11 shows the results from the regressions controlling for trade flows. For comparison further tables providing the regression results from the GLS models without controlling for trade as well as the PPML estimations are included in the appendix.

The empirical results from the GLS regression indicate that PTA membership might indeed have an impact on migration flows. All coefficients of the varying PTA dummies are positive and statistically significant. The only exception is the model, which includes the 10-year lagged PTA dummy indicating that a phase-in period might not be essential for the development of migration. Further, a large number of agreements were signed since the 1990s so the number of PTAs older than 10 years included in the dataset is rather small. In fact, depth of an agreement is probably more important than age. Both the coefficients for the PTA dummy and index are positive and significant in model (6). Engaging in a PTA in the first place is associated with an increase in migration flows of 23.6%. Each further step in integration is related to an increase of 9.7% as the PTA index indicates. Similarly, the coefficient of the PTA for CU and EIA is positive and highly significant and also larger than the coefficients for the lagged dummies.

Even though the GLS model supports the intuition that PTA membership has an impact on migration flows, the results are not robust when employing the PPML estimator. In contrast to Orefice (2012), the coefficients estimated by the PPML model are partly negative and significant in some regressions and insignificant in others. However, other control variables except for differences in GDP are not significant in these regressions either, which might indicate that the model specification is not appropriate as a whole.

Further, the analysis cannot replicate the whole theory mentioned above. The data does not give any information on corporate personnel that is temporally sent to foreign countries and thus contributes to trade inside the multinational firm. It is important to see that the data is not consistently measured for all countries (OECD, 2014b), as illegal immigrants are partially covered and as visa regulations differ significantly among countries. Thus, the inflow of foreign population does not always include the same defined group. One of the reasons why the estimated coefficients differ from the ones reported by Orefice (2012) might be that the sample size is significantly larger (49,528 to less than 7,500 by Orefice, 2012) and covers 200 countries of origin (vs. 207 by Orefice, 2012) and 38 destination countries (vs. 29 by Orefice, 2012).

Table 11: Regression results of gravity equation on migration (including trade)

VARIABLES	(1) ln (M_{ijt})	(2) ln (M_{ijt})	(3) ln (M_{ijt})	(4) ln (M_{ijt})	(5) ln (M_{ijt})	(6) ln (M_{ijt})
PTA (WTO)	0.387***					
	(0.0549)					
PTA (DESTA)						0.212**
						(0.0931)
PTA index		0.144***				0.0929***
		(0.0184)				(0.0254)
PTA (CU or EIA)			0.233***			
			(0.0667)			
PTA (5 years)				0.165***		
				(0.0574)		
PTA (10 years)					0.0167	
					(0.0570)	
ln ($1 + v_{ijt}$)	0.0339***	0.0336***	0.0344***	0.0347***	0.0349***	0.0335***
	(0.00459)	(0.00459)	(0.00460)	(0.00460)	(0.00460)	(0.00458)
ln (L_{it})	0.247*	0.154	0.199	0.226*	0.164	0.153
	(0.132)	(0.134)	(0.133)	(0.132)	(0.134)	(0.134)
ln (N_{jt})	2.501***	2.592***	2.606***	2.562***	2.606***	2.584***
	(0.390)	(0.390)	(0.389)	(0.390)	(0.390)	(0.390)
ln (inc_{it})	-0.106	-0.144*	-0.118	-0.1000	-0.113	-0.147*
	(0.0844)	(0.0845)	(0.0843)	(0.0845)	(0.0843)	(0.0845)
ln (inc_{jt})	1.743***	1.783***	1.754***	1.763***	1.767***	1.785***
	(0.141)	(0.141)	(0.141)	(0.141)	(0.141)	(0.141)
ln($diff\_inc\_2_{ij}$)	0.0202**	0.0115	0.0172**	0.0185**	0.0177**	0.0109
	(0.00874)	(0.00884)	(0.00874)	(0.00875)	(0.00873)	(0.00884)
Constant	-72.41***	-72.65***	-73.66***	-73.47***	-73.27***	-72.51***
	(8.762)	(8.755)	(8.727)	(8.757)	(8.762)	(8.755)
Observations	49,528	49,528	49,528	49,528	49,528	49,528
Number of id	4,843	4,843	4,843	4,843	4,843	4,843
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Country-time FE	YES	YES	YES	YES	YES	YES
Country pair RE	YES	YES	YES	YES	YES	YES
Robust SE	YES	YES	YES	YES	YES	YES
Pseudo R-squared	0.662	0.665	0.659	0.660	0.659	0.666

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

6.2. Is migration part of the trade stimulating effects?

Given that PTAs do seem to at least partially drive migration, this final section completes the link to trade. We show that PTA induced migration also drives trade and as such has similarly positive effects on the economy as the increase in FDI and reduced tariffs and NTBs.

Rationale

As for international capital flows, there is also some ambiguity whether migration is a complement or substitute of trade. Genc et al. (2012) survey theories on this question and conduct a meta-analysis of previous empirical research on the relationship between trade and migration.

Theory suggests that migration promotes trade on both a macro and micro level. In macroeconomic terms demand and output in the economy increase as populations grow and with them their imports. Further, labor mobility and potential decreases in wages lead to lower variable production costs and as such increase international competitiveness of domestic firms. Consequently, exports increase (Melitz, 2003).

On a microeconomic level, immigrants influence the overall demand in certain goods through their preferences for products from their home country and their continuing social links. Felbermayr and Toubal (2012) find empirical evidence that migrants increase the demand for goods from their country of origin. Beyond this, migration decreases trade costs in several ways. First, immigrants benefit from their knowledge of the language in their home country. Second, they profit from a better understanding of institutional and legal arrangements in their home country. Third, a larger group of immigrants from a certain country could also increase trust in business relationships. The meta-analysis of empirical studies by Genc et al. (2012) confirms the theoretical suggestion that migration and trade are rather complements than substitutes (see also Nana and Poot, 1996; Gaston and Nelson, 2011; Bowen and Pédussel-Wu, 2011).

Conventional neoclassical trade theory such as the Heckscher-Ohlin-model, however, implies that migration and trade are rather substitutes than complements. The reasoning is similar to the one for FDI: countries indirectly export their abundant production factor. Lewer and Van den Berg (2009) argue that traditional theory might not be able to fully explain the relationship between migration and trade. There are also empirical limitations as both migration and trade have shown a parallel, increasing trend over the past decades. Even though many empirical studies have confirmed that migration and trade flows are closely connected (Head and Ries, 1998; Wagner et al., 2002; Rauch and Trindade, 2002; Bandyopadhyay et al., 2008), no obvious conclusion on the causal direction has emerged in the literature. One implication of this is that the causality might be running in the opposite direction: PTAs might be influencing trade in a way that fosters migration, which would seem particularly likely if labor is more mobile than expected and people opt to relocate in order to seek higher financial opportunities in places with scarce labor. Empirical analyses by Aguiar et al. (2007), however, provide evidence that trade flows do not significantly explain migration flows. In order to account for this issue, Orefice (2012) makes use of a Propensity Score Matching approach to confirm that PTA membership has a positive impact on migration flows and derives similar results as from his further regressions explained above.

Similar to FDI, migration cannot conclusively be categorized as a substitute or complement of trade. Empirical results and recent theoretical research indicate that the relationship is rather complementary. Hence, we would expect, as it turns out to be the case, a positive sign on the coefficient of the migration variable.

Empirical analysis

The gravity model is similar to the one previously used in section 3. It is extended by controlling for migration flows. Table 12 below shows that the coefficient of the PTA is not significant in two of three regressions even without migration flows. The regressions cover different samples than the one in section 3 as only country pairs and years are included for which information on migration flows is available. For the dummy variable of the two most integrated forms of PTAs, i.e. CU or EIA, the coefficient is significant. When adding migration flows, the coefficient increases and coefficients of the control variables also change suggesting multicollinearity. Most strikingly, the coefficient of common language becomes insignificant. It makes sense that migration and language are related as migrants face lower migration costs in countries where they are native speakers. One would argue similarly to explain why the coefficient of *colony* decreases, as the colonial relationship indicates cultural similarities as explained above. Even though the coefficient of migration flows is positive, indicating that migration actually boosts trade, it cannot be concluded that migration is necessarily one of the additional trade stimulating factors.

As shown in the appendix the results slightly differ when no country pair random effects are included. In both the Least Squares and the PPML model the coefficient of PTA membership is positive and highly significant. More importantly, they decrease when trade flows are added. These findings actually suggest that migration might be one of the trade stimulating factors. However, the coefficients for the other PTA dummy types do not support this finding.

Table 12: Regression results of gravity equation on trade controlling for migration

VARIABLES	(1) $\ln(1+X_{ijp})$	(2) $\ln(1+X_{ijp})$	(3) $\ln(1+X_{ijp})$	(4) $\ln(1+X_{ijp})$	(5) $\ln(1+X_{ijp})$	(6) $\ln(1+X_{ijp})$
PTA (WTO)	0.0898	0.0996				
	(0.0921)	(0.0835)				
PTA (CU or EIA)			0.230**	0.308***		
			(0.108)	(0.0997)		
PTA (10 years)					0.0332	0.0960
					(0.112)	(0.105)
$\ln(M_{ijt})$		0.194***		0.197***		0.194***
		(0.0162)		(0.0159)		(0.0164)
$\ln(1+\text{tariff}_{ijp})$	-0.475**	-0.467**	-0.476**	-0.469**	-0.475**	-0.466**
	(0.207)	(0.207)	(0.207)	(0.207)	(0.207)	(0.207)
$\ln(NTM_{jp})$	0.00319	0.00342	0.00312	0.00331	0.00321	0.00348
	(0.0896)	(0.0896)	(0.0896)	(0.0896)	(0.0896)	(0.0896)
$\ln(d_{ij})$	-1.200***	-1.039***	-1.189***	-1.017***	-1.210***	-1.043***
	(0.0388)	(0.0378)	(0.0388)	(0.0374)	(0.0377)	(0.0365)
$bord_{ij}$	0.985***	1.049***	0.992***	1.063***	0.974***	1.038***
	(0.154)	(0.132)	(0.155)	(0.131)	(0.153)	(0.131)
$lang_{ij}$	0.382***	0.0647	0.382***	0.0586	0.386***	0.0677
	(0.0951)	(0.0849)	(0.0946)	(0.0841)	(0.0947)	(0.0845)
col_{ij}	1.013***	0.635***	1.024***	0.644***	1.010***	0.631***
	(0.143)	(0.115)	(0.144)	(0.115)	(0.143)	(0.114)
$comcol_{ij}$	1.826**	1.749*	1.849**	1.784*	1.808**	1.738*
	(0.826)	(0.971)	(0.824)	(0.970)	(0.825)	(0.971)
Constant	14.08***	13.21***	13.96***	13.02***	14.16***	13.26***
	(0.426)	(0.382)	(0.425)	(0.379)	(0.419)	(0.373)
Observations	173,093	173,093	173,093	173,093	173,093	173,093
Number of id	1,489	1,489	1,489	1,489	1,489	1,489
Sector FE	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES
Country pair RE	YES	YES	YES	YES	YES	YES
Pseudo R-squared	0.667	0.671	0.667	0.671	0.667	0.671

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Even though some regressions have different results, we find that migration does not seem to be one of the strong trade stimulating factors. There might be some weak influence but it is not as clear as for FDI.

7. Conclusion

Given the increasing prevalence and prominence of PTAs, the intention of this paper was to address the puzzle of the strikingly high estimates of trade creation. To this end, we investigated whether additional trade stimulating drivers of PTAs beyond the reductions in trade costs exist. Employing gravity equations, we find significant, positive coefficients for PTAs and thus conclude that PTA membership indeed seems to have a positive impact on trade even when controlling for changes in tariffs and NTBs. Throughout different model specifications and econometric approaches, this finding appears to be fairly stable. Despite the fact that the model variations still suffer from a few weaknesses, mainly due to constraints in the empirical method or the underlying data, we conclude that additional drivers of trade that are associated with PTAs might well exist.

Having provided evidence for the existence of additional drivers, the subsequent part identifies, based on theory, that both investments and migration may be further trade stimulating factors and thus lay the foundation for further analysis. After confirming a positive relation between PTAs and both migration and FDI, we include those factors as controls in the initial gravity equation on trade. Those results suggest that in particular FDI is likely to also have a positive impact on trade flows and thus might well represent an additional trade stimulating factor. The role of migration, on the contrary, cannot be clearly determined.

Nevertheless, these findings should be considered in light of some limitations. Even though we try to base the estimations and analyses on consistent theory, there are limitations in our context. One weakness arises from constraints in the availability of the underlying data. In particular, the data on NTBs limits the variations and does, for example, not allow for panel data analysis. Furthermore, it is important to see that we partly neglect the heterogeneity of PTAs, as the estimated impacts can only be considered as the average treatment effect of all forms of PTAs. To assign the magnitude of the effect, one should distinguish between the depth, intention, flexibility, and enforceability of the included measures. Deep reaching agreements explicitly include provisions in the treaty, while in other cases developments might rather be inadvertent reactions of the PTA establishment. Both foreign investments as well as labor movements are regularly listed as provisions in the contract texts. While investments, on the one hand, even resemble one of the seven key provisions mentioned by Dür et al. (2014), measures on migration vary concerning their depth, ranging from simple service provisions to far-reaching labor market policies. Similar to Dür et al. (2014), our findings suggest that depth matters in all contexts, but this is specifically true for migration. To take the discussion one step further, one would need to consider that FDI and migration might actually partly be substitutes as migrants might transfer knowledge from their home to their host country.

Despite the above mentioned limitations we altogether conclude that there are indeed additional trade stimulating factors beyond cuts in tariffs and NTBs. Combining the different findings in this thesis, we believe that in particular FDI represents one of them as it is not only positively affected by PTAs but also seems to boost trade flows.

Future research is necessary to determine which other factors and developments induce these high rises in trade flows among PTA country pairs. One speculative reason would be that PTA members form alliances excluding and therefore negatively affecting third countries. They might establish some forms of unofficial custom union which benefit members at the cost of non-members. Besides that this question opens up further possibilities for future research. The model could be extended by including interaction terms of the PTA dummy and the suspected trade stimulating factor. Also, as mentioned above, it would be advantageous to use panel data for this analysis.

Given the results of our analysis, we can derive two main policy implications. First, PTAs seem to provide a second best alternative to multilateral economic integration through the WTO. Despite negative third-country effects, PTAs provide many advantages for member countries through closer economic connection and higher trade. Further, PTAs can also have spill-over effects that positively affect third countries as they might align to the standards that PTA members agreed on and might thus decrease their own trade costs as well. Second, politicians should consider PTAs as a valid opportunity to make credible commitments to sound economic policies, which might attract foreign investors.

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Appendix

Table A 1: List of countries

Country Code	Country	Country Code	Country
8	Albania	454	Malawi
12	Algeria	458	Malaysia
32	Argentina	466	Mali
36	Australia	480	Mauritius
40	Austria	484	Mexico
50	Bangladesh	498	Moldova, Rep.of
68	Bolivia	504	Morocco
76	Brazil	512	Oman
96	Brunei Darussalam	528	Netherlands
112	Belarus	554	New Zealand
120	Cameroon	558	Nicaragua
124	Canada	566	Nigeria
144	Sri Lanka	579	Norway
152	Chile	598	Papua New Guinea
156	China	600	Paraguay
170	Colombia	604	Peru
188	Costa Rica	608	Philippines
203	Czech Republic	616	Poland
208	Denmark	620	Portugal
222	El Salvador	642	Romania
231	Ethiopia	643	Russian Federation
233	Estonia	646	Rwanda
246	Finland	682	Saudi Arabia
251	France	686	Senegal
266	Gabon	699	India
276	Germany	702	Singapore
288	Ghana	705	Slovenia
300	Greece	711	South Africa
320	Guatemala	724	Spain
340	Honduras	736	Sudan
344	Hong Kong (SARC)	752	Sweden
348	Hungary	757	Switzerland
352	Iceland	764	Thailand
360	Indonesia	780	Trinidad and Tobago
372	Ireland	788	Tunisia
381	Italy	792	Turkey
384	Côte d'Ivoire	800	Uganda
392	Japan	804	Ukraine
398	Kazakstan	818	Egypt
400	Jordan	826	United Kingdom
404	Kenya	834	Tanzania, United Rep. of
410	Korea, Rep. of Korea	842	United States of America
422	Lebanon	854	Burkina Faso
428	Latvia	858	Uruguay
440	Lithuania	862	Venezuela
450	Madagascar	894	Zambia

Table A 2: List of migration destination countries

Country Code	Country	Country Code	Country
36	Australia	428	Latvia
40	Austria	440	Lithuania
124	Canada	484	Mexico
152	Chile	528	Netherlands
203	Czech Republic	554	New Zealand
208	Denmark	579	Norway
233	Estonia	616	Poland
246	Finland	620	Portugal
251	France	642	Romania
276	Germany	643	Russian Federation
300	Greece	705	Slovenia
348	Hungary	724	Spain
352	Iceland	752	Sweden
372	Ireland	757	Switzerland
381	Italy	792	Turkey
392	Japan	826	United Kingdom
410	Korea, Rep. of Korea	842	United States of America

Table A 3: Regression results of main gravity equation with latest PTA dummy

Variables	(1) ln (1 + X_{ijp})	(2) ln (1 + X_{ijp})	(3) X_{ijp}	(4) X_{ijp}
PTA (DESTA)	0.239***	0.240***	0.380***	0.384***
	(0.0517)	*(0.0517)*	*(0.0439)*	*(0.0439)*
ln (1 + tariff_s_{ijp})	-0.785***		-2.180***	
	(0.0507)		*(0.372)*	
ln (1 + tariff_w_{ijp})		-0.455***		-1.703***
		(0.0450)		*(0.416)*
ln (NTB_{jp})	0.0290	0.0330	0.0370	0.0546
	(0.0319)	*(0.0320)*	*(0.155)*	*(0.155)*
ln (d_{ij})	-0.631***	-0.631***	-0.285***	-0.286***
	(0.0517)	*(0.0517)*	*(0.0140)*	*(0.0140)*
$bord_{ij}$	2.139***	2.143***	1.097***	1.094***
	(0.123)	*(0.123)*	*(0.0450)*	*(0.0449)*
$lang_{ij}$	0.583***	0.584***	0.448***	0.448***
	(0.0550)	*(0.0550)*	*(0.0513)*	*(0.0512)*
col_{ij}	0.846***	0.845***	0.142**	0.145**
	(0.122)	*(0.122)*	*(0.0585)*	*(0.0584)*
$comcol_{ij}$	0.530***	0.529***	0.485***	0.483***
	(0.0622)	*(0.0622)*	*(0.143)*	*(0.144)*
Constant	5.939***	5.903***	4.819***	4.753***
	(0.521)	*(0.521)*	*(0.337)*	*(0.337)*
Observations	890,664	890,664	890,664	890,664
Method	OLS	OLS	PPML	PPML
Country FE	YES	YES	YES	YES
Sector FE	YES	YES	YES	YES
County pair RE	YES	YES	NO	NO
R-squared	0.563	0.563	0.280	0.281

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A 4: Regression results of main gravity equation with latest PTA index

Variables	(1) ln (1 + X_{ijp})	(2) ln (1 + X_{ijp})	(3) X_{ijp}	(4) X_{ijp}
PTA index	0.114***	0.115***	0.0695*	0.0706*
	(0.0166)	(0.0166)	(0.0373)	(0.0372)
ln (1 + $tariff\_s_{ijp}$)	-0.785***		-2.202***	
	(0.0507)		(0.457)	
ln (1 + $tariff\_w_{ijp}$)		-0.455***		-1.709***
		(0.0450)		(0.506)
ln (NTB_{jp})	0.0290	0.0330	0.0374	0.0554
	(0.0319)	(0.0320)	(0.160)	(0.159)
ln (d_{ij})	-0.631***	-0.631***	-0.314***	-0.315***
	(0.0505)	(0.0506)	(0.0537)	(0.0537)
$bord_{ij}$	2.155***	2.159***	1.077***	1.074***
	(0.123)	(0.123)	(0.135)	(0.134)
$lang_{ij}$	0.599***	0.600***	0.468***	0.468***
	(0.0548)	(0.0548)	(0.105)	(0.104)
col_{ij}	0.869***	0.867***	0.141	0.144
	(0.121)	(0.121)	(0.120)	(0.119)
$comcol_{ij}$	0.524***	0.523***	0.512***	0.511***
	(0.0624)	(0.0624)	(0.182)	(0.182)
Constant	6.011***	5.975***	5.256***	5.193***
	(0.504)	(0.504)	(0.842)	(0.843)
Observations	890,664	890,664	890,664	890,664
Method	GLS	GLS	PPML	PPML
Country FE	YES	YES	YES	YES
Sector FE	YES	YES	YES	YES
Country pair RE	YES	YES	NO	NO
R-squared	0.564	0.564	0.276	0.277

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A 5: Balancing results of Propensity Score matching

Variable	Unmatched Matched	Mean Treated	Mean Control	% bias	% reduct bias	t-test t	t-test p>t
$\ln(1 + tariff_{ijp})$	U	.07754	.08341	-8.3		-3.15	0.002
	M	.07908	.07606	4.2	48.7	1.16	0.248
$\ln(NTB_{jp})$	U	.11411	.11447	-0.3		-0.12	0.903
	M	.11619	.1167	-0.5	-42.9	-0.13	0.899
$\ln(GDP_i)$	U	24.702	25.063	-18.6		-6.83	0.000
	M	24.767	24.85	-4.2	77.1	-1.19	0.233
$\ln(GDP_j)$	U	24.703	24.885	-9.5		-3.55	0.000
	M	24.757	24.89	-7.0	26.5	-1.95	0.052
total GDP_{ij}	U	49.385	49.953	-20.9		-7.72	0.000
	M	49.524	49.74	-7.9	62.0	-2.23	0.026
$lang_{ij}$	U	.21284	.09829	32.0		13.06	0.000
	M	.19427	.19682	-0.7	97.8	-0.18	0.857
$bord_{ij}$	U	.06081	.01598	23.5		10.55	0.000
	M	.0465	.03503	6.0	74.4	1.62	0.104
$\ln(d_{ij})$	U	7.9686	8.8661	-98.4		-40.76	0.000
	M	8.155	8.1558	-0.1	99.9	-0.02	0.981
BVCONTIG	U	.03934	-.00663	24.3		10.92	0.000
	M	.02509	.01331	6.2	74.4	1.69	0.091
BVDIST	U	-.58932	.08952	-83.8		-36.29	0.000
	M	-.42048	-.39999	-2.5	97.0	-0.70	0.483
BVLANG	U	.06048	-.00888	22.2		8.65	0.000
	M	.04167	.04879	-2.3	89.7	-0.57	0.565

Table A 6: Regression results of gravity equation on FDI (GLS, country, year, country-period FE)

Variables	(1) ln (F_{ijt})	(2) ln (F_{ijt})	(3) ln (F_{ijt})	(4) ln (F_{ijt})	(5) ln (F_{ijt})
PTA (WTO)	0.383				
	(0.294)				
PTA index		-0.0685			
		(0.0642)			
PTA (CU or EIA)			-0.0385		
			(0.315)		
PTA (5 years)				0.715**	
				(0.356)	
PTA (10 years)					0.606
					(0.461)
ln (d_{ij})	-2.511***	-2.599***	-2.556***	-2.486***	-2.507***
	(0.146)	(0.151)	(0.144)	(0.144)	(0.146)
$lang_{ij}$	1.692***	1.659***	1.687***	1.687***	1.685***
	(0.326)	(0.326)	(0.326)	(0.327)	(0.326)
$ToColy_{ij}$	3.432***	3.385***	3.404***	3.451***	3.433***
	(0.556)	(0.558)	(0.558)	(0.555)	(0.555)
$FromColy_{ij}$	3.390***	3.357***	3.377***	3.384***	3.380***
	(0.728)	(0.732)	(0.732)	(0.726)	(0.727)
Constant	-0.187	0.684	0.181	-0.411	-0.228
	(3.890)	(3.912)	(3.889)	(3.885)	(3.891)
Observations					
Number of id	12,928	12,928	12,928	12,928	12,928
Country FE	2,769	2,769	2,769	2,769	2,769
Country pair RE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Country-period FE	YES	YES	YES	YES	YES
Pseudo R-squared	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A 7: Regression results of gravity equation on M&A (GLS, country FE)

Variables	(1) ln (M&A_{ijt})	(2) ln (M&A_{ijt})	(3) ln (M&A_{ijt})	(4) ln (M&A_{ijt})	(5) ln (M&A_{ijt})
PTA (WTO)	-0.138				
	(0.122)				
PTA index		-0.00245			
		(0.0351)			
PTA (CU or EIA)			-0.0316		
			(0.146)		
PTA (5 years)				-0.190	
				(0.136)	
PTA (10 years)					0.00867
					(0.154)
ln (d_{ij})	-0.234***	-0.216***	-0.218***	-0.238***	-0.214***
	(0.0620)	(0.0590)	(0.0614)	(0.0632)	(0.0631)
$lang_{ij}$	0.143	0.149	0.148	0.146	0.149
	(0.114)	(0.115)	(0.115)	(0.114)	(0.115)
$ToColy_{ij}$	0.122	0.134	0.132	0.110	0.136
	(0.177)	(0.176)	(0.179)	(0.176)	(0.180)
$FromColy_{ij}$	0.272	0.274	0.273	0.272	0.274
	(0.207)	(0.208)	(0.206)	(0.204)	(0.207)
Constant	0.0277	-0.0693	-0.0572	0.0460	-0.0787
	(0.456)	(0.444)	(0.454)	(0.460)	(0.461)
Observations	1,702	1,702	1,702	1,702	1,702
Number of id	617	617	617	617	617
Country FE	YES	YES	YES	YES	YES
Country pair RE	NO	NO	NO	NO	NO
Year FE	NO	NO	NO	NO	NO
Country-period FE	NO	NO	NO	NO	NO
Pseudo R-squared	0.195	0.193	0.193	0.195	0.193

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A 8: Regression results of gravity equation on FDI (PPML, clustered SE)

Variables	(1) F_{ijt}	(2) F_{ijt}	(3) F_{ijt}	(4) F_{ijt}	(5) F_{ijt}
PTA (WTO)	0.0223				
	(0.191)				
PTA index		0.0443			
		(0.204)			
PTA (CU or EIA)			-0.0491		
			(0.203)		
PTA (5 years)				-0.132	
				(0.176)	
PTA (10 years)					0.0165
					(0.0381)
ln (d_{ij})	-0.623***	-0.620***	-0.632***	-0.642***	-0.622***
	(0.0637)	(0.0629)	(0.0630)	(0.0620)	(0.0607)
$lang_{ij}$	0.224*	0.225*	0.222*	0.221*	0.229*
	(0.132)	(0.132)	(0.132)	(0.132)	(0.134)
$ToColy_{ij}$	0.409*	0.413*	0.393*	0.378*	0.408*
	(0.217)	(0.218)	(0.213)	(0.212)	(0.212)
$FromColy_{ij}$	0.387*	0.386*	0.394*	0.404*	0.390*
	(0.216)	(0.215)	(0.218)	(0.220)	(0.217)
Constant	1.140	1.143	1.289	1.450*	1.160
	(0.891)	(0.820)	(0.885)	(0.863)	(0.810)
Observations	12,928	12,928	12,928	12,928	12,928
R-squared	0.347	0.347	0.347	0.347	0.346
clustered SE	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A 9: Regression results of gravity equation on trade controlling for FDI (PPML, sector and country FE, clustered SE)

VARIABLES	(1) X_{ijp}	(2) X_{ijp}	(3) X_{ijp}	(4) X_{ijp}	(5) X_{ijp}	(6) X_{ijp}
PTA (DESTA)	0.317***	0.280***				
	(0.0779)	(0.0765)				
PTA (CU or EIA)			0.0340	0.0241		
			(0.102)	(0.0981)		
PTA (10 years)					-0.0321	-0.0229
					(0.107)	(0.103)
ln (F_{ij})		0.0277***		0.0321***		0.0321***
		(0.00718)		(0.00771)		(0.00775)
ln (1 + $tariff_{ijp}$)	-1.163***	-1.140***	-1.184***	-1.153***	-1.195***	-1.161***
	(0.413)	(0.409)	(0.409)	(0.405)	(0.413)	(0.409)
ln (NTB_{jp})	-0.0691	-0.0683	-0.0686	-0.0678	-0.0688	-0.0680
	(0.192)	(0.192)	(0.192)	(0.192)	(0.192)	(0.192)
ln (d_{ij})	-0.661***	-0.635***	-0.703***	-0.667***	-0.708***	-0.671***
	(0.0318)	(0.0317)	(0.0327)	(0.0327)	(0.0324)	(0.0327)
$bord_{ij}$	0.463***	0.495***	0.421***	0.462***	0.417***	0.459***
	(0.103)	(0.0989)	(0.106)	(0.0999)	(0.108)	(0.102)
$lang_{ij}$	0.340***	0.306***	0.368***	0.325***	0.367***	0.323***
	(0.113)	(0.111)	(0.124)	(0.121)	(0.124)	(0.121)
col_{ij}	0.0741	0.0360	0.0233	-0.0161	0.0169	-0.0205
	(0.0994)	(0.0967)	(0.112)	(0.110)	(0.113)	(0.111)
$comcol_{ij}$	2.156***	1.855***	2.197***	1.842***	2.195***	1.840***
	(0.280)	(0.271)	(0.263)	(0.253)	(0.262)	(0.252)
Constant	7.275***	7.738***	7.901***	8.370***	7.936***	8.396***
	(0.776)	(0.792)	(0.746)	(0.763)	(0.748)	(0.764)
Observations	295,725	295,725	295,725	295,725	295,725	295,725
R-squared	0.428	0.429	0.423	0.425	0.423	0.426
Sector FE	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES
Clustered SE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A 10: Regression results of gravity equation on trade controlling for migration (GLS, all FE)

VARIABLES	(1) ln (M_{ijt})	(2) ln (M_{ijt})	(3) ln (M_{ijt})	(4) ln (M_{ijt})	(5) ln (M_{ijt})
PTA (WTO)	0.392***				
	(0.0552)				
PTA index		0.130***			
		(0.0186)			
PTA (CU or EIA)			0.239***		
			(0.0670)		
PTA (5 years)				0.166***	
				(0.0571)	
PTA (10 years)					0.00672
					(0.0561)
ln (1 + v_{ijt})					
ln (L_{it})	0.280**	0.192	0.235*	0.259**	0.200
	(0.128)	(0.129)	(0.129)	(0.127)	(0.129)
ln (N_{jt})	2.427***	2.508***	2.524***	2.481***	2.521***
	(0.366)	(0.366)	(0.365)	(0.366)	(0.366)
ln (inc_{it})	-0.111	-0.143*	-0.122	-0.106	-0.117
	(0.0799)	(0.0800)	(0.0798)	(0.0800)	(0.0798)
ln (inc_{jt})	1.745***	1.780***	1.756***	1.763***	1.767***
	(0.135)	(0.135)	(0.135)	(0.135)	(0.135)
ln($diff\_inc\_2_{ij}$)	0.0136	0.00625	0.0108	0.0120	0.0112
	(0.00885)	(0.00893)	(0.00887)	(0.00887)	(0.00886)
Constant	-70.98***	-71.14***	-72.13***	-71.88***	-71.68***
	(8.186)	(8.184)	(8.155)	(8.184)	(8.189)
Observations	53,491	53,491	53,491	53,491	53,491
Number of id	4,931	4,931	4,931	4,931	4,931
Country FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Country-time FE	YES	YES	YES	YES	YES
Country pair RE	YES	YES	YES	YES	YES
Robust SE	YES	YES	YES	YES	YES
Pseudo R-squared	0.683	0.685	0.680	0.681	0.679

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A 11: Regression results of gravity equation on migration (PPML, all FE)

VARIABLES	(1) M_{ijt}	(2) M_{ijt}	(3) M_{ijt}	(4) M_{ijt}	(5) M_{ijt}
PTA (WTO)	-0.129				
	(0.218)				
PTA (DESTA)					
PTA index		0.0684			
		(0.0458)			
PTA (CU or EIA)			-0.117		
			(0.228)		
PTA (5 years)				-0.202	
				(0.189)	
PTA (10 years)					-0.400***
					(0.113)
$\ln(1 + v_{ijt})$					
$\ln(L_{it})$	-0.0432	-0.0128	-0.0288	-0.0408	0.0120
	(0.393)	(0.379)	(0.390)	(0.379)	(0.372)
$\ln(N_{jt})$	0.362	0.332	0.367	0.450	0.462
	(0.994)	(1.055)	(0.989)	(0.930)	(0.927)
$\ln(inc_{it})$	-1.065***				
	(0.338)				
$\ln(inc_{jt})$	1.311**	0.256	0.227	0.272	0.348
	(0.538)	(0.633)	(0.640)	(0.631)	(0.660)
$\ln(diff\_inc\_2_{ij})$	-0.203***	-0.208***	-0.204***	-0.207***	-0.212***
	(0.0532)	(0.0537)	(0.0526)	(0.0555)	(0.0572)
$\ln(diff\_inc_{ij})$		-1.075***	-1.065***	-1.103***	-1.166***
		(0.329)	(0.336)	(0.355)	(0.364)
Observations	51,677	51,677	51,677	51,677	51,677
Number of id	4,540	4,540	4,540	4,540	4,540
Country FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Country-time FE	YES	YES	YES	YES	YES
Country pair FE	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A 12: Regression results of gravity equation on trade controlling for migration (GLS, sector and country FE)

VARIABLES	(1) $\ln(1+X_{ijp})$	(2) $\ln(1+X_{ijp})$	(3) $\ln(1+X_{ijp})$	(4) $\ln(1+X_{ijp})$	(5) $\ln(1+X_{ijp})$	(6) $\ln(1+X_{ijp})$
PTA (WTO)	0.148***	0.0728***				
	(0.0283)	(0.0267)				
PTA (CU or EIA)			-0.0595	-0.00793		
			(0.0379)	(0.0335)		
PTA (10 years)					-0.00672	0.0544
					(0.0398)	(0.0353)
$\ln(M_{ijt})$		0.0859***		0.0891***		0.0903***
		(0.00616)		(0.00622)		(0.00601)
$\ln(1+tariff_{ijp})$	-0.280***	-0.249***	-0.246***	-0.230***	-0.246***	-0.217***
	(0.0767)	(0.0730)	(0.0753)	(0.0723)	(0.0756)	(0.0720)
$\ln(NTB_{jp})$	0.0324	0.0341	0.0341	0.0350	0.0340	0.0355
	(0.0239)	(0.0239)	(0.0239)	(0.0239)	(0.0239)	(0.0239)
$\ln(d_{ij})$	-0.213***	-0.169***	-0.247***	-0.181***	-0.241***	-0.173***
	(0.0170)	(0.0150)	(0.0165)	(0.0144)	(0.0160)	(0.0138)
$bord_{ij}$	-0.0567	-0.0235	-0.0757*	-0.0305	-0.0712*	-0.0295
	(0.0418)	(0.0359)	(0.0428)	(0.0372)	(0.0428)	(0.0365)
$lang_{ij}$	0.192***	0.0579*	0.188***	0.0501	0.187***	0.0513
	(0.0391)	(0.0338)	(0.0385)	(0.0333)	(0.0381)	(0.0324)
col_{ij}	0.273***	0.132***	0.269***	0.126***	0.272***	0.126***
	(0.0489)	(0.0412)	(0.0498)	(0.0401)	(0.0494)	(0.0393)
$comcol_{ij}$	0.447***	0.430**	0.383**	0.402**	0.395**	0.415**
	(0.168)	(0.192)	(0.161)	(0.190)	(0.161)	(0.193)
Constant	1.873***	1.774***	2.257***	1.931***	2.201***	1.867***
	(0.243)	(0.229)	(0.237)	(0.222)	(0.235)	(0.220)
Observations	173,093	173,093	173,093	173,093	173,093	173,093
R-squared	0.631	0.641	0.627	0.640	0.627	0.640
Sector FE	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A 13: Regression results of gravity equation on trade controlling for migration (PPML, sector and country FE)

VARIABLES	(1) X_{ijp}	(2) X_{ijp}	(3) X_{ijp}	(4) X_{ijp}	(5) X_{ijp}	(6) X_{ijp}
PTA (DESTA)	0.365***	0.293***				
	(0.100)	(0.108)				
PTA_int			0.0681	0.234**		
			(0.126)	(0.118)		
PTA_old10y					0.00249	0.170
					(0.117)	(0.106)
ln (M_{ijt})		0.0667***		0.0909***		0.0883***
		(0.0181)		(0.0179)		(0.0175)
ln (1 + $tariff_{ijp}$)	-0.540	-0.573	-0.320	-0.389	-0.330	-0.378
	(0.532)	(0.529)	(0.536)	(0.527)	(0.535)	(0.527)
ln (NTB_{jp})	0.312	0.310	0.325	0.319	0.325	0.322
	(0.296)	(0.295)	(0.296)	(0.296)	(0.296)	(0.296)
ln (d_{ij})	-0.551***	-0.533***	-0.577***	-0.531***	-0.582***	-0.537***
	(0.0387)	(0.0391)	(0.0398)	(0.0404)	(0.0397)	(0.0405)
$bord_{ij}$	0.401***	0.450***	0.389***	0.452***	0.391***	0.446***
	(0.0926)	(0.0964)	(0.0944)	(0.0991)	(0.0950)	(0.0994)
$lang_{ij}$	0.561***	0.469***	0.587***	0.464***	0.583***	0.476***
	(0.108)	(0.105)	(0.123)	(0.110)	(0.123)	(0.110)
col_{ij}	0.0844	-0.00742	0.0917	-0.0254	0.0887	-0.0264
	(0.0949)	(0.0944)	(0.0994)	(0.0900)	(0.0984)	(0.0912)
$comcol_{ij}$	-0.0323	-0.0685	-0.103	-0.0895	-0.117	-0.110
	(0.750)	(0.779)	(0.759)	(0.781)	(0.763)	(0.788)
Constant	11.12***	11.26***	11.56***	11.49***	11.61***	11.53***
	(0.616)	(0.622)	(0.598)	(0.600)	(0.600)	(0.604)
Observations	173,093	173,093	173,093	173,093	173,093	173,093
R-squared	0.408	0.406	0.406	0.404	0.406	0.404
Sector FE	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1