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Intellectual Property Rights, Trade Agreements, and International Trade

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Intellectual Property Rights, Trade Agreements, and International Trade

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ABSTRACT

The global process of strengthening and harmonization of intellectual property rights (IPRs) systems has been intensified in the last twenty five years by the signing of trade agreements (TAs) that include chapters with intellectual property (IP) provisions and other non-trade-related issues. This paper provides a first exploration of whether and how the signing of TAs with IP chapters influences bilateral trade flows for a panel of 122 countries and the period 1995-2013. We address methodological issues related to the assessment of the effect of TAs on bilateral trade. We use matching econometrics to evaluate the treatment of TAs with and without IP chapters. In addition, we estimate the effects of TAs on bilateral trade in a more dynamic fashion using a panel data approach based on the gravity model. We perform our analysis for trade in low- and high-IP intensive products. We found that both types of TAs increase bilateral trade. However, TAs with no IPRs chapters have a stronger positive effect on trade, while TAs with IP chapters have a stronger effect if we include lags to consider that they might need a longer implementation time. We also found that the effects depend on the development level of countries and, to a lesser extent, on the IP intensity of products. We found a clear positive effect for developed countries, but we do not observe gains for developing countries in all sectors and to all destinations derived from TAs with IP chapters. This raises the question of whether trade gains can compensate the effort related with IP reforms.

RESUMEN

El proceso global de fortalecimiento y armonización de los sistemas de derechos de propiedad intelectual (DPI) se ha intensificado en los últimos veinticinco años mediante la firma de acuerdos comerciales (ACs) que incluyen capítulos con disposiciones de propiedad intelectual (PI) y otras cuestiones no relacionadas con el comercio. Este documento proporciona una primera exploración sobre si la firma de ACs con capítulos de DPI influyen, y de qué manera, en los flujos comerciales bilaterales para un panel de 122 países y el período 1995-2013. Abordamos cuestiones metodológicas relacionadas con la evaluación del efecto de los ACs en el comercio bilateral. Utilizamos econometría de emparejamiento de datos para evaluar el tratamiento de los ACs con y sin capítulos de DPI. Además, estimamos los efectos de los ACs en el comercio bilateral de una manera dinámica utilizando un modelo gravitacional con el panel de datos. Realizamos nuestro análisis para el comercio de productos de alta y baja intensidad en el uso de DPI. Encontramos que ambos tipos de ACs aumentan el comercio bilateral. Sin embargo, los ACs sin capítulos de DPI tienen un efecto positivo más fuerte en el comercio, mientras que los ACs con capítulos de DPI sólo tienen un efecto más fuerte si incluimos rezagos para considerar que podrían necesitar un tiempo de implementación más largo. También encontramos que los efectos dependen del nivel de desarrollo de los países y, en menor medida, de flujos comerciales de productos de diferente intensidad de uso de DPI. Encontramos un claro efecto positivo para los países desarrollados, pero no observamos ganancias para los países en desarrollo derivadas de los ACs con capítulos de propiedad intelectual en todos los diferentes tipos de comercio analizados. Esto plantea la pregunta de si las ganancias comerciales pueden compensar el esfuerzo relacionado con las reformas de propiedad intelectual.

Keywords: Intellectual Property Rights - International Trade - Trade Agreements - Matching Econometrics Gravity Model

JEL Codes: O10 - O34 - F14

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1 Introduction

The last decades have been characterized by an increasing interaction among countries, especially through trade and foreign direct investment (FDI). In particular, since the 1990s there has been a process of reduction of trade barriers, reinforced through the signing of bilateral, regional, and multilateral trade agreements. The last twenty five years have been also characterized by the proliferation of different types of trade agreements (TAs) and investment agreements, which are shaping international relations.

The process of globalization is also reflected in changes in international institutional and normative aspects. The creation of the World Trade Organization (WTO) in 1994 to regulate international trade and to establish a framework for trade policies, came along with several agreements demanding institutional reforms including those related with intellectual property rights (IPRs). The agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) is certainly one of the most renowned.

With the signing of the TRIPS agreement, countries commit to adopt or modify their intellectual property (IP) related legislation in accordance to the minimum standards demanded by the agreement. Since then, there has been a process of global strengthening and harmonization of IPRs systems (see the increasing scores of IPRs indexes in: [Park, 2008](#); [Liu and La Croix, 2015](#); [Campi and Nuvolari, 2015](#)), despite different countries in terms of development and capabilities might need specific types of IPRs systems ([Kim et al., 2012](#)).

In addition, several countries have been tightening their IPRs systems because they have signed trade agreements that include complex chapters covering IPRs, with IP provisions that demand higher standards of IP protection and are known as TRIPS-Plus or TRIPS+. The obligations related to IPRs are usually included along with a set of policies that need to be implemented in order to comply with the requirements of the agreement and to take advantage of its trade-related issues. TRIPS-plus includes new areas of IPRs, such as the patenting of life forms or copyright applying to electronic content, the implementation of more extensive levels or standards of IP protection than the one demanded by TRIPS, the adoption of new conventions not included in other TAs, or the elimination of an option or flexibility available under TRIPS ([Mercurio, 2006](#); [Biadgleng and Maur, 2011](#)).

As a consequence, TAs are increasingly guiding the design of IPRs systems and strengthening IP protection worldwide, despite being, in principle, a trade policy. In fact, as [Maskus \(2015\)](#) argues, it is difficult to think that the increase in the number of TAs and the strengthening of IPRs systems are independent processes.

In particular, IP-demanding countries are often developed countries (DCs), while the ones that need to implement the reforms are usually developing or least developed

countries (LDCs). Thus, TAs are clearly drivers of significant reform in developing countries and the implementation implies a real and complex challenge for them (Biadgleng and Maur, 2011).

In this context, we ask whether and how TAs with IP chapters affect international trade. Several other question arise: are these TAs, with their effects on IPRs systems, affecting or shaping differently international trade relations compared to TAs with no IP chapters? Do they affect equally countries of different development level? Could the expected gains in trade compensate the efforts related with IP reforms for developing countries?

Despite the increase in the number of TAs including IP provisions, there are only a few recent studies addressing their implications and investigating how they affect international trade. In this paper we provide an empirical and econometric analysis of the effect of TAs and TAs with IP chapters on bilateral trade flows of 122 countries, for the post-TRIPS period: 1995-2013.

We use data from Kohl et al. (2016), which has information on TAs with IP provisions and bilateral trade data from Gaulier and Zignago (2010). We first employ matching econometrics in the cross-section in order to compare the effect on two treatment groups (country pairs that signed TAs with IPRs chapters, and country pairs that signed TAs with no IPRs chapters) against a control group (country pairs that did not signed TAs). Secondly, we do a difference-in-difference analysis to estimate the impact of both types of TAs on bilateral trade flows, employing a fixed-effects technique and a gravity model framework with panel data. We analyze the effect on bilateral trade of manufactures of high- and low-IP intensity, and we control whether the effect differs for countries of different development level.

Overall, we found that both types of TAs increase bilateral trade. However, TAs with no IP chapters have a stronger positive effect than TAs with IP chapters, while TAs with IP chapters seem to have a stronger effect if we include lags to consider that they might need a longer implementation time. Also, we found that the effect of both types of TAs depends on the development level of the signatory countries. In particular, both types of TAs increase trade flows from developed countries to both developed and developing countries, in total trade, low-IP, and high-IP intensive trade. While we found a clear positive effect for developed countries, we do not observe gains for developing countries in all sectors and to all destinations. This raises the question of whether trade gains can compensate the effort related with IP reforms for developing countries.

The paper is organized as follows. Section 2 provides the motivation, reviews the literature, and discusses several methodological challenges related to the estimation of the effect of TAs on trade. Section 3 analyses the evolution and diffusion of trade

agreements. Section 4 carries out the econometric estimations. Finally, section 5 concludes.

2 Motivation and methodological aspects

The remarkably increase of different types of TAs during the last twenty five years has spurred the interest of economists. A large literature analyzes, both empirically and theoretically, the effect of TAs on international trade, FDI, economic integration, and economic growth (see, for example, [Krugman, 1993](#); [Baier and Bergstrand, 2007](#); [Medvedev, 2012](#)).

Theoretically, given that TAs remove domestic barriers to trade, most authors expect a positive effect on trade flows of signatory countries. However, TAs can lead to trade diversification rather than to trade creation, and can be a substitute for the full implementation of WTO rules, which can not necessarily lead to a positive effect on trade ([Kohl et al., 2016](#)).

Empirically, the findings related to the effect of TAs in trade flows are rather mixed. On one of the first studies, [Rose \(2004\)](#) found little evidence that the General Agreement on Tariffs and Trade (GATT) and the WTO positively affect trade. Later, other authors showed that the WTO and other TAs have a positive but uneven impact on trade (see, for example, [Subramanian and Wei, 2007](#); [Cheong et al., 2015](#), for the case of the WTO).

A reason behind the mixed empirical findings is the existence of several methodological issues. Moreover, despite several contributions made efforts to address them, the estimated effect of TAs on trade flows is highly sensitive to the specification of the model and the groups of countries or years chosen (see, [Magee, 2003](#), for a discussion).

A major methodological issue and a plausible explanation for these non-concluding results derives from the endogeneity of TAs. There exist clear endogenous reasons for countries to engage in TAs, which are also likely to be correlated with the levels of trade and country characteristics (see: [Magee, 2003](#); [Baier and Bergstrand, 2004](#), for studies on the determinants of TAs).

Due to the presence of endogeneity, the effect of TAs is usually under- or over-estimated. In particular, endogeneity is acknowledged as an important problem when dummy variables are used to estimate the effects of TAs using gravity models with cross-sectional data and ordinary least squares (OLS) estimation method. Several authors have used instrumental variables to deal with this problem showing stronger effects of TAs on bilateral trade (see, for example [Trefler, 1993](#); [Lee and Swagel, 1997](#)). In addition, a few contributions have addressed the issue of endogeneity using gravity estimations, finding that previous analysis underestimated the effect of TAs.

Baier and Bergstrand (2007) showed that most cross-section gravity estimations of the effect of TAs on bilateral trade flows result in biased, unstable, and underestimated effects, and that the major source of endogeneity derives from omitted (selection) bias. They argue that better estimations are obtained with gravity equations using panel data with bilateral fixed and country and time effects or differenced panel data with country and time effects.

In a more recent article, Baier and Bergstrand (2009) used matching econometrics to estimate the long-run effects of TAs on bilateral trade flows, avoiding the bias introduced by non-random selection and non-linearities. They concluded that estimations are more stable across years and have more plausible values than estimations of cross-section estimates of gravity equations with OLS.

Building on this contribution, Falvey and Foster-McGregor (2017) use matching econometrics to investigate the impact of PTAs on goods trade flows. They consider two sequential decisions of PTAs: first, whether two trading partners should form a PTA and, second, if they do, how broad that agreement should be. They find that distance, common language, common boarder, and GDP are significant for both decisions, but often have opposing effects on each. They estimate a dose response function that relates the trade change due to PTA treatment to the breath of the PTA adopted, and they show that it exhibits an inverted u-shape.

However, Baier and Bergstrand (2007, 2009) and Falvey and Foster-McGregor (2017) use in their estimations the log of the sum of the bilateral trade flows between partners as the dependent variable. In this way, they can only observe the average effect of TAs on country pairs but they cannot address the possible uneven effect of TAs on trade partners. Cheong et al. (2015) showed that the more similar the partner countries are in terms of size, income, or location, the larger the increase in intra-bloc trade is under a TA. In particular, they showed that the gain for LDCs from a TA among themselves is about two and a half times that from partnering with DCs. Likewise, there might exist differences derived from the level of technology of trading countries. Shin et al. (2016) found that IPRs may act as an export barrier to trade. They argue that while recent IPRs reforms have facilitated global trade, they have not helped promoting exports of developing countries. Considering this evidence, we allow for the existence of heterogeneous effects on trade partners.

Another relevant issue is that TAs include not only trade-related issues but also they are increasingly including provisions on investments, intellectual property rights, services, public procurement, competition, sanitary and phytosanitary measures, dispute settlements, trade defense instruments, market access, and other dimensions, which can also affect trade relations. Despite TAs are different in scope, content, and design, in general, the literature considers simply the number of TAs in force. Addressing this

issue, [Dür et al. \(2014\)](#) created a database that considers the differences in the design of preferential trade agreements (PTAs) and they analyzed whether and to what an extent PTAs affect trade flows. They find that, on average, PTAs increase trade but the effect depends on how deep are the agreements.

Similarly, [Hofmann et al. \(2017\)](#) created a database of PTAs notified to the WTO that provides a detailed assessment of the content of PTAs. They show that the depth of the PTA measured according to their content on trade-related issues and other provisions is positively correlated with the intensity of trade flows. Using this database, [Mattoo et al. \(2017\)](#) use a gravity model to evaluate the impact of the depth of PTAs on trade, controlling the effect of other determinants of trade flows and assessing endogeneity problems. They found that deep agreements lead to more trade creation and less trade diversion than shallow agreements.

Likewise, [Kohl et al. \(2016\)](#) studied if heterogeneous TAs stimulate international trade differently. Using a gravity model, they analyzed 296 trade agreements signed between 1948 and 2011, finding that heterogeneity of TAs is relevant for explaining trade flows. Also, they showed that the degree to which countries negotiate comprehensive TAs depends positively on their development level and also on the number of WTO members on the agreement. This implies that TAs that involve developed countries or WTO members are in general more comprehensive. Similarly, [Kohl and Trojanowska \(2015\)](#) addressed the heterogeneous nature of TAs using matching econometrics to evaluate their impact. They found that the magnitude and significance of the treatment effects of TAs are strongly related to their type, with more extensive agreements showing larger treatment effects.

Until recently, the effect of extra-trade provisions and, in particular, those related with IP protection, had been marginally studied. To our knowledge, the first empirical contribution is the one developed by [Maskus and Ridley \(2016\)](#) who study the role of PTAs with complex chapters on IPRs on the magnitude and composition of trade. They found that PTAs in which one partner is the United States (US), the European Union (EU), or the Europe Free Trade Association (EFTA), and have chapters on IP-related issues have significant impacts on trade flows of the members. These positive effects on trade are mostly observed for middle-income countries, but also in some particular sectors in high- and low-income countries. Our analysis complements the results of [Maskus and Ridley \(2016\)](#) because we estimate the effects of TAs with IP chapters on bilateral trade flows considering the interaction with the development level of signatory countries.

Most TAs with IP chapters involve an IP-demanding country, which is usually a developed country, and one or several countries that need to implement the IP reforms. TAs with IPRs provisions between the US and developing countries have been

expanding over time and they usually require detailed obligations. TAs between the EU and developing partners contain, mostly, the general principle of adhering to the highest standards of protection and ratification of WIPO treaties and UPOV 1991. More recently, the EU started including wider provisions on IPRs (for example, in the agreements with CARIFORUM, CAFTA, Peru, and Colombia) (Biadgleng and Maur, 2011). Thus, not considering the differences in the development levels of countries can provide an incomplete or biased assessment of the effect of TAs with IP chapters.

Also, there exist other methodological issues to evaluate the impact of TAs with IP chapters on trade that derive from some characteristics of the data. One of them is related with the difficulty of separating the effect of IPRs chapters from the effect of trade-related issues, both included in the same agreement. Another important issue around IP provisions of TAs is their implementation. Claiming that the actual implementation of IP obligations in PTAs has been rarely studied, Biadgleng and Maur (2011) analyzed how PTAs have influenced IP regimes in developing countries. Fulfilling this task is not straightforward because there is little information regarding what countries do after signing the agreements. Also, the demands often require a relatively extensive review of legislation, regulations, and practices, which creates a challenge for econometric studies that use information contained in TAs. The authors found that TAs are clearly drivers of significant reform in countries and that the implementation challenge for developing countries is real and complex.

In the econometric analysis we make an effort to address these methodological issues by adopting different strategies. To separate the effect of trade-related issues and IP provisions, we use matching econometric and compare the effects of TAs with and without IPRs chapters. To deal with endogeneity, we use panel data with fixed effects and time dummies in a gravity framework. To consider the implementation time of IP provisions, we use lags in our estimations. Finally, we use interaction variables between TAs and the level of development of countries to consider possible different effects.

3 The diffusion of trade agreements

Countries around the world have been increasingly signing different types of trade agreements.¹ Figure 1 shows the evolution of the number of TAs signed since the mid twentieth century. While a few TAs were signed between 1948 and 1991, the diffusion

¹The WTO defines RTAs as reciprocal trade agreements between two or more partners, including free trade agreements and customs unions. Meanwhile, PTAs are defined as unilateral trade preferences, which include Generalized System of Preferences schemes (under which developed countries grant preferential tariffs to imports from developing countries), as well as other non-reciprocal preferential schemes granted a waiver by the General Council. See: https://www.wto.org/english/tratop_e/region_e/rta_pta_e.htm, accessed on January 2017.

of TAs is a phenomenon that clearly characterizes the last twenty five years. Moreover, the number of TAs that include IP provisions, mostly legally enforceable, has been also increasing since 1992.

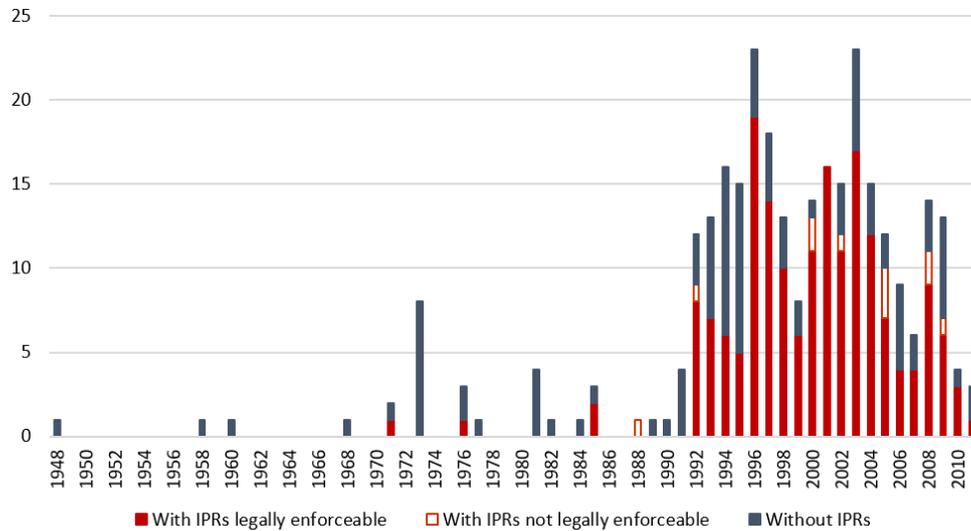


Figure 1: Evolution of the number of signed trade agreements. 1948-2011

This process is expected to have several implications for signatory countries and also for countries that have trade relations with them. The TRIPS agreement extends the principles of “national treatment” and of “most-favored-nation” to IPRs for all WTO members. This means that WTO members must be treated equally to the residents regarding IP protection and that IP reforms derived from TAs that are signed by two or more countries are immediately extended to all other countries connected with the members of TAs. This reinforces the process of harmonization and strengthening of IPRs systems.

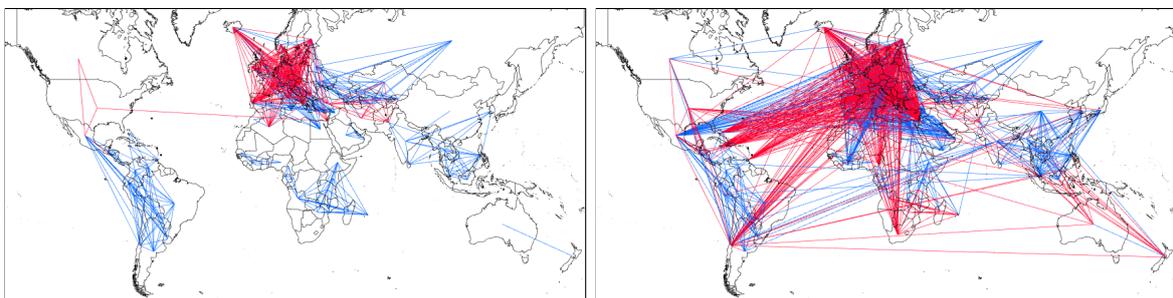


Figure 2: Network of countries with trade agreements. In blue, trade agreements with no IP chapters. In red, trade agreements with IP chapters. 1995 (left) and 2010 (right)

In particular, TAs are inducing the diffusion of stronger IPRs systems to developing countries because TAs with IP chapters usually involve a developed country or developed area and one or several developing countries. Figure 2 shows how bilateral connections

through TAs with no IP chapters (in blue) and TAs with IP chapters (in red) have increased between 1995 and 2010. Also, it shows that most countries with TAs with IP chapters are linked with the EU or the US. In addition, we observe that several less developed countries, such as Chile or South Africa, have signed mainly TAs with IP chapters and most of them with the EU or the US as a partner.

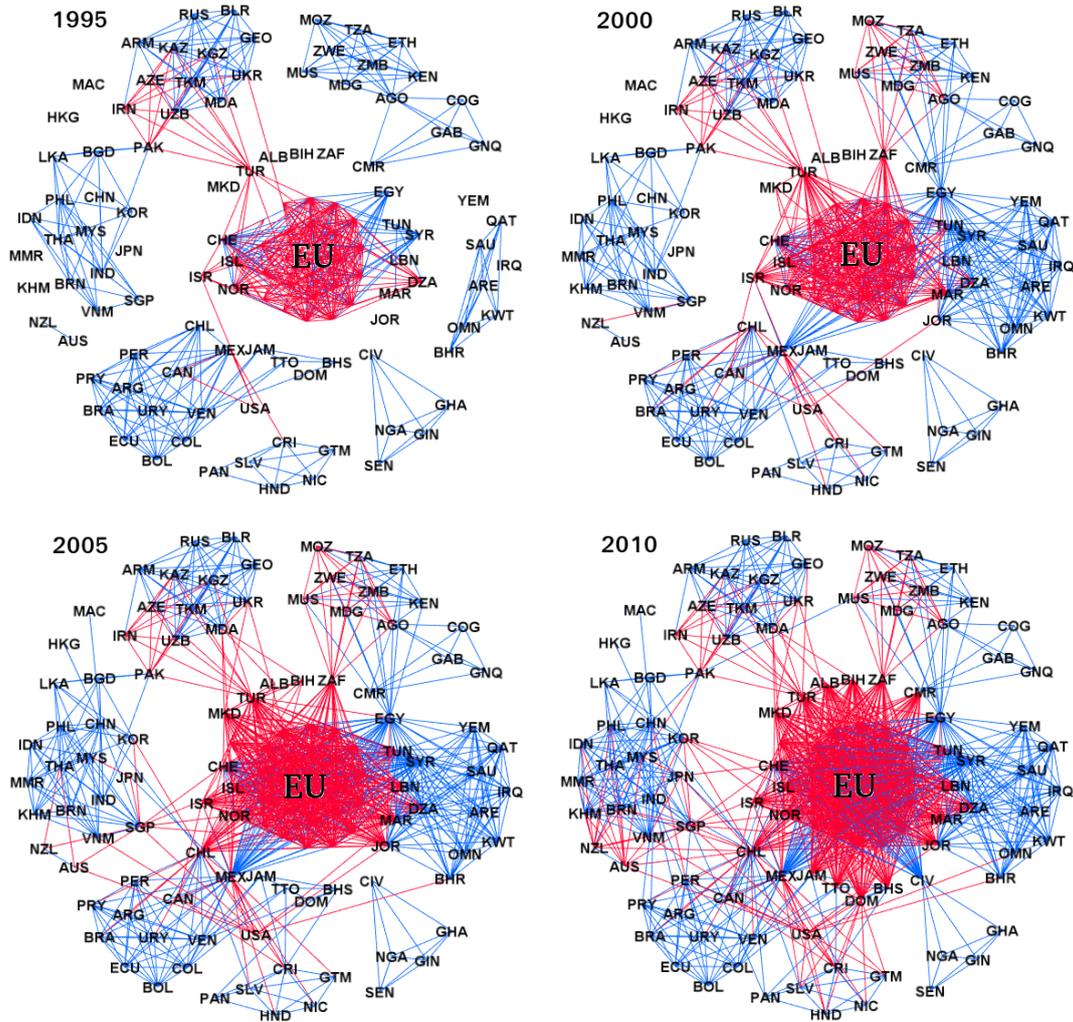


Figure 3: Trade agreements without IP chapters (in blue) and with complex IPRs chapters (in red). Evolution of the network of signatory countries. See Appendix A for the list of countries.

From a different perspective, Figure 3 illustrates how countries have become more integrated through different types of TAs. We observe that TAs have been increasing over time with an expansion of members as a consequence. While the network was disconnected in 1995, it looks highly connected in 2010, although it still has strong regional features. The networks show the existence of communities or clusters of countries, which usually are trade areas or geographical neighbors. For all the years, there are clearly distinguishable clusters of countries linked through TAs with no IP

chapters (in blue). Some of these clusters include LDCs and are not linked to DCs. Instead, most clusters of countries with TAs with IP chapters include DCs.

In 1995, we only observe three clusters of countries with TAs with IP chapters composed by the EU, a group of Eastern European countries, and a third smaller cluster composed by the US, Canada, and Mexico. In 2000, a fourth cluster composed of a group of African countries appears and the other three clusters get more dense. In 2005, the network grows and several Asian countries enter the network of countries that have signed TAs with IP chapters. In 2010, we observe a more connected network, more dense clusters, and a new cluster composed of a group of Asian countries.

4 Econometric estimations

We use bilateral trade flows from [Gaulier and Zignago \(2010\)](#) for the years 1995-2013 and a balanced panel of 122 countries. We deflate the data by the US imports price index applying the index of each corresponding chapter in order to consider heterogeneity among price variations for different sub-sectors²

We use data from [Kohl et al. \(2016\)](#) that contains TAs and TAs with IP chapters signed between 1948 and 2011, and distinguish TAs with no IP chapters and with both legally and not legally enforceable IP chapters. We use TAs with legally enforceable IP chapters in our variable indicating the presence of IP provisions as we are interested in TAs that entail a compulsory implementation of IP reforms. We have modified the database to consider that the accession agreements enacted to become part of the European Union include legally enforceable IP provisions.³ We consider TAs signed before 1995 that are still in force in our time period, and we extrapolate the list of TAs in force for the years 2012 and 2013.

In order to evaluate the impact of TAs, we follow two complementary strategies. Firstly, we employ matching econometrics in the cross-section and, secondly, we use a difference-in-difference technique applied to the whole time period. In both cases we define the control group as all those country pairs without TAs, and two different treated groups: one includes countries that have signed TAs without IP chapters, and the other one includes countries that have signed TAs with IP chapters.

We use two treatment groups because we want to compare the effect of the two types of TAs using a common control group. Therefore, we define two different *policy* variables: one for TAs without IP chapters TA_{ijt}^{nip} , and another one for TAs with IP chapters TA_{ijt}^{ip} . These are dummy variables that take the value of one from the entry

²The deflators are available at the US Bureau of Labor Statistics, <http://www.bls.gov/web/ximpim/beaexp.htm>, accessed on January 2017.

³We have analyzed legal documents of the European Union to determine this. See: EUR-Lex, to access European Union law: <http://eur-lex.europa.eu>.

into force of a specific trade agreement between the country pair ij . Because TAs have different dates of entry into force and are signed by different country pairs ij , both control and treatment groups change over time.

Table 1: Number of links, bilateral trade flows, and differences for selected years. Countries with: no TAs, TAs without IP chapters, and TAs with IP chapters

		1995	2000	2005	2010
Number of links	TA^{nip}	618	822	929	1,053
	TA^{ip}	542	850	1,397	1,851
	No TAs	13,602	13,090	12,436	11,858
Average of the ln of trade	TA^{nip}	10.68	10.56	10.95	11.43
	TA^{ip}	12.48	12.26	11.70	11.22
	No TAs	8.37	8.25	8.48	8.72
Difference in ln between	TA^{nip} and No TAs	2.31	2.31	2.47	2.71
	TA^{ip} and No TAs	4.11	4.01	3.22	2.50

Table 1 shows several statistics for the three groups of countries and for selected years. We observe that the number of bilateral trade links (strictly positive flows) with any type of TAs increases over time, while the number of bilateral trade links of countries with no TAs decreases. This reflects the increase in the number of signatory countries. On average, country pairs with any type of TAs trade more than country pairs with no TAs. The difference between the control group and the two treated groups changes over time. In the case of TA^{nip} , the difference increases, while in the case of TA^{ip} , the difference decreases. Interestingly, a possible explanation for the lower average trade levels for country pairs with TA^{ip} can be derived from the fact that the number of links increased by 3.4 times between 1995 and 2010. Instead, the number of links of countries with TA^{nip} increased by 1.7 times.

We perform the estimations for total bilateral trade and trade of products of different IP intensity. We use the classification of Delgado et al. (2013), which divides products from the Standard International Trade Classification (SITC), Revision 3, into two categories: high-IP or low-IP intensive products. Using this information, we classify products in the Harmonized System Codes 1992.⁴ Appendix B presents the detailed list of products of different IP intensity.

⁴Conversion tables can be found here: <https://unstats.un.org/unsd/trade/conversions/HS%20Correlation%20and%20Conversion%20tables.htm>, accessed on January 2017.

4.1 Matching estimations

We use a matching approach in order to have a better assessment of the treatment effect of TAs in the cross-section. Another motivation for using matching econometrics derives from the difficulty in evaluating the impact of TAs with IP chapters given that it is not possible to separate their effect from the effect of trade-related issues included in the same TA. Thus, by creating two treated groups and comparing them with a common control group, we are able to compare in relative terms the effects of these two different treatments.

We use the methodology presented by [Abadie and Imbens \(2006\)](#). The authors developed a matching methodology, which stresses on how to define properly a control group of countries (without TAs) that can be compared and paired with treated countries (with TAs). To do this, the matching mechanism simulates random assignments based on a set of characteristics (x) of the country pairs in both groups that might be as much similar as possible. Therefore, it allows to derive the change in the expected value of total bilateral trade taking as a reference the non-treated and the treated group of countries. Accordingly, the first case is called the average treatment effect (ATE), while the second one is called the average treatment effect of the treated (ATET). These two measures are relevant for the treatment evaluation of trade agreements. The ATE is known to be relevant when the treatment has universal applicability, while the ATET is relevant to consider the counterfactual, i.e. the average gain from the treatment for the treated ([Cameron and Trivedi, 2005](#)).

From the analysis above, it is clear that TAs have been rapidly diffusing in the world trade network. The evaluation of this phenomena is not completely captured by the ATET, which allows to asses the impact of TAs on the treated. In contrast, with the ATE we can study the effect at the population level in order to take into account the potential outcome for country pairs which still lack TAs.

We derive the ATE and ATET for the group of country pairs with TA^{nip} and the group of country pairs with TA^{ip} . The treatment effects for the treatment groups are defined as:

$$ATE^{nip}(x) = E[\tilde{w}_1^{nip} - \tilde{w}_0 | X = x]; \quad (1)$$

$$ATET^{nip}(x) = E[\tilde{w}_1^{nip} - \tilde{w}_0 | TA^{nip} = 1, X = x]; \quad (2)$$

$$ATE^{ip}(x) = E[\tilde{w}_1^{ip} - \tilde{w}_0 | X = x]; \quad (3)$$

$$ATET^{ip}(x) = E[\tilde{w}_1^{ip} - \tilde{w}_0 | TA^{ip} = 1, X = x]; \quad (4)$$

where, \tilde{w} is the natural logarithm of total trade between country pairs ij in a given year; and \tilde{w}^{nip} refers to total trade of countries that have signed TAs without IP chapters,

\tilde{w}^{ip} is total trade of countries that have signed TAs with IP chapters, w_0 is total trade of countries that have not signed TAs; and, X is a random vector of dimension k of continuous covariates distributed on \mathbb{R}^k , with compact and convex support x .

For the matching mechanism, we employ a logit model to find the propensity scores, in which the independent variable is whether country pairs have (or do not have) a TA (with and without IP chapters), using as covariates countries' GDPs, geographical distance, contiguity, common language, and a set of dummies characterizing trade relationships according to the development level of countries. More formally, the set of economic characteristics x is a vector of $k = 7$ dimensions which we define as $x = \{\ln(\text{GDP}_i \cdot \text{GDP}_j), \ln(d), \text{contig}, \text{comlang}, G_{dc \leftrightarrow dc}, G_{dc \leftrightarrow ldc}, G_{ldc \leftrightarrow ldc}\}$. Table 2 presents a complete description of the variables and sources. Finally, once propensity scores are determined, we use three nearest neighbors in the control group.

Table 2: Variables employed in the matching estimations

Label	Related to	Description	Source
w	Link	Exports (in ln) in constant (2000) US dollars	BACI-CEPII: Gaulier and Zignago (2010)
TA^{nip}	Link	Trade agreement with no IP chapters	Kohl et al. (2016)
TA^{ip}	Link	TAs with legally and non legally enforceable IP chapters	Kohl et al. (2016)
GDP	Country	Gross domestic product	Penn World Tables: Feenstra and Timmer (2013)
d	Link	Distance between two countries, based on bilateral distances between the largest cities of those two countries, weighted by the share of the city in the overall country's population	BACI-CEPII: Gaulier and Zignago (2010)
contig	Link	Contiguity dummy equal to 1 if two countries share a common border	BACI-CEPII: Gaulier and Zignago (2010)
comlang	Link	Dummy equal to 1 if both countries share a common official language	BACI-CEPII: Gaulier and Zignago (2010)
G_k	Link	Set of dummies indicating bilateral relations by development levels	United Nations (2017)

[Baier and Bergstrand \(2009\)](#) extensively discuss three conventional assumptions made in order to apply the matching methodology for the treatment evaluation of TAs. The *ignorability assumption* is that, conditional to x , trade agreements are independent of the outcomes \tilde{w}_1 and \tilde{w}_0 . The *overlap assumption* claims that the distribution of x for the treated and the untreated trade partners have a common support. And, a third assumption, the *stable-unit-treatment-value*, assumes that conditional to x : i) the treatment (TAs) is the same for all treated countries: i.e. there are no multiple versions of TAs, and ii) there are no network effects (no interference) such that a TA between a country pair ij influences the outcome of another country pair without a TA.

All these assumptions are hard to meet, in particular, the third one. To deal with

this, [Baier and Bergstrand \(2009\)](#) use the strategy of redefining the set of covariates x . Their approach departs from the theoretical hypotheses of general equilibrium, which borrows from the microfounded model proposed by [Anderson \(1979\)](#). However, the network effects in the international trade system are too strong to be reconciled with these micro-assumptions (see the role of network structure in [Arpino et al., 2017](#)). In fact, there is an important amount of studies showing that the international trade network has strong signals of complexity, which implies that departing from the micro to explain the macro phenomena is very difficult [Serrano and Boguñá \(2003\)](#); [Garlaschelli and Loffredo \(2005\)](#); [Dueñas and Fagiolo \(2013\)](#); [Almog et al. \(2017\)](#). That said, we prefer not to redefine the covariates (x) because in doing so one would accept that any trading country pair may be equally affected by any other trading country pair, which ignores the topology that governs the international trade network. Of course, we are aware of the caveats at using the matching methodology in order to do the treatment evaluation.

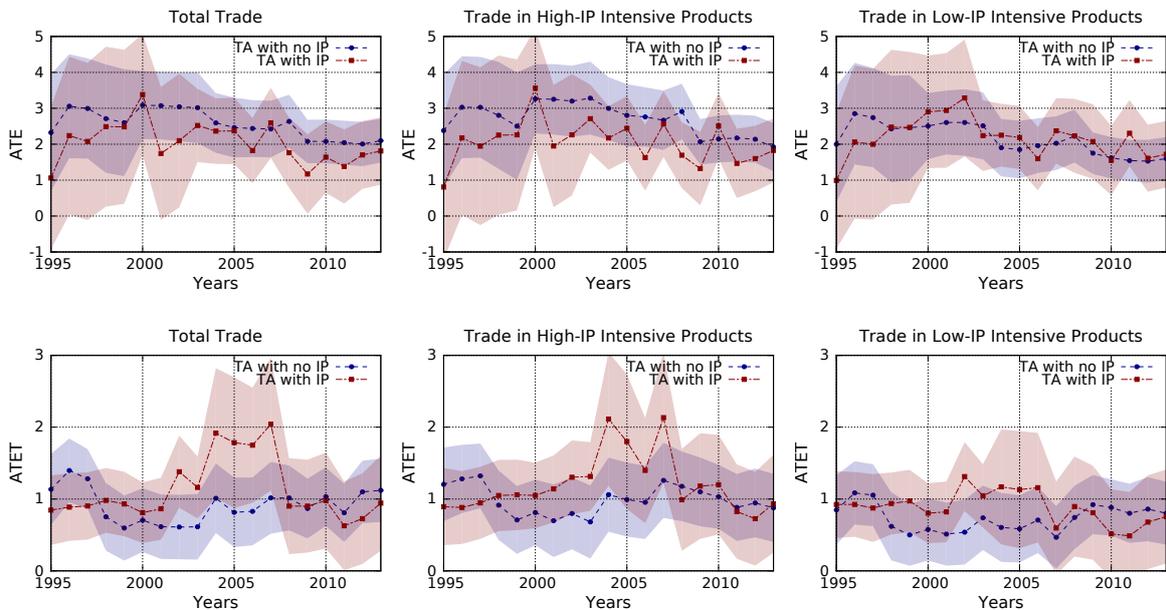


Figure 4: Estimated average treatment effect (ATE, upper panel) and estimated average treatment effect on the treated (ATET, lower panel) using matching econometrics for bilateral trade flows (in ln): total, high-IP intensive products, and low-IP intensive products. Shaded areas correspond to the 95% confidence intervals.

Figure 4 shows the estimation results. In the upper panel, we show the estimated ATE for total bilateral trade (left), trade of high-IP intensive products (middle), and trade of low-IP intensive products (right). In all cases, we observe that for both treated groups (either country pairs with TA^{nip} or country pairs with TA^{ip}), the average treatment effect is significant and shows that both treated groups have higher average trade levels than the control group (country pairs with no TAs). We observe no significant differences between the estimated average bilateral trade of the two treated

groups with respect to the average trade of the control group.

The lower panel of Figure 4 shows the estimation results of the ATET for total trade (left), trade of high-IP intensive products (middle), and trade of low-IP intensive products (right). The estimation results show that both types of TAs actually increase the levels of trade of both treated groups and of trade of different IP intensity. This confirms that countries that sign TAs, regardless of their type, increase their bilateral trade.

4.2 Gravity estimation using panel data

The second strategy to study the effect of TAs is to implement an individual-level panel data estimation, considering that country pairs have signed TAs at different moments. We take as benchmark the gravity model (GM) to estimate the bilateral trade flows and to address the effect of TAs on a balanced panel of 122 countries for the period 1995-2013.

The GM has been widely used to explain bilateral trade flows using country size (GDP) and the geographical distance between two countries as the main explanatory variables (see [Anderson, 2011](#), for a review). In addition, the GM allows the consideration of several other controls, such as trade barriers, cultural differences, trade agreements, and transaction and transportation costs. Gravity models have been also used to study the effect of IPRs on bilateral trade flows, finding mixed but significant effects (see, for example, [Fink and Primo Braga, 2005](#); [Campi and Dueñas, 2016](#)), and to estimate the effect of free trade agreements (see, for example, [Carrere, 2006](#); [Baier and Bergstrand, 2007](#)).

The following equation represents our benchmark specification. Let w_{ijt} be the natural logarithm of exports from country i to country j at the year t . The gravity equation is defined as:

$$w_{ijt} = X_{ijt} \cdot \beta + TA_{ijt}^{nip} \cdot \zeta + TA_{ijt}^{ip} \cdot \xi + \tau_t + \eta_{ijt}; \quad (5)$$

where $i, j = 1, \dots, N$; $X = \{\ln(GDP_i), \ln(GDP_j), hc_i, hc_j\}$ is a vector of country specific macro variables, including GDP, as an indicator of economic and market size, and human capital, as an indicator of development or capabilities (both variables from [Feenstra and Timmer \(2013\)](#); TA^{nip} and TA^{ip} take the value of one since the signing and zero before; τ_t are time dummies; and η is the residual.

As in the matching estimations, we use as the control group the outcomes of all country pairs which do not have any TA and the treatment groups are composed by country pairs that have signed TA^{nip} or TA^{ip} . We estimate the GM equation using fixed effects (FE) estimation method with time dummies for all the different

specifications of the model. Of course, it is assumed that TA is strictly exogenous, and that it is not correlated with η .

Table 3: Bilateral trade estimation results of the gravity model

Model	(1)	(2)	(3)	(4)	(5)
TA	0.098*** (0.026)				
TA^{nip}		0.154*** (0.052)		0.136*** (0.042)	0.129*** (0.041)
TA^{ip}			0.072** (0.028)	0.083*** (0.027)	0.036 (0.027)
TA_{t-5}^{nip}					0.029 (0.035)
TA_{t-5}^{ip}					0.130*** (0.020)
$\ln(\text{GDP}_i)$	1.129*** (0.053)	1.147*** (0.057)	1.144*** (0.056)	1.127*** (0.053)	1.137*** (0.053)
$\ln(\text{GDP}_j)$	1.442*** (0.045)	1.473*** (0.049)	1.477*** (0.048)	1.440*** (0.045)	1.450*** (0.046)
hc_i	0.185* (0.097)	0.169* (0.103)	0.226** (0.102)	0.184* (0.097)	0.176* (0.097)
hc_j	-0.016 (0.090)	-0.047 (0.095)	-0.025 (0.095)	-0.018 (0.090)	-0.026 (0.090)
Constant	-22.505*** (0.859)	-23.248*** (0.948)	-23.318*** (0.928)	-22.455*** (0.861)	-22.673*** (0.865)
Time dummies	yes	yes	yes	yes	yes
Observations	201,769	180,572	188,326	201,769	201,769
R-squared	0.205	0.194	0.199	0.205	0.206
Number of links	11,919	11,420	11,467	11,919	11,919

Notes: The dependent variable is total bilateral trade. Standard errors are in parenthesis. Significance level: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 3 shows the estimation results of the gravity model for total bilateral trade. GDP of both the importer and the exporter are positive and significant. Human capital is positive and significant for the exporter, indicating that countries with higher capabilities are able to export more.

In model (1) we include a variable indicating if country pairs have a trade agreement regardless of the type. We observe a positive and significant estimated coefficient. In models (2) and (3) we include a variable indicating if the countries have signed a trade agreement with no IP chapters (TA^{nip}) and with IP chapters (TA^{ip}), respectively. We observe that signing these TAs increases bilateral trade flows. In model (4), we include both variables in order to be able to compare their effect on bilateral trade flows. We observe that both variables are positive and significant, but TA^{nip} have a stronger effect.

Trade agreements are phased-in over time, generally over five to ten years, as they include agreed upon phased-in tariff cuts. For example, [Baier and Bergstrand \(2007\)](#) showed that the effect of TAs can be seen after 10 years of the entry into force. In addition, non-trade-related issues, including IP provisions, might demand a relatively long implementation time. In order to consider this, in model (5), we also include the five-years lag of the variables TA^{nip} and TA^{ip} .⁵ Note that given that the data on TAs are available since 1948, we do not lose observations when we create the lags. We observe that TA_{t-5}^{nip} is not significant while TA_{t-5}^{ip} is positive and significant. This implies that, on average, the positive effect of TA^{ip} tends to be stronger five years after its entry into force.

Table 4: Estimation results of the gravity model for bilateral trade of high- and low-IP intensive products

Model	High-IP intensive products		Low-IP intensive products	
	(1)	(2)	(3)	(4)
TA^{nip}	0.230*** (0.046)	0.206*** (0.044)	0.145*** (0.044)	0.124*** (0.042)
TA^{ip}	0.119*** (0.029)	0.072*** (0.027)	0.060* (0.031)	0.009 (0.031)
TA_{t-5}^{nip}		0.071* (0.038)		0.066* (0.038)
TA_{t-5}^{ip}		0.131*** (0.022)		0.138*** (0.022)
$\ln(\text{GDP}_i)$	1.138*** (0.052)	1.148*** (0.052)	1.046*** (0.057)	1.056*** (0.057)
$\ln(\text{GDP}_j)$	1.326*** (0.048)	1.335*** (0.048)	1.457*** (0.049)	1.467*** (0.050)
hc_i	0.212** (0.097)	0.202** (0.097)	0.098 (0.104)	0.087 (0.104)
hc_j	-0.006 (0.090)	-0.017 (0.091)	-0.020 (0.098)	-0.030 (0.098)
Constant	-22.405*** (0.874)	-22.592*** (0.877)	-22.103*** (0.946)	-22.337*** (0.947)
Time dummies	yes	yes	yes	yes
Observations	185,203	185,203	194,657	194,657
R-squared	0.266	0.266	0.135	0.135
Number of links	11,754	11,754	11,863	11,863

Notes: The dependent variable is bilateral trade of high-IP intensive products (models (1-2)) and bilateral trade of low-IP intensive products (models (3-4)). Standard errors are in parenthesis. Significance level: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

⁵We also estimated the model using 2, 3, and 10-years lags. The results provide similar conclusions and are available upon request.

Next, we estimate Equation (5) for products that are expected to be differently affected by IPRs. Table 4 shows the estimation results of the gravity model using trade flows of high-IP and low-IP intensive products as dependent variables.

As before, GDP per capita of both the importer and the exporter are positive and significant. The variable that indicates the level of human capital of the exporter is positive and significant for exports of high-IP intensive products, which mainly include products from high-technology sectors and not significant for trade of low-IP intensive products.

As we found for total bilateral trade, we observe in models (1) and (3) that both TA^{nip} and TA^{ip} increase bilateral trade of both types of products, but the effect of TA^{nip} is again stronger than the effect of TA^{ip} , regardless of the IP intensity of traded products. If we consider the lagged effects of TAs, we observe in models (2) and (4) that the effect of TA_{t-5}^{nip} and TA_{t-5}^{ip} are significant for both types of products, but in both cases, TA_{t-5}^{ip} has a stronger effect.

Finally, we evaluate the effect of TAs on bilateral trade for country pairs of different development levels.⁶ We classify trade flows in four groups: i) trade between DCs; ii) trade from DCs to LDCs; iii) trade from LDCs to DCs; and iv) trade between LDCs. We generalize equation (5) to derive interactions between trade agreements and these different groups. Thus,

$$w_{ijt} = X_{ijt} \cdot \beta + \sum_k G_k \cdot TA_{ijt}^{ip} \cdot \zeta_k + \sum_k G_k \cdot TA_{ijt}^{nip} \cdot \xi_k + \tau_t + \eta_{ijt}; \quad (6)$$

where G is a binary variable indicating the trade group type $k = \{dc \rightarrow dc, dc \rightarrow ldc, ldc \rightarrow dc, ldc \rightarrow ldc\}$.

Table 5 shows the estimation results of the gravity model that includes interaction variables between the level of development of trading partners and TAs for total bilateral trade flows (1-2), trade flows of high-IP intensive products (3-4), and trade flows of low-IP intensive products (5-6).

In model (1), the interaction variables indicate that both TA^{nip} and TA^{ip} increase the level of total bilateral trade between DCs, and from DCs to LDCs. Instead, bilateral trade flows between LDCs and from LDCs to DCs are not increased by the signing of any type of trade agreements.

Models (3) and (5) estimate the effect of trade agreements on trade flows of products of different IP-intensity. In the case of high-IP intensive products, we estimate that TA^{nip} increases flows of all types of trade partners, while TA^{ip} increases flows between DCs, and from LDCs to DCs (at the 1% level of significance). In the case of low-IP

⁶The classification of countries according to their development level is based on [United Nations \(2017\)](#).

Table 5: Estimation results of the gravity model with interaction variables

Model	Total bilateral trade		High-IP intensive products		Low-IP intensive products	
	(1)	(2)	(3)	(4)	(5)	(6)
$G_{dc \rightarrow dc} \cdot TA^{nip}$	0.188*** (0.062)	0.070 (0.061)	0.326*** (0.071)	0.181** (0.072)	0.167** (0.071)	0.082 (0.068)
$G_{dc \rightarrow ldc} \cdot TA^{nip}$	0.352*** (0.104)	0.289*** (0.100)	0.169* (0.101)	0.148 (0.092)	0.268*** (0.091)	0.223** (0.087)
$G_{ldc \rightarrow dc} \cdot TA^{nip}$	0.124 (0.107)	0.040 (0.102)	0.445*** (0.122)	0.378*** (0.129)	0.027 (0.114)	-0.064 (0.110)
$G_{ldc \rightarrow ldc} \cdot TA^{nip}$	0.084 (0.069)	0.137** (0.068)	0.183** (0.078)	0.203*** (0.074)	0.201*** (0.077)	0.221*** (0.073)
$G_{dc \rightarrow dc} \cdot TA^{ip}$	0.185*** (0.043)	0.103** (0.043)	0.272*** (0.044)	0.180*** (0.043)	0.142*** (0.049)	0.070 (0.049)
$G_{dc \rightarrow ldc} \cdot TA^{ip}$	0.088** (0.044)	0.026 (0.044)	0.023 (0.046)	-0.014 (0.045)	0.031 (0.055)	-0.050 (0.055)
$G_{ldc \rightarrow dc} \cdot TA^{ip}$	-0.018 (0.055)	-0.043 (0.057)	0.107* (0.063)	0.073 (0.060)	-0.025 (0.062)	-0.041 (0.064)
$G_{ldc \rightarrow ldc} \cdot TA^{ip}$	0.107 (0.083)	0.122 (0.075)	0.073 (0.077)	0.084 (0.070)	0.203** (0.094)	0.194** (0.085)
$G_{dc \rightarrow dc} \cdot TA_{t-5}^{nip}$		0.226*** (0.043)		0.289*** (0.052)		0.158*** (0.045)
$G_{dc \rightarrow ldc} \cdot TA_{t-5}^{nip}$		0.201** (0.095)		0.080 (0.091)		0.148 (0.122)
$G_{ldc \rightarrow dc} \cdot TA_{t-5}^{nip}$		0.272** (0.106)		0.220* (0.116)		0.300*** (0.113)
$G_{ldc \rightarrow ldc} \cdot TA_{t-5}^{nip}$		-0.117** (0.053)		-0.040 (0.057)		-0.039 (0.058)
$G_{dc \rightarrow dc} \cdot TA_{t-5}^{ip}$		0.167*** (0.023)		0.190*** (0.027)		0.149*** (0.026)
$G_{dc \rightarrow ldc} \cdot TA_{t-5}^{ip}$		0.183*** (0.036)		0.119*** (0.040)		0.238*** (0.043)
$G_{ldc \rightarrow dc} \cdot TA_{t-5}^{ip}$		0.083 (0.054)		0.109* (0.059)		0.059 (0.057)
$G_{ldc \rightarrow ldc} \cdot TA_{t-5}^{ip}$		0.022 (0.086)		0.005 (0.098)		0.045 (0.090)
$\ln(\text{GDP}_i)$	1.136*** (0.053)	1.154*** (0.053)	1.140*** (0.052)	1.155*** (0.053)	1.045*** (0.057)	1.064*** (0.058)
$\ln(\text{GDP}_j)$	1.441*** (0.046)	1.456*** (0.046)	1.335*** (0.048)	1.350*** (0.048)	1.452*** (0.050)	1.465*** (0.050)
hc_i	0.190** (0.097)	0.186* (0.097)	0.205** (0.097)	0.198** (0.098)	0.099 (0.104)	0.094 (0.105)
hc_j	-0.024 (0.090)	-0.034 (0.090)	0.000 (0.091)	-0.007 (0.091)	-0.026 (0.098)	-0.041 (0.098)
Constant	-22.569*** (0.868)	-22.969*** (0.875)	-22.544*** (0.880)	-22.899*** (0.888)	-22.048*** (0.951)	-22.392*** (0.960)
Time dummies	yes	yes	yes	yes	yes	yes
Observations	201,769	201,769	185,203	185,203	194,657	194,657
R-squared	0.206	0.206	0.266	0.267	0.135	0.135
Number of links	11,919	11,919	11,754	11,754	11,863	11,863

Notes: The dependent variable is total bilateral trade (models (1-2)), bilateral trade of high-IP intensive products (models (3-4)), and bilateral trade of low-IP intensive products (models (5-6)). Standard errors are in parenthesis. Significance level: *** p<0.01, ** p<0.05, * p<0.10.

intensive products, TA^{nip} increases flows for all kind of trading partners except when a LDC exports to a DC. Instead, TA^{ip} increases flows when both trade partners are DCs and when both partners are LDCs.

Models (2), (4) and (6) include interactions between the level of development of the country pairs and the 5-years lagged TAs. We observe that some of the interaction variables in levels lose significance, although they do not change their signs, as the lagged variables gain significance. For total bilateral trade, we observe that TA_{t-5}^{nip} increases trade flows in all cases but has a negative effect for flows between LDCs. Instead, TA_{t-5}^{ip} only positively affects flows between DCs and from DCs to LDCs. In the case of trade of high-IP intensive products, TA_{t-5}^{nip} has a positive effect on flows between DCs and from LDCs to DCs, while TA_{t-5}^{ip} has a positive effect on flows between DCs, from DCs to LDCs, and from LDCs to DCs. In the case of trade of low-IP intensive products, we estimate positive effects of TA_{t-5}^{nip} for flows between LDCs and from LDCs to DCs, and of TA_{t-5}^{ip} only for flows involving DCs.

Table 6: Summary of estimation results

	Total bilateral trade		High-IP intensive trade		Low-IP intensive trade	
	TA^{nip}	TA^{ip}	TA^{nip}	TA^{ip}	TA^{nip}	TA^{ip}
Full sample	+	+	+	+	+	+
$dc \rightarrow dc$	+	+	+	+	+	+
$dc \rightarrow ldc$	+	+	+	n.s.	+	n.s.
$ldc \rightarrow dc$	n.s.	n.s.	+	+	n.s.	n.s.
$ldc \rightarrow ldc$	n.s.	n.s.	+	n.s.	+	+
	TA_{t-5}^{nip}	TA_{t-5}^{ip}	TA_{t-5}^{nip}	TA_{t-5}^{ip}	TA_{t-5}^{nip}	TA_{t-5}^{ip}
Full sample	n.s.	+	+	+	+	+
$dc \rightarrow dc$	+	+	+	+	+	+
$dc \rightarrow ldc$	+	+	n.s.	+	n.s.	+
$ldc \rightarrow dc$	+	n.s.	+	+	+	n.s.
$ldc \rightarrow ldc$	-	n.s.	n.s.	n.s.	n.s.	n.s.

Notes: + indicates a positive and significant estimated coefficient, and - indicates negative and significant estimated coefficients. n.s. indicates a not significant estimated coefficient.

Table 6 summarizes the main results of the gravity estimations for the coefficients of TA^{nip} and TA^{ip} and their 5-years lags. Overall, we can conclude that trade agreements increase bilateral trade but unevenly for developed and developing countries.

If we consider the full sample of countries, we find that both types of trade agreements increase bilateral trade, but TA^{nip} have a stronger effect in all specifications, except when we include lags. TA_{t-5}^{ip} has in most specifications a stronger effect than TA_{t-5}^{nip} . The reason behind this can be that reforms that derive from IP provisions usually have phased-in implementation times specified in the agreements. Thus, it might take a longer time for this type of TAs to be completely implemented and obviously trade-related issues depend on this implementation.

Considering trade flows between countries of different development levels, we observe

heterogeneous effects. In most cases there is a positive and significant effect of both types of TAs for bilateral trade flows between DCs and from DCs to LDCs, regardless of the IP intensity of products.

Instead, from LDCs to DCs, we only observe positive effects in the case of high-IP intensive products (from TA^{nip} , TA^{ip} , and their lags), while trade flows of low-IP intensive products only increase with TA_{t-5}^{nip} . Moreover, trade flows between LDCs are only positively affected by TA^{nip} and TA^{ip} in low-IP intensive products. This evidence is in line with the findings of [Shin et al. \(2016\)](#), which show that IP protection creates a distributional bias in favour of exporters from developed countries relative to those from developing countries. This is because strong IPRs act as an obstacle to trade, discouraging exports from developing countries that are in the process of catching-up in terms of their levels of technology.

5 Concluding remarks

During the last twenty years there has been an increase in the number of trade agreements containing IPRs chapters and in the number of signatory countries, which has contributed to the strengthening and harmonization of IPRs systems beyond the process triggered by the TRIPS.

In this framework, IP-demanding countries are usually developed countries, while developing countries are the ones that need to implement the reforms. This implies for LDCs losing flexibility in the design of their IPRs systems which could best fit their needs and also important challenges in the implementation process. Thus, the motivations for accepting these IP reforms might be guided by the expected benefits derived from trade-related gains of trade agreements.

Despite the increasing relevance of TAs with IP chapters and their possible implications, this issue has been marginally addressed in empirical analysis, except from the recent study of [Maskus and Ridley \(2016\)](#) that studied the effect of TAs with IP chapters on total trade.

This paper presented a first exploration of how trade agreements with IP chapters affect bilateral trade flows. We used matching econometrics to compare the effect of TAs and TAs with complex IP chapters with respect to a control group of countries which did not signed TAs. The matching estimations showed that country pairs with any type of TAs have on average higher levels of trade than country pairs with no TAs. But we found no significant differences on how different types of agreements affect trade.

The estimations with panel data that capture fixed effects provide a better framework to assess and evaluate the differences between the effect of each type of agreements.

Also, they allow for the consideration of possible asymmetric effects for countries of different development levels. Thus, we estimated a gravity model with fixed effects and a difference-in-difference technique. We found that both types of TAs increase bilateral trade but TAs with no IP chapters have a stronger positive effect than TAs with IP chapters. Instead, the 5-years lag of TAs with IP chapters has a stronger effect, which can imply that these TAs need a longer implementation time.

Also, we found that the effects are heterogeneous for signatory countries of different development levels and products of different IP intensity. We found a clear positive effect for developed countries in all types of products and to all destinations. Instead, the gains for developing countries are weaker. TAs with IP chapters only increase flows from LDCs to DCs in the case of high-IP intensive products. Trade flows between LDCs are only positively affected by TAs with IP chapters when they trade low-IP intensive products. This can imply that IP chapter in TAs reinforce the role of IPRs as trade barriers for developing countries.

Finally, TAs with IP chapters are increasingly leading to stronger and harmonized systems of IPRs. This does not consider that countries with different capabilities might need different types of IPRs systems in order to enhance innovation and economic growth ([Kim et al., 2012](#)). Moreover, given that IP provisions and their related reforms imply real challenges for LDCs, the results of this paper raise the question of whether trade gains can compensate the effort related with IP reforms for developing countries.

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Appendix A: List of Countries

Developed Countries

Australia (AUS), Austria (AUT), Bulgaria (BGR), Canada (CAN), Croatia (HRV), Cyprus (CYP), Czech Rep. (CZE), Denmark (DNK), Estonia (EST), Finland (FIN), France (FRA), Germany (DEU), Greece (GRC), Hungary (HUN), Iceland (ISL), Ireland (IRL), Israel (ISR), Italy (ITA), Japan (JPN), Latvia (LVA), Lithuania (LTU), Malta (MLT), Netherlands (NLD), New Zealand (NZL), Norway (NOR), Poland (POL), Portugal (PRT), Slovakia (SVK), Slovenia (SVN), Spain (ESP), Sweden (SWE), Switzerland (CHE), United Kingdom (GBR), United States (USA).

Developing Countries

Albania (ALB), Algeria (DZA), Angola (AGO), Armenia (ARM), Azerbaijan (AZE), Argentina (ARG), Bahamas (BHS), Bahrain (BHR), Bangladesh (BGD), Bolivia (BOL), Bosnia Herzegovina (BIH), Brazil (BRA), Brunei Darussalam (BRN), Belarus (BLR), Cambodia (KHM), Cameroon (CMR), Chile (CHL), China (CHN), Colombia (COL), Congo (COG), Costa Rica (CRI), Côte d'Ivoire (CIV), Dominican Rep. (DOM), Ecuador (ECU), Egypt (EGY), El Salvador (SLV), Equatorial Guinea (GNQ), Ethiopia (ETH), Gabon (GAB), Georgia (GEO), Ghana (GHA), Guatemala (GTM), Guinea (GIN), Honduras (HND), Hong Kong (HKG), India (IND), Indonesia (IDN), Iran (IRN), Iraq (IRQ), Jamaica (JAM), Jordan (JOR), Kazakhstan (KAZ), Kenya (KEN), Rep. of Korea (KOR), Kuwait (KWT), Kyrgyzstan (KGZ), Lebanon (LBN), Macao (MAC), Madagascar (MDG), Malaysia (MYS), Mauritius (MUS), Mexico (MEX), Rep. of Moldova (MDA), Morocco (MAR), Mozambique (MOZ), Myanmar (MMR), Nicaragua (NIC), Nigeria (NGA), Oman (OMN), Pakistan (PAK), Panama (PAN), Paraguay (PRY), Peru (PER), Philippines (PHL), Qatar (QAT), Russian Federation (RUS), Saudi Arabia (SAU), Senegal (SEN), Singapore (SGP), South Africa (ZAF), Sri Lanka (LKA), Syria (SYR), TFYR of Macedonia (MKD), Thailand (THA), Trinidad and Tobago (TTO), Tunisia (TUN), Turkey (TUR), Turkmenistan (TKM), Ukraine (UKR), United Arab Emirates (ARE), United Rep. of Tanzania (TZA), Uruguay (URY), Uzbekistan (UZB), Venezuela (VEN), Viet Nam (VNM), Yemen (YEM), Zambia (ZMB), Zimbabwe (ZWE).

Appendix B: Classification of exports according to IP intensity

High-patent products (most of which are also high-trademark)	
Crude fertilizers	Metalworking machinery
Organic & Inorganic chemicals	General machinery
Dyeing materials	Office machines
Medicinal & pharmaceutical products	Telecommunications
Essential oils & perfume materials	Electrical machinery
Chemical materials & products	Professional apparatus
Rubber manufactures	Photographic apparatus
Power-generating machinery	Miscellaneous mfg.
Machinery for industries	
High-trademark products (with low-patent/copyrights)	
Dairy products & beverages	Manufactures of metals
Crude rubber	Pulp & waste paper
Road vehicles	Plastics
Furniture	Paper & related articles
Footwear	
High-copyright products (most of which are also high-trademark)	
Cinematographic film	Printed matter & recorded media