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The Suspense of Trade Agreements

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The Suspense of Trade Agreements

Filip Tarlea*

Abstract

Preferential trade agreements (PTAs) are signed between two or more countries following the conclusion of the negotiation process. The duration of this process varies considerably across existing trade agreements and ranges between 316 and 5125 days. This paper presents the consequences of the length of the negotiation process on trade growth. The contribution of this paper to the literature is threefold. Firstly, it includes as a determinant of trade a new variable that captures negotiations duration for the largest number of PTAs possible, covering all such events from January 1988 until October 2014. This unveils yet another previously ignored feature of PTAs (as trade driver) that leaves results based on a dichotomous PTA status in question. Secondly, this paper evaluates for the first time the anticipation effects of a PTA, concentrating solely on the negotiation period. Lastly, methodologically, this paper introduces for the first time in the international economics literature a dose response-function approach permitting continuous treatment and many non-treated units. The paper concludes that —ceteris paribus —lengthy PTA negotiations undermine trade growth.

Keywords: Trade agreements; Negotiations; Enforcement; Uncertainty. **JEL codes:** F10; F12; F17

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Introduction

Over the last two decades, the international economics literature has been focusing on evaluating the influence that governments exercise on trade. With the general movement towards deregulating the global market, understanding the consequence of such measure is crucial. It is without much debate acknowledged that countries (or firms) tend to self-select into trading internationally. This is often decided on the basis of evaluating their own potential to benefit from trade. The potential is directly related with a series of individual characteristics, such as GDP (total assets), capital-to-labor ratio (productivity) and partner characteristics such as whether it shares the same language and the same border. Importantly, the potential of benefiting from trade is inversely related to the geographical distance to the trading partner. These have built the basis for the so-called gravity equation as first introduced by Tinbergen (1962), which acted as a workhorse for international trade models ever since. With all these factors cumulatively explaining the lion's share of the trade happening between two countries, not much is left for governments to control such cross-border transactions. However, the one instrument at hand, able to shape trade to a certain extent, is the materialization of economic preferentialism. This usually takes the form of preferential economic integration agreements (PEIAs) such as preferential trade agreements (PTAs), bilateral investment treaties (BITs) or double taxation treaties (DTTs). The most extensively used and known of these three is the PTA, and it is this one alone the makes the object of our analysis.

The liberalization of trade has been extensively investigated and shown to benefit economic growth (Matoo et. al, 2008; Wacziarg and Welsch, 2008), productivity (Pavcnik, 2002; Arnold et al. 2010, 2011; Topalova and Khandelwal, 2011) while hurting unemployment (Egger and Kreickemeier, 2009; Dutt et. al, 2009; Helpman and Itskhoki, 2010) and poverty (Winters et. al, 2004; Topalova, 2010). Analyzing the effect of a PTA on cross-border trade is also not a novel topic. Jan Tinbergen (1962) is the first to include the binary variable capturing the presence or absence of a PTA respectively in the gravity equation, finding no significant effects on trade. Since then, a plethora of literature has brought overwhelming evidence of the beneficial impact that PTAs have on trade. Frankel (1997) finds positive significant effects from Mercosur and negative significant effects from the European Community. Further studies aiming to improve the estimation of PTA effect on trade of which notably Egger et. al (2008) and Baier and Bergstrand (2009) find strong evidence in favor of contemporaneous and long-term trade-creating consequences of trade agreements respectively. Anderson and Yotov (2011) confirm these findings using panel data. Chang and Lee (2011) confirm the direction of the effect of GATT/WTO membership on bilateral trade. More recently Baier et. al (2014) find evidence that both intensive and extensive margins of trade are positively impacted by such materialization of preferentialism, or as they call it economic integration agreements.

The econometric problem with estimating the effects of preferentialism is, however, that PTAs are meant to stimulate trade, and, according to economic theory, concluding PTAs has greater benefits for natural trading partners than otherwise (see Frankel, Stein, and Wei, 1996; Baier and Bergstrand, 2004; Egger and Larch, 2008). While earlier work used a log-linear-index regression approach for the identification of partial PTA treatment effects conditional on observables (see Aitken, 1973; Soloaga and Winters, 2001), more recent work resorted to nonparametric estimation techniques (see, e.g., Egger, Egger, and Greenaway, 2008; Baier and Bergstrand, 2009, Egger and Tarlea, 2017). These latter papers prominently pave the way for a new cottage literature using non-parametric estimators to evaluate the effect of preferentialism on trade. Egger et. al (2008) use a difference-in-difference matching approach and find particularly strong effects on intra-industry trade. Baier and Bergstrand (2009) use matching on a host of metrics to compare bilateral trade between country pairs with a signed PTA with very similar country pairs without one.¹ The similarity is evaluated on the basis of the standard gravity covariates such as GDP, common language, adjacency and distance. They find that estimates obtained through non-parametric approaches are much more stable across different years and return more economically plausible magnitudes compared to the typically-estimated linear gravity equations.

Although to a great extent non-parametric estimation is relatively flexible and assumes much less than parametric estimators, one potentially problematic assumption is still made. In order to non-parametrically estimate the average treatment effect (ATE) of PTAs, all studies so far implicitly assume treatment homogeneity, that is, any two countries bounded by a PTA have qualitatively an identical status, all else equal. In reality however, no PTA is identical to another. This violates the assumption of treatment homogeneity and leads to inexact inference with regards to the impact of each such PEIA on its respective bilateral trade.

A few studies aim to tackle this issue, by revealing as finely grained as possible PTA-specific characteristics. Famously, Dür et. al (2014) have developed a dataset describing the design of PTAs, covering 587 of them, between 3318 countries (one country can have a PTA with several partners) over 10 sectors during the 1945-2009 period. It has been the most widely used dataset distinguishing between PTAs, with studies suggesting PTAs do

¹A more extensive discussion on the benefits of non-parametric estimators of trade is provided in the Empirical Strategy section.

have differential impact on trade.² The most recent and potentially most exhaustive dataset capturing the heterogeneity of PTAs is introduced by Hoffman et. al (2017) and covers 279 PTAs notified during the period 1958 - 2015, for which 52 different provisions are mapped.

Despite the richness of these afore-mentioned studies, one PTA-specific characteristic has been consistently ignored as a trade determinant by the international trade literature, namely the negotiations duration of each PTA (see Table 5 in the Tables Appendix 1 for a complete list).³ This paper aims to fill this gap and unveils a negative robust causal relationship between the suspense (or the duration) of negotiations and the anticipation effect this has on trade between countries directly involved. It is structured as follows: section 1 discusses how negotiations duration may impact trade. Section 2 describes the data capturing trade and negotiations duration. Section 3 explains the estimator choice, introducing the empirical model. Section 4 presents the results and the last section concludes.

1 Trade during PTA negotiations

Let us first introduce the conceptual expectations with regards to the potential impact of PTA negotiations duration on trade. The setup is simple. Two non-PTA partnering countries decide to bilaterally negotiate the signing of a trade agreement. As we know from Baier and Bergstrand (2009), similar country and country-pair characteristics that determine trade volumes also determine the decision to enter an agreement. Furthermore, Egger et. al (2011) document that PTAs are virtually never signed among country

²Among others Baldwin (2014); Egger et. al (2015); Felbermayr et. al (2015); Bagwell et. al (2016); Kohl et. al (2016).

³One notable exception is Moser and Rose (2012), only they look at negotiations duration the other way around, i.e. aiming to identify its causes.

pairs where there is no trade, allowing us to make the informed assumption that pre-negotiation (or pre-treatment) there is positive trade between the two countries. This means that with non-preferential tariffs, there are still firms that find it profitable to export. There are also firms who don't find it profitable to export so they produce for the domestic market. Following the conclusion of negotiations, there are two potential outcomes: negotiation success leads to a *tariff drop* and negotiation failure leaves *tariffs unchanged*. The question we ask is what happens during negotiations. The uncertainty of what goes on behind the stage at the negotiation table generates a lot of suspense and forces firms to speculate. Firms may interpret each of these two potential outcomes in a *positive* way (leading them accelerate trade) or a *negative* way (and slow down trade). Thus, the start of negotiations generates a 2×2 decision (read speculation) matrix for the average firm, as described below:

Tariffs

		drop	unchanged
Perception	+	(1.1) Exports will become cheaper	(1.2) Current exporters face no extra competition
(trade action)	_	(2.1) Current exporters face more competition	(2.2) Exports will remain expensive

Scenario 1.1: Future decrease in tariffs is certainly good for the firm

Lower tariffs would benefit currently-exporting firms by decreasing the socalled iceberg costs. These firms therefore continue to increase the export volumes. Previously non-exporting firms reassess their exporting profitability in the light of the potentially future reduced transport costs, and some of them might begin to trade and incur losses in anticipation that PTA will be enforced and tariffs will drop, by which time they will be in the market already. Overall, export accelerates with the start of negotiations.

Scenario 1.2: Stagnation in tariffs is certainly good for the firm

While exports will not become cheaper for exporting firms, the stagnating tariffs ensure limited competition, as the less productive firms cannot afford to enter the export market. Even if this scenario doesn't play out and tariffs will drop, the more productive firms will be able to lower prices. In anticipation of this, exporters start to trade even more during negotiations.

Scenario 2.1: Future decrease in tariffs is uncertainly good for the firm

Lower tariffs would allow more (less productive firms) to enter the export market. This channel would negatively affect the market for firms currently exporting. Less productive firms that might benefit from lower tariffs cannot yet enter the market. In addition, the beginning of negotiations could alter the sense of predictability for some firms. This leads to reduction in bilateral trade growth (deceleration in trade) or even to a negative growth rate (decrease in trade).

Scenario 2.2: Stagnation in tariffs is uncertainly good for the firm

Exports will remain expensive so until they know for sure that this will be the case, there is no reason for current exporters to accelerate trade.

This paper sheds light on which of these scenarios plays out, or to be more precise, which of the negative and positive anticipation is predominant in terms of change in exports. To do so we rely on the data presented in the next section.

2 Data

The dataset that this paper relies on combines a number of different sources and types of data that will be discussed next. Summary statistics of the full sample as well as the estimation sample are reported in a reduced format in Table 1 below and in an extended format in Table 5 of the Table Appendix 1. We observe complete information for all variables during the period of 1988-2014.

Dependent variable (Exports growth): The dependent variable is based on country-level data on bilateral trade from the United Nations' (UN) Comtrade Database. Since the level of trade is always positive, we would like to capture exporters attitude even when that stays positive only to a lesser degree. We therefore construct year-on-year export growth variable, as the difference in logs between current exports and previous-year exports, and use it as our outcome variable.

Duration of negotiation: The starting point of the analysis are all PTAs notified to and reported by the WTO's PTA-database during the sample period. We use data on beginning and conclusion of negotiations from 1988 to 2008 as collected by Moser and Rose (2014) and updated by Egger, Moser

and Tarlea (2017) to include all new PTAs that have been notified to the WTO and were in force by October 15, 2014. The event dates are identified through a careful full-text analysis on LexisNexis, where we mainly focus on international newswires, press releases, and well-known newspapers published in English (see Egger, Moser and Tarlea (2018) for a full account of data collection). In order to quantify the duration of negotiations we subtract the date corresponding to the start of negotiations from the date corresponding to the start of negotiations from the date corresponding to the start of negotiations from the date corresponding to 5125.

GDP Growth: Exporter and importer sizes are captured by the value of real GDP and are obtained from the World Bank's World Development Indicators (WDI). The traditional gravity variables (at the country-pair level) are taken from the Centre d'Études Prospectives et d'Informations Internationales' (CEPII) geographical and gravity data-sets. We report summary statistics of the difference in logs between current GDP and previous-year GDP for each exporter and importer.

Exporter - Importer Dissimilarity Growth: We calculate the difference in logs between exporter and importer GDP and log-differentiate its current value and its previous-year value.

	Mean Min		$\mathbf{p95}$	Max	Ν			
	D 11							
Exports growth	0.088932	-20.8472	2.399181	17.33638	438928			
Duration of negotiations	25.17608	0	0	5125	480409			
Duration on 0-100 scale	0.513145	0	0	100	459902			
1 if negotiating, 0 otherwise	0.062905	0	1	1	480409			
Exporter GDP Growth	4.649505	-48.5686	12.06586	760.6343	442013			
Importer GDP Growth	4.803759	-89.9624	13.29907	4173.503	422035			
X - M Dissimilarity Growth	0.338499	-96.5452	9.997232	1082.782	414149			
Bottom 95	th percen	tile expor	t growth					
Exports growth	-0.11887	-20.8472	1.444262	2.387197	416805			
Duration of negotiations	27.19739	0	0	5125	420337			
Duration on 0-100 scale	0.557666	0	0	100	399997			
1 if negotiating, 0 otherwise	0.070484	0	1	1	420337			
ExporterGDP Growth	4.393599	-48.5686	11.1783	760.6343	412883			
Importer GDP Growth	4.5318	-89.9624	12.37288	4173.503	394374			
X - M Dissimilarity Growth	0.303096	-96.5452	9.610764	1082.782	387298			
Bottom 95th perc	entile exp	ort growt	h (treated	only)				
Exports growth	0.052716	-7.80652	0.648054	2.384346	9287			
Duration of negotiations	1230.975	3	3193	5125	9287			
Duration on 0-100 scale	24.01903	0.058537	62.30244	100	9287			
1 if negotiating, 0 otherwise	1	1	1	1	9287			
Exporter GDP Growth	2.937639	-17.5788	8.354553	27.8607	9287			
Importer GDP Growth	2.949098	-62.0759	8.59375	77.2011	9287			
X - M Dissimilarity Growth	0.11658	-36.452	6.486697	199.5458	9287			
			-					

Table 1: Summary Statistics

=

A more detailed version of this table is available in Table 5 in the Table Appendix 1.

3 Empirical strategy

The aim of our paper is estimating the average marginal effect (or average treatment effect, henceforth ATE) of a PTA while accounting for a specific kind of PTA heterogeneity, namely its respective negotiation duration. The standard approach in the last decades for estimating PTA effect on trade has been to employ a log-linear form of the gravity equation and theoretically interpret the coefficient on the PTA dummy as the reduced form from a general equilibrium model, as per Eaton and Kortum (2002) or van Wincoop (2003). However, due to likely non-linearities in the data, combined with the potential argument for countries self-selecting into trade agreements, OLS estimation of PTA effects may suffer from a bias. The non-parametric estimators come to the rescue by accommodating any form of relation between outcome and explanatory variable, be it non-linear, as well as removing the concern of non-random selection of country pairs into a PTA (or in the treatment evaluation jargon - non-random assignment of treatment).

3.1 Non-parametric estimation

With that in mind, we would proceed to calculating the ATE of PTAs (and later negotiations duration thereof) as the difference between the average outcome (i.e. export growth) of country pairs during PTA negotiations and average outcome for those same pairs not negotiating a PTA. However, the main obstacle of the non-parametric techniques is that these two outcomes can *never* be observed simultaneously. The next best is calculating ATE as the difference between average export growth of negotiating country pairs and average export growth of non-negotiating country pairs. However, unless country pairs are randomly assigned to negotiating PTAs, this estimated ATE suffers from a self-selection bias. Rosenbaum and Rubin (1993) introduce propensity score matching as a way to correct for this bias, implying the comparison of units similar in terms of observable characteristics. However, applying their model to our data structure would mean ignoring the treatment heterogeneity (i.e. remember we want to account for country pairs taking different amounts of time to conclude a PTA negotiations). Imbens (2000) extends the binary case to categorical multivalued treatment and finally Hirano and Imbens (2004) extend it to continuous multivalued treatments. Following Rosenbaum and Rubin (1983), they make an unconfoundedness assumption, which allows them to remove all biases in comparisons by treatment status by adjusting for differences in a set of covariates. Then they define a generalization of the propensity score for the binary case henceforth labeled generalized propensity score (GPS) - which has many of the attractive properties of the binary-treatment propensity score. The one shortcoming of this model is that it relies on the assumption that the treatment intensity d conditional on covariates X, d|X is drawn from a normal distribution. With data structures such as ours, where many units are not treated, there is a non-zero probability mass at zero, i.e. Pr(d = 0) > 0. The Hirano and Imbens (2004) model is therefore untenable for estimating the ATE relative to a non-treated base, with the spike of the distribution of zero suggesting discontinuity, thus violating the normality assumption.

3.2 ATE with a continuous (as opposed to binary) treatment: the Dose-Response function

As an extension to the Hirano and Imbens (2004) model, Cerulli (2014) proposes an econometric model for estimating dose response-function through a regression approach when treatment is continuous. Since the model works within a control function approach, it does not need to specify a GPS. Compared with Hirano and Imbens (2004), the model does not need a full normality assumption and is well-suited to accommodate many untreated units. Specifically, it models the dose response-function as approximated by a third degree polynomial. In our context, if we imagine a country pair not negotiating a PTA as the control unit, a country pair starting to negotiate a PTA as the treated unit, and the number of days it takes until it reaches an agreement as the intensity or the dose of treatment it receives, we can model the yearly growth rate in bilateral exports as a dose response-function. This application we introduce next.

Let X be a vector of confounding factors in the export growth equation consisting of exporter GDP growth, importer GDP growth, and the growth of the dissimilarity between exporter GDP and importer GDP. Following the continuous treatment approach, and assuming a parametric form for the unit response function g(X) to the vector of confounding X as $g_0(X) = X\delta_0$ and $g_1(X) = X\delta_1$ we start with a potential outcome model adapted to the context of continuous treatment:

$$w = 1 : Y_1 = \alpha_1 + \delta_1 X + h(d) + \epsilon_1$$

$$w = 0 : Y_0 = \alpha_0 + \delta_0 X + h(d) + \epsilon_0$$
(1)

where d is the intensity of the treatment captured by the duration of negotiations, and $w = \mathbf{1}[d > 0]$ is the binary treatment indicator that equals 1 for the country pairs observed during negotiations. We code all country pairs that never enter or have not entered yet a negotiation for a PTA as control units and all country pairs that enter negotiation as treated units. Country pairs that have concluded negotiations (i.e. are already in an enforced PTA) are excluded from the sample

$$w_{ijt} = \begin{cases} 0, & \text{if } PTA_{ijt} = 0 \quad \& \quad ij \text{ are not negotiating} \\ 1, & \text{if } PTA_{ijt} = 0 \quad \& \quad ij \text{ are negotiating} \\ -, & \text{if } PTA_{ijt} = 1 \end{cases}$$
(2)

 Y_1 and Y_0 are the two mutually exclusive potential outcomes for a particular subject and $\delta_1 X$ and $\delta_2 X$ are the subject's response to the vector of observed confounding variables X when the subject is treated and untreated, respectively. Finally, h(d) is a flexible function of the treatment level.

We can therefore formulate the average treatment effect (ATE) as

$$ATE(X,d) = E(Y_1 - Y_0) = \begin{cases} (\alpha_1 - \alpha_0) + X(\delta_1 - \delta_0) + h(d) & \text{if } d > 0\\ (\alpha_1 - \alpha_0) + X(\delta_1 - \delta_0) & \text{if } d = 0 \end{cases}$$

$$= \begin{cases} \alpha + X\delta + h(d) & \text{if } d > 0\\ \alpha + X\delta & \text{if } d = 0 \end{cases}$$
(3)

thereby getting

$$ATE(X, d, w) = \begin{cases} ATE(X, d > 0) & if \quad d > 0\\ ATE(X, d = 0) & if \quad d = 0\\ = I(d > 0)[\alpha + X\delta + h(d)] + I(d = 0)[\alpha + X\delta]\\ = w[\alpha + X\delta + h(d)] + (1 - w)[\alpha + X\delta] \end{cases}$$
(4)

By averaging on x, d, w we obtain

$$ATE = \frac{N_T}{N} (\alpha + \overline{X}_{d>0}\delta + \overline{h}_{d>0}) + \frac{N_{NT}}{N} (\alpha + \overline{X}_{d=0}\delta)$$
(5)

By definition $ATE = p(w = 1) \times ATET + p(w = 0) \times ATENT$ so the analytical form based on Equation 5 for each treatment effect is

$$\begin{cases}
ATE = p(w = 1)(\alpha + \overline{X}_{d>0}\delta + \overline{h}_{d>0}) + p(w = 0)(\alpha + \overline{X}_{d=0}\delta) \\
ATET = \alpha + \overline{X}_{d>0}\delta + \overline{h}_{d>0} \\
ATENT = \alpha + \overline{X}_{d=0}\delta
\end{cases}$$
(6)

Then by simple algebra we obtain

$$\begin{cases}
ATE = p(w = 1)(\alpha + \overline{X}_{d>0}\delta + \overline{h}_{d>0}) + p(w = 0)(\alpha + \overline{X}_{d=0}\delta) \\
ATET(x, d) = ATE(x, d, w = 1) = ATET + (X_{d>0} - \overline{X}_{d>0})\delta + (h(d) - \overline{h}_{d>0}) \\
ATENT = \alpha + \overline{X}_{d=0}\delta
\end{cases}$$
(7)

and we can define the Dose Response-function by averaging ATE(X, d) over X:

$$ATE(d,w) = E_X\{ATE(X,d,w)\} = w \times [ATET + h(d) - \overline{h}_{d>0}] + (1-w) \times ATENT$$
(8)

 \mathbf{SO}

$$ATE = \begin{cases} ATET + h(d) - \overline{h}_{d>0} & if \quad d > 0\\ ATENT & if \quad d = 0 \end{cases}$$
(9)

In order to consistently estimate the causal parameters, we start from the potential outcome model as formulated in Equation 1:

$$Y_0 = \alpha_0 + \delta_0 X + \epsilon_0$$
$$Y_1 = \alpha_1 + \delta_1 X + h(d) + \epsilon_1$$

We can rewrite the observable outcome $y = y_0 + w(y_1 - y_0)$ as

$$Y = Y_0 + w(Y_1 - Y_0) = (\alpha_0 + \delta_0 X + \epsilon_0) - w(\alpha_1 + \delta_1 X + h(d) + \epsilon_1) - w(\alpha_0 + \delta_0 X + \epsilon_0)$$

= $\alpha_0 + w(\alpha_1 - \alpha_0) + -\delta_0(X) + w[\delta_1(X) - \delta_0(X)] + wh(d) + \epsilon_0 + w(\epsilon_1 - \epsilon_0)$

By adding and subtracting $w\overline{X}\delta$ and $w\overline{h}$ we get

$$Y = \alpha_0 + w[(\alpha_1 - \alpha_0) + \overline{X}\delta + \overline{h}] + X\delta_o + w(X - \overline{X})\delta + w(h(d) - \overline{h}) + \epsilon_0 + w(\epsilon_1 - \epsilon_0)(10)$$

By assuming Conditional Mean Independence (CMI), namely that given X both w and d are endogenous in Equation 10 we can rewrite the regression line for Y as

$$E(Y|X, w, d) = \alpha_0 + X\delta_0 + w \underbrace{[(\alpha_1 - \alpha_0) + \overline{X}\delta + \overline{h}]}_{ATE} + w(X - \overline{X})\delta + w(h(d) - \overline{h})(11)$$

as CMI implies that $E[\epsilon_0 + w(\epsilon_1 - \epsilon_0)|X, w, d] = E[\epsilon_0 + w(\epsilon_1 - \epsilon_0)|X] = 0.4$ We end up estimating the following regression equation:

$$E(Y|X, w, d) = \alpha_0 + X\delta_0 + wATE + w(X - \overline{X})\delta + w(h(d) - \overline{h})$$
(12)

Under CMI we assume a third-degree polynomial for the treatment intensity function h(d) in the form of $h(d) = ad + bd^2 + cd^3$ which we plug into Equation 12 which becomes

$$E(Y|X, w, d) = \alpha_0 + X\delta_0 + wATE + w(X - \overline{X})\delta + + w[ad + bd^2 + cd^3 - (aE(d) + bE(d^2) + cE(d^3)] = \alpha_0 + X\delta_0 + wATE + w(X - \overline{X})\delta + + a[t - E(t)]w + b[t^2 - E(t^2)]w + c[t^3 - E(t^3)]w$$
(13)

Assuming CMI, we can consistently estimate parameters $\hat{\alpha}_0$, $\hat{\delta}_0$, $A\hat{T}E$, $\hat{\delta}$, \hat{a} , \hat{b} and \hat{c} in Equation 13 using least-squares regression. Finally, on the back of these parameters we can estimate the Dose Response-function of this form:

⁴See Cerulli (2014) for proof that $ATE = (\alpha_1 - \alpha_0) + \overline{X}\delta + \overline{h}$.

$$\widehat{ATE}(d_{ij}) = w[\widehat{ATET} + \widehat{a}(d_{ij} - \frac{1}{N}\sum_{\substack{i=1\\j=1}}^{N} d_{ij}) + \overline{b}(d_{ij}^2 - \frac{1}{N}\sum_{\substack{i=1\\j=1}}^{N} d_{ij}^2) + \overline{c}(d_{ij}^3 - \frac{1}{N}\sum_{\substack{i=1\\j=1}}^{N} d_{ij}^3)] + (1 - w)\widehat{ATENT}$$
(14)

In order to obtain the analytical standard errors we define $T_1 = t - E(t)$, $T_2 = t^2 - E(t^2)$ and $T_3 = t^3 - E(t^3)$. Then it follows that the standard error of the Dose Response-function is

$$\widehat{\sigma}_{\widehat{ATE}(d)} = \{ T_1 \widehat{\sigma}_a^2 + T_2 \widehat{\sigma}_b^2 + T_2 \widehat{\sigma}_c^2 + 2T_1 T_2 \widehat{\sigma}_{a,b} + 2T_1 T_3 \widehat{\sigma}_{a,c} + 2T_2 T_3 \widehat{\sigma}_{b,c} \}^{\frac{1}{2}}$$
(15)

which gives us the 95% confidence interval of $\widehat{ATE}(d)$ for each d

$$\{\widehat{ATE}(d) \pm 1.96\widehat{\sigma}_{\widehat{ATE}(t)}\}\tag{16}$$

In the forthcoming Results section we report $\widehat{ATE}(d)$ as an average over all dosage levels (i.e. durations of PTA negotiations) as well as a breakdown thereof. In addition we present results for $\widehat{ATET}(d)$ to which we separately construct 95% confidence interval using bootstrapped standard errors.

4 Results

Figure 1 shows the dose-response function (DRF), in particular the response of export growth to different doses of treatment (i.e. negotiation duration) compared to the untreated country pair units (i.e. those who don't negotiate and have no PTA). The negative effect of negotiations *increases* in magnitude from 18 percentage points in the first year to about 20 in the second and third year. After that negotiations taking from 4 up to 7 years have a smaller yet still negative effect on export growth of around 11 percentage points. The effect becomes even smaller later but after year 7 it is no longer statistically significant at 95% confidence level. One might say that after a long enough period, parties no longer react to the suspense of negotiations in a systematic manner.



Figure 1: Comparison to Non-negotiators

At this point it is worth making a few clarifications with relation to how these results reconcile with the literature on PTA effects on trade. Firstly, and most importantly, this paper does not deal with the effect of the enforcement of a PTA. This would imply a reduction of tariff already in place, and we know from a host of papers cited in the introductory section that PTAs or their implicit tariff reduction enhance trade. What this paper evaluates is the behavior of countries (or firms) facing uncertainty with regards to tariffs. Temporally this translates in distinguishing between trade changes after negotiations and during negotiations - when dealing with the suspense is an additional factor in the exporting decision process. The second point is that between two naturally trading partners (as theory predicts 2 countries negotiating a PTA to be), trade likely increases with time. For that reason, we look at the rate at which trade increases, and whether this is impacted by the length of negotiations. A negative coefficient estimated for export growth rate may or may not thus imply less trade, but it will certainly imply a deceleration of trade. Importantly, these results are not indicative of an actual slowdown in trade during negotiations in absolute terms. The economic performance (GDP growth) of each country in the pair and how they converge in size with each other are important drivers of bilateral exports. The story that the negative coefficients on the negotiation duration say is that once we abstract away the positive effect of economic growth and country-pair convergence, longer duration of negotiation undermines trade growth.

We run multiple regressions: M1 of Table 2 shows results from OLS on the duration (variable ranging from 3 to 5125 days). M2 shows results from least-squares regression using a scaled measure of duration, ranging from 0-100. M3 shows results for OLS on binary treatment variable that takes value 1 for country pairs during PTA negotiations and zero for all the

		OLS		DRF			
	$\mathbf{M1}$	M2	$\mathbf{M3}$	$\mathbf{M4}$			
	b/se	b/se	b/se	b/se			
Duration of negotiations	-0.006***						
	0						
Duration on 0-100 scale		-0.358***					
		-0.05					
1 if negotiating, 0 otherwise			-22.536***	-13.143***			
			-0.88	-4.05			
Exporter GDP Growth	0.755^{***}	0.699^{***}	0.722^{***}	0.688^{***}			
	-0.04	-0.04	-0.04	-0.04			
Importer GDP Growth	0.088***	0.079^{***}	0.081^{***}	0.077^{***}			
	-0.02	-0.02	-0.02	-0.02			
X - M Dissimilarity Growth	-0.450***	-0.434***	-0.443***	-0.427***			
	-0.04	-0.04	-0.04	-0.04			
Ν	387439	367406	387437	367404			
*** p<0.01, ** p< 0.05 * p<0.1; robust standard errors reported under coefficients; .							

Table 2: Negotiations duration effect on bilateral export growth

remaining country pairs (including those who never negotiate and those who have not started yet). M4 shows the ATE using the DRF method (or a control function) allowing for different levels of treatment. The displayed value is the ATE averaged in turn over all levels of treatment. The interpretation is therefore that the effect of an average negotiation duration dose (with the 0-100 dose covering negotiations up to 5125 days, a one-unit dose is approximately 16 months) compared to country pairs who do not negotiate is to reduce trade growth by 13%. To exemplify, the same country pair trading 50% more this year compared to last year, should it hypothetically be engaged in PTA negotiations for 16 months, it would only increase its trade by $50 - (50 \times 0.13) = 43.5\%$.

In order to better visualize the ATE of different durations of PTA negotiations on exports growth, we tabulate the ATE for the decile values of the treatment as displayed by Figure 1. The estimated coefficients represent the average effect of a PTA having been negotiated for X number of days on the bilateral export growth between the two countries involved, or more formally, when the dose response-function is evaluated at different dose levels. When evaluated at the dose level of 10 (approximately equivalent to 500 days of negotiation), the estimated ATE coefficient suggests duration decreases export growth rate by 19 percentage points, a result that is highly statistically significant at 1% significance level. As negotiations continue, we can observe the magnitude as well as the statistical significance diminishing to 11 percentage points at 2500 days of negotiation and only significant at 10% significance level. Beyond that, duration has no longer a statistically significant effect different from 0.

Implicitly, the comparison group for results in column 1 consists of all country pairs that do not negotiate in that year. One might wonder however

	ATE evaluat	ted at X level of treatment
X	Control g	group: duration in days
	0	< 485 (5th percentile)
10	-18.8780***	-21.4104***
20	17 0717***	15 6911***
30	-11.2111	-13.0811
50	-10.0725*	-11.1175***
70	-6.8100	-9 9827*
10	0.0100	0.0021
	1 4 0 2 4 0	1.4 7 222
90	-14.0248	-14.5399
N treated	9210	8656
N untreated	358,194	554
Ν	$367,\!404$	9210

Table 3: DRF: Negotiations duration ATE on bilateral exports growth

*** p<0.01, ** p<0.05 * p<0.1; standard errors in parantheses; Results are obtained using the Dose Response Function model; all estimation models include the same covariates listed in Table 2.

about the relative ATE when comparing negotiators to country pairs that have only been negotiating for a short while. We therefore construct an alternative control group consisting of those country pairs that have only been negotiating for a maximum of 485 days (the equivalent of the bottom 5th percentile in negotiations duration) and run the same dose response-function procedure. Column 2 of Table 3 shows the results obtained this way. Magnitudes are consistently larger at almost all dosage levels when using short-time negotiators as control group instead of non-negotiators. This result could be explained by the fact that the first one or two years of negotiations (period captured by the dosage of the newly-created control group) systematically give subjects in matter a positive perception about the international trading scene. This leads to faster trade growth during that period. Consequently, when comparing the mean trade growth in the treatment group (negotiations > 485 days) with that in the new control group, the difference is larger than in the absence of such positive perception, as is the case in the old control group. The bigger picture of this result can be observed in Figure 2, where the interval of duration with an estimated effect that is statistically significant is more apparent, ranging between dose levels of about 5 to 25, or 250 to 625 days.



Figure 2: Comparison to Short-time Negotiators

Negotiating a PTA implies at least two countries trying to reach those terms generating most benefits while compromising the least. The position at the negotiation table is rarely equitable (see for example Bagwell and Staiger, 2011). The imbalance is often generated by each country's economic strength. We therefore proceed to testing whether country imbalances generate different effects of negotiations duration on export growth. We calculate the discrepancy between importer and exporter GDPs as one's share to the





Importer > Exporter

Figure 3: Dissimilarity at the Negotiation Table

other and estimate the dose response-function of negotiations duration for the its 100th, 95th, 75th, and 50th percentile. In the context of a negotiation between two countries of relatively different sizes, it would be informative to see in which direction does the negatively-impacted trade growth go, from the richer to the poorer or vice-versa. ⁵

Looking at Figure ?? above, we see that when the exporter is smaller than the importer (X<M), the magnitude of ATE is only significantly negative until dose level 30 (approximately 4 years of negotiation), while it is of larger magnitude and significantly negative until dose level 55 (approximately 7 years) when the exporter is larger (X>M). This suggests that prolonged negotiations have on average a larger detrimental effect on export growth for the larger countries.

However, the results reported in Table 4 show that for the average treatment effect on the treated (ATET), i.e. the average effect on countries negotiating only the opposite is true. The results indicate one clear pattern:

⁵The percentile values correspond to the factors of 508512, 597, 24, and 2 for exporters larger than importers and 10074, 769, 45, and 9 for exporters smaller than importers respectively.

the magnitude of the deceleration effect of negotiations on exports is larger when the exporter is smaller than the importer. The trade balance of the smaller country is therefore impacted more drastically by the prolonged PTA negotiations.

Furthermore, as we move from the full sample (100th percentile) to the subsample of country pairs in the bottom half of dissimilarity (or the most similar 50%) the effect is consistently reduced, yet still statistically significant at 1% level. This suggests that prolonged negotiations have a smaller effect on trade growth between more similar countries.

Exporter - Importer Dissimilarity < x percentile								
x	10	Oth	95	- 95th		\mathbf{th}	$50 \mathrm{th}$	
	$\mathbf{X} \! > \! \mathbf{M}$	$\mathbf{X} \! < \! \mathbf{M}$	$\mathbf{X} \! > \! \mathbf{M}$	$\mathbf{X} \! < \! \mathbf{M}$	$\mathbf{X} \! > \! \mathbf{M}$	$\mathbf{X} \! < \! \mathbf{M}$	$\mathbf{X} \! > \! \mathbf{M}$	$\mathbf{X} \! < \! \mathbf{M}$
ATET	-14.89	-17.47	-15.34	-17.45	-14.88	-17.45	-12.84	-16.49
ATE	-13.27	-8.60	-13.62	-8.44	-12.50	-7.97	-7.20	-6.86
N treated	4861	4345	4858	4344	4472	3902	3394	2786
N control	214149	142792	202457	136514	156627	106647	99780	70169
N total	219010	147137	207315	140858	161099	110549	103174	72955

Table 4: Negotiations duration ATE on bilateral exports growth

All coefficients are significant at 99% confidence level. Estimation sample restricted to the export growth top 95th percentile. Confidence intervals are constructed based on estimated robust standard errors for ATE and bootstrapped standard errors obtained through 100 draws with replacement for ATET and ATENT. X denotes exporter GDP and M denotes importer GDP.

We run a series of robustness checks, which reinforce the sturdiness of our base results that, on average, long negotiations slow down trade, and present the tabulated results in Table Appendix 2. Table 6 shows the ATE of an increase in treatment dose level, namely of number of days of negotiations. We report values for 500-day increments from 500 to 4500. Furthermore, we address the concern of a phasing-in effect. The act of observing the duration of negotiations between two countries today could potentially only impact trade patterns tomorrow. Of course, since our data is observed yearly, this issue is not so pressing. We include a one-year lead of the outcome variable nevertheless, run similar specifications as in Table 3, and report results in Table 7.

5 Conclusions

The main focus of the international economics literature is identifying the factors that shape world trade patterns, and estimating the effect thereof. This paper directly adds to it. In particular, the contribution is threefold: firstly, it sheds light on a feature of preferential trade agreements (PTAs) relatively ignored in the literature - the duration of their negotiation - and investigates it as a potential trade determinant. This helps to further disentangle the heterogeneous PTAs. Secondly, as opposed to evaluating PTA effects after enforcement, this paper focuses on PTA *anticipation* effects, by looking at the period prior to the enforcement, i.e. during negotiation. Thirdly, it makes use of an estimation technique that accommodates continuous treatment as well as non-linearities between outcome and explanatory variables, never before used to estimate trade determinants, and provides clear and robust results of a negative effect of PTA negotiation duration on trade growth.

It is important to clarify the meaning of this result. The negative and statistically significant relation between negotiation duration and trade growth is by no means indicative of a slowdown in exports in absolute terms, or even stronger - a drop therein - every time there is a PTA negotiation. What this result reveals is that two countries negotiating a trade agreement will on average increase their exports to each other by a lower rate than, hypothetically, the exact same two countries, should they not negotiate. This result therefore doesn't contradict the strong positive marginal effects of trade agreements on trade documented by the literature (Egger et. al, 2009; Baier and Bergstrand, 2009; Anderson and Yotov, 2011; Chang and Lee, 2011; Baier et. al; (2014); Egger and Tarlea, 2017). So a conclusion we should *not* draw from this study is that trade agreements are detrimental to trade. Conversely, the policy implication we would highlight is that lengthier negotiations lead to a marginal drop in the growth rate of trade due to the suspense (or uncertainty) that governs this period. To the extent of our knowledge, there is no prior empirical or theoretical attempt to investigate trade growth during PTA negotiations.

While shortening PTA negotiations is not immediately clear from this paper to be the optimal long-run strategy for policymakers, their duration is certainly not of negligible impact to trade. Furthermore, future work estimating PTA effect on trade should estimate and discount the (trade) expenses of that PTA that were spent during negotiations, before concluding on the marginal benefit once negotiations had succeeded.

Several extensions of this paper are possible. Before explicitly suggesting that shortening PTA negotiations is certainly beneficial, clarifying another issue would be in order. Do longer negotiations actually lead to deeper PTAs, which in turn ensure a relatively larger boost in trade compared to shallower ones. Clarifying this would require extending the current result with a statistical test comparing the potential trade lost during negotiations and the trade gained once the PTA is in place. Additionally, in the future we will evaluate third party effects of PTA negotiation, namely on trade growth between exporter (and in turn importer) and non-PTA members, PTA members, different-PTA members, and future-PTA members. All these should complement the picture of the PTA negotiations duration effect on shaping international trade patterns and shed further light on this relatively ignored period in the life cycle of a PTA.

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Table Appendix 1

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Table 5: PTAs and their negotiation duration

Name of PTA	PTA Negotiation Duration
	(# of days)
Pan-Arab Free Trade Area (PAFTA)	316
ASEAN Free Trade Area (AFTA)	451
Common Economic Zone	452
New Zealand - Singapore	478
Mercosur	485
Canada - Chile	554
China - Hong Kong	557
US - Jordan	559
EFTA - Croatia	560
Thailand - New Zealand	620
Chile-Japan	623
EFTA - Korea	630
EC - Croatia	677
EFTA - Singapore	691
EFTA - Mexico	757
Japan - Singapore	769
Canada - Israel	770
Turkey - Tunisia	774
US - Australia	779
EEC/EC/EU enlargment Finland	788
Jordan - Singapore	789

816
847
860
861
884
888
909
921
939
945
969
983
985
1005
1016
1033
1049
1126
1127
1141
1148
1148
1168
1193
1195
1229
1250

EEC/EC/EU enlargment Austria/Sweden/Finland	1250
TPSEP	1309
Turkey - Chile	1313
India - Malaysia	1316
Chile - China	1340
US - Morocco	1349
Australia - Thailand	1366
Japan - Viet Nam	1389
Japan - Mexico	1396
Hong Kong - Chile	1403
China - New Zealand	1412
Switzerland - China	1418
Japan - Thailand	1421
SAPTA	1447
EFTA - Morocco	1454
EU - Colombia and Peru	1471
EFTA - Chile	1472
European Economic Area (S)	1474
EFTA - Lebanon	1481
ASEAN - China	1500
US - Oman	1508
EC - Mexico	1510
Canada - Colombia	1530
Peru - Chile	1623
EEC/EC/EU enlargment Latvia et. Al	1662
EC - Chile	1686
India - Japan	1689

Singapore - Peru	1716
EFTA - Colombia	1730
Pakistan - Sri Lanka	1746
EU - Serbia	1756
Gulf Cooperation Council (GCC)	1777
EFTA - SACU	1806
EU - Korea	1870
ASEAN - Japan	1881
US - Peru	1902
Canada - Jordan	1907
EC - South Africa	1909
Japan - Switzerland	1912
Chile - Malaysia	1923
New Zealand - Malaysia	1949
Korea - Chile	1963
CEFTA - Croatia	1995
Korea - US	2294
GCC - Singapore	2470
EEC/EC/EU enlargment Cyprus et. Al	2481
EC - Jordan	2515
Chile - Vietnam	2602
EC - Lebanon	2650
EC - Israel	2799
Malaysia - Australia	2826
Egypt - Turkey	3006
US-Colombia	3101
EC - Cote d'Ivoire	3193

US-Panama	3270
India - Sri Lanka	3299
EFTA - Tunisia	3432
EEC/EC/EU enlargment Bulgaria/Romania	3456
EC - Egypt	3526
Asia Pacific Trade Agreement (APTA) - China	3664
Hong Kong - New Zealand	3706
EU (28) Enlargement	3791
EFTA - GCC	4188
EFTA - Canada	4227
EFTA - Egypt	4254
EFTA (S)	4396
SAFTA	5125

	Full sample							
	Mean	Min	$\mathbf{p25}$	Median	p75	p95	Max	\mathbf{N}
Exports growth	0.088932	-20.8472	-0.32484	0.078133	0.492066	2.399181	17.33638	438928
Duration of negotiations	25.17608	0	0	0	0	0	5125	480409
Duration on 0-100 scale	0.513145	0	0	0	0	0	100	459902
1 if negotiating, 0 otherwise	0.062905	0	0	0	0	1	1	480409
Yearly X GDP Growth	4.649505	-48.5686	1.777778	3.816794	6.086957	12.06586	760.6343	442013
Yearly M GDP Growth	4.803759	-89.9624	1.714286	3.875969	6.352941	13.29907	4173.503	422035
X - M Disimilarity Growth	0.338499	-96.5452	-3.06895	-0.03819	3.114926	9.997232	1082.782	414149
			bottom 95	oth percen	tile expor	t growth		
Exports growth	-0.11887	-20.8472	-0.36287	0.049277	0.39508	1.444262	2.387197	416805
Duration of negotiations	27.19739	0	0	0	0	0	5125	420337
Duration on 0-100 scale	0.557666	0	0	0	0	0	100	399997
1 if negotiating, 0 otherwise	0.070484	0	0	0	0	1	1	420337
Yearly X GDP Growth	4.393599	-48.5686	1.744186	3.768844	5.995204	11.1783	760.6343	412883
Yearly M GDP Growth	4.5318	-89.9624	1.699996	3.831667	6.235997	12.37288	4173.503	394374
X - M Disimilarity Growth	0.303096	-96.5452	-3.02832	-0.04541	3.057272	9.610764	1082.782	387298
		bottom	95th perc	entile exp	ort growt	h (treated	only)	
Exports growth	0.052716	-7.80652	-0.08473	0.072394	0.220374	0.648054	2.384346	29606
Duration of negotiations	1230.975	3	446	1105	1777	3193	5125	9287
Duration on 0-100 scale	24.01903	0.058537	8.702439	21.56098	34.67317	62.30244	100	9287
1 if negotiating, 0 otherwise	1	1	1	1	1	1	1	9287
Yearly X GDP Growth	2.937639	-17.5788	1.317778	2.831858	4.672897	8.354553	27.8607	9287
Yearly M GDP Growth	2.949098	-62.0759	1.269841	2.851324	4.755784	8.59375	77.2011	9287
X - M Disimilarity Growth	0.11658	-36.452	-2.14878	-0.05439	2.111943	6.486697	199.5458	9287

Tables Appendix 2

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Table 6: Negotiations duration ATE on bilateral exports growth

Δ	$ATE(t;\Delta)$	Std. Dev.	$\mathbf{P} > \mathbf{t}$	95% cont	fidence interval
10	2.6106	1.1562	0.0240	0.3445	4.8768
20	2.4066	2.4891	0.3340	-2.4719	7.2851
30	0.3013	3.4489	0.9300	-6.4585	7.0611
40	-2.7917	3.0415	0.3590	-8.7529	3.1695
50	-5.9590	1.4468	0.0000	-8.7947	-3.1233
60	-8.2871	1.9604	0.0000	-12.1295	-4.4448
70	-8.8626	3.4327	0.0100	-15.5906	-2.1346
80	-6.7719	5.1170	0.1860	-16.8010	3.2571
90	-1.1017	7.5573	0.8840	-15.9136	13.7103

Estimation sample restricted to the export growth top 95th percentile. Δ denotes the increment in dose level and is evaluated at levels from 10 to 90, corresponding to duration of negotiations from 500 to 4500 days.

Table 7: Negotiations	duration ATE on	bilateral	exports growth
-----------------------	-----------------	-----------	----------------

	τ -year lead of export growth		
au	1	2	
ATE	-18.500***	-25145	
ATET	-16.93***	-15.56***	
ATENT	-18.52***	-15.22***	

*** p<0.01, ** p< 0.05 * p<0.1.

Estimation sample restricted to the export growth top 95th percentile. Estimation period restricted to one and two years before conclusion of negotiations respectively. Confidence intervals are constructed based on estimated robust standard errors for ATE and bootstrapped standard errors obtained through 100 draws with replacement for ATET and ATENT.