



ICAE

Instituto Complutense
de
Análisis Económico

Intellectual Property Rights as a Driver of Offshoring Flows by Stage of Economic Development

David Rodríguez-González

Department of Economics
Universidad EAFIT
Colombia

Elena Huergo

ICAE – Department of Economic Analysis
Universidad Complutense de Madrid
Spain

Mery Patricia Tamayo

Department of Economics
Universidad EAFIT
Colombia

Abstract

This paper examines how the strength of intellectual property rights (IPR) affects offshoring between countries at different development stages. Using a panel dataset covering offshoring flows between 60 origin and 76 destination countries from 2000–2011—measured through intra-industry trade in intermediate inputs—we estimate several econometric models addressing heterogeneity, zero flows, endogeneity, and trade persistence. We find that stronger IPR protection reduces a country's outward offshoring, especially in developing economies, while it increases inward offshoring, particularly in high-tech industries and when the destination is developing. These results show the varied role of IPR in shaping global production networks and suggest that strengthening IPR—especially in developing countries—can enhance participation in global value chains and promote technology transfer.

Keywords: Offshoring flows, IPR, Development, Technology transfer.

JEL Classification: F14, F23, O34, O38

ICAE Working Paper # 0825

December, 2025

ISSN: 2341-2356

WEB DE LA COLECCIÓN:

<http://www.ucm.es/fundamentos-analisis-economico2/documentos-de-trabajo-del-icae>

Copyright © 2013-2025 by ICAE.

Working papers are in draft form and are distributed for discussion. It may not be reproduced without permission of the author/s.

Intellectual Property Rights as a Driver of Offshoring Flows by Stage of Economic Development

David Rodríguez-González^a, Elena Huergo^b and Mery Patricia Tamayo^c

Abstract

This paper examines how the strength of intellectual property rights (IPR) affects offshoring between countries at different development stages. Using a panel dataset covering offshoring flows between 60 origin and 76 destination countries from 2000–2011—measured through intra-industry trade in intermediate inputs—we estimate several econometric models addressing heterogeneity, zero flows, endogeneity, and trade persistence. We find that stronger IPR protection reduces a country’s outward offshoring, especially in developing economies, while it increases inward offshoring, particularly in high-tech industries and when the destination is developing. These results show the varied role of IPR in shaping global production networks and suggest that strengthening IPR—especially in developing countries—can enhance participation in global value chains and promote technology transfer.

Keywords: offshoring flows, intellectual property rights, development, technology transfer.

JEL Classification: F14, F23, O34, O38.

^a Department of Economics at Universidad EAFIT, Medellín, Colombia. Email: drodrigue1@eafit.edu.co. ORCID: 0000-0002-5228-6245.

^b Department of Economic Analysis, ICAE and GRIPICO. Universidad Complutense de Madrid, Spain. Email: ehuergoo@ucm.es. ORCID: 0000-0001-7140-7551.

^c Department of Economics at Universidad EAFIT, Medellín, Colombia. Email: mptamayo@eafit.edu.co

1. Introduction

Over the final decades of the 20th century, transport and communication costs fell considerably, allowing for *fragmenting*, that is, dividing part of the production process to send it to other countries later (Jones, 2000). This phenomenon, which is usually called *offshoring*, has grown in recent decades and has attracted the attention of scholars given its macroeconomic implications (Feenstra 2010). In particular, the literature analyses the reasons why firms carry out part of their production process outside their home country. These reasons include minimising costs, increasing productivity, enhancing competitiveness and efficiency and accessing qualified personnel (Lewin & Peeters 2006; Grossman & Rossi-Hansberg 2008; Feenstra 2010; Tamayo 2014).

From an empirical point of view, one problem with analysing offshoring determinants is that available databases usually do not include direct information on firms' relocating part of its production abroad. As an alternative, most studies examine offshoring flows by focusing on the purchase of intermediate goods from foreign providers. In the analysis of the drivers of this foreign sourcing, one outstanding factor in recent literature is the strength of the system of intellectual property rights (IPR) in destination countries of offshoring flows. This factor largely reflects the institutional conditions for the diffusion and assimilation of new knowledge embedded in offshored products or tasks (Canals et al., 2023; Canals & Şener, 2014). It may be especially relevant for multinational enterprises (MNEs), which can choose between purchasing intermediate inputs from either vertically integrated producers (internal or captive offshoring) or independent suppliers (international outsourcing or external offshoring). The strength of IPR protection in destination countries may differently affect the choice between intra-firm and through-the-market channels of import sourcing as internal and external offshoring flows imply a distinct risk of imitation.

Previous empirical literature focuses primarily on the relationship between offshoring flows and IPR protection with data on intermediate goods that MNEs based in developed countries import from (integrated or independent) suppliers located in developing countries. These studies tend to confirm that IPR are relevant factors for firms when offshoring is performed in high-tech industries or involves technology transfer (Canals & Şener, 2014; Naghavi et al., 2015). However, most studies have overlooked the effect of IPR protection when interactions are undertaken between firms located in countries with similar stages of development. Moreover, the rise of practices like

reshoring and *nearshoring* highlights the need to reassess the role of IPR systems beyond the traditional North-South offshoring framework.

We contribute to the literature by analysing the relationship between strength in IPR protection and offshoring flows explicitly accounting for all possible development-stage pairings between origin and destination countries: developing–developing, developing–developed, developed–developing, and developed–developed. To our knowledge, there is no other empirical study that considers such a large set of countries in this context. This allows us to examine whether the impact of IPR protection on offshoring flows varies depending on the stage of economic development of the countries involved in these transactions. It also enables us to consider IPR roles in both origin and destination countries. Prior literature has examined whether the strengthening of IPR in a given country enhances its attractiveness for offshoring inflows. However, it has overlooked the role of domestic IPR as a potential determinant of outflow offshoring decisions.

For our purpose, we use a rich panel dataset with information about sectoral offshoring flows between 60 origin countries and 76 destination countries for the period 2000-2011. Following Canals & Şener (2014), we use a measure of narrow offshoring flows based on intra-industry trade in intermediate inputs between firms located in different countries. It captures the intensity of (internal and external) offshoring performed by each of the 16 manufacturing industries within a country. As for IPR, we use an approximation of the strength of IPR protection based on the indicator provided by the Heritage Foundation. This indicator reflects the degree to which a country’s laws protect property rights and the extent to which those laws are enforced by the government. Likewise, we incorporate the degree of informality to construct a more robust measure of IPR protection and contrast our hypotheses.

For the empirical analysis, we take into account that our measure of sectoral offshoring flows is the result of a two-stage decision process. First, firms from one country operating in a specific sector decide whether to purchase intermediate inputs from foreign providers within the same industry. Second, conditional on this decision, firms determine the intensity of these purchases. To this end, we implement a range of econometric models—including fixed effects Poisson Pseudo-Maximum Likelihood, dynamic random effects probit, and fixed effects log-linear models—which are also intended to account for unobserved heterogeneity, the presence of zero trade values, endogeneity concerns and trade persistence.

Our findings reveal that stronger IPR protection in a country reduces outgoing offshoring flows from that country, especially when it is a developing country. Conversely, the strengthening of IPR stimulates incoming offshoring flows, particularly in high-tech industries and when the destination is a developing economy. These effects are magnified when we use the adjusted IPR index, which accounts for institutional quality through informality rates, underscoring the importance of credible enforcement mechanisms. These results highlight the heterogeneous role of IPR systems in shaping global production networks and suggest that policy efforts to strengthen IPR protection, especially in developing economies, can promote integration into global value chains and foster technology transfer.

The remainder of this paper is organised as follows. In Section 2, we provide a literature review of the studies that focus on offshoring for different countries and present our hypotheses. In Section 3, we describe the database and the variables. Section 4 presents the empirical models and the methodology used to test our hypothesis. Section 5 presents the estimates and the main results. Finally, Section 6 concludes.

2. Related Literature

During the 20th century, international trade showed considerable growth due to improvements in transport and communication (Feenstra, 2010). These advances allowed the fragmentation of production, which stimulated international flows of intermediate inputs that are associated with offshoring processes. As a consequence, the literature that studies offshoring processes and their determinants also increased (Feenstra, 2010; Grossman & Rossi-Hansberg, 2008).

Following foreign direct investment (FDI) literature, some papers have used a macroeconomic perspective to develop theoretical North-South models where Northern firms import inputs from Southern low-income countries to produce final goods in the North. Because Northern firms have better technological capacity, they can innovate with new designs and developments for their products, while Southern firms access this type of product only through imitation since they may have low technological capacity.

Glass & Saggi (2002), Glass (2004) and Benz (2014) are three examples of studies that refer to a North-South framework when analysing the effect of the strength of a country's IPR on innovation, FDI or offshoring flows under the existence of imitation risk. Glass & Saggi (2002) develop a product cycle model where both FDI and imitation can be channels of international technology transfers and imitation has a cost. In addition, the resource requirement for imitation is assumed to be higher when targeting products from Northern firms than when targeting those from Southern MNEs. In this context, an increase in IPR protection in the South forces Southern firms to allocate more resources to imitation. This leads to an endogenous decline in imitation and FDI in the South. In the North, the use of resources in local production will increase since FDI directed to the South contracts, causing a fall in innovation. Interestingly, the negative effect of strengthening Southern IPR protection on innovation rate does not depend on the (internal or external) channel of international technology transfer.

In turn, Glass (2004) develops a quality ladder model that focuses on international outsourcing without explicitly considering the FDI decision, leading to opposite results: a strengthening of IPR in Southern countries increases the innovation rate and promotes international outsourcing flows. Since in this model imitation is assumed to be costless, the increase in IPR protection lowers the imitation rate without generating higher resource expenditure on imitation. Therefore, Northern firms have more incentives to offshore part of their production process.¹

Departing from Grossman & Rossi-Hansberg's (2008) theory of tasks trade, Benz (2014) proposes a dynamic product cycle model where production can be fragmented into a continuum of tasks and there are homogeneous iceberg offshoring costs. In the model, the information that each task contains about the final product is heterogeneous. Tasks that contain less information are expected to be offshored first, and each additional offshored task results in an over proportional increase of the imitation risk. The optimal level of Northern firms' offshoring is determined by the trade-off between the savings on production costs and the imitation risk. In this context, the model predicts that an improvement of IPR protection in the South will decrease the innovation rate and the imitation rate. However, the effect on offshoring volume cannot be unambiguously determined.

¹ Branstetter & Saggi (2011) also predict that stronger IPR enforcement will encourage innovation and reduce imitation by developing a North-South variety expansion product cycle model that also allows for endogenous FDI. However, they do not specifically analyse the effect on offshoring flows.

Notice that what these theoretical models have in common is the analysis of sourcing decisions of innovative (Northern) firms that can buy intermediate inputs from potential imitators in foreign (Southern) countries. However, their predictions about the impact of strengthening IPR in the Southern country on the magnitude or channel of offshoring flows differ depending on the assumptions about the existence of imitation costs, the mechanism of innovation and the endogeneity of FDI.

This theoretical literature has been complemented with numerous empirical microeconomic analyses that address the strength of IPR as a determining factor of trade and offshoring flows from a developed country (mainly, the United States) to developing countries. Specifically, as strengthening IPR protection is expected to be more relevant in the case of products with high technological content, an important part of the empirical literature focuses on its effects on technology transfers or R&D offshoring (Biancini & Bombarda, 2021; Branstetter et al., 2006; Ivus & Park, 2019; Kumar, 1996, 2001; Rodgers et al., 2019).

The results of empirical analyses are heterogeneous, partly because they consider different measures of IPR enforcement in destination countries, such as adherence to international IPR agreements (Ferrantino, 1993), country-level patent protection indexes² (Biancini & Bombarda, 2021; Kumar, 1996, 2001), evidence on national patent reforms (Branstetter et al., 2006, 2011; Canals & Şener, 2014) and, more recently, the establishment of IP-related preferential trade agreements (Canals et al., 2023). Nevertheless, they tend to confirm that an enforcement of IPR protection in developing countries favours foreign sourcing, especially R&D offshoring from firms in technology-intensive industries in developed countries.

There is no systematic analysis, from either a theoretical or an empirical point of view, of the impact of stronger IPR protection on offshoring flows between firms located in countries at similar stages of development. However, as Grossman & Rossi-Hansberg (2012) already note, “most trade in intermediate goods takes place between and among the advanced industrialized economies, and

² For instance, Kumar (1996) uses an index constructed by Rapp & Rozek (1990) and based on conformity of each country’s patent laws to the minimum standards proposed by the US Chamber of Commerce. Alternatively, Kumar (2001) uses a relative strength patent protection index built by Ginarte & Park (1997). This index represents the country’s performance in five dimensions: the extent of coverage, membership in international patent agreements, provisions for loss of protection, enforcement mechanisms and duration of protection. Both indices take a value between 0 and 5, with 0 indicating no IPR recognition and 5 representing the highest degree of protection.

that most value added generated by foreign subsidiaries of American multinational corporations originates in other OECD countries” (page 594). In addition, the emergence of practices like reshoring and nearshoring highlights the need to rethink the role of IPR systems outside the traditional North-South offshoring context.

Reshoring, defined as the practice of bringing production and operations back to the country of origin, is seen as a strategy for strengthening domestic economies, improving the security and resilience of supply chains and meeting market demands and government regulations (Pedroletti & Ciabuschi, 2023). The trend towards reshoring also reflects a shift towards more sustainable production and an appreciation for local manufacturing.

Reshoring often implies a change in the sourcing strategy of MNEs, which substitute offshoring with domestic outsourcing. In this context, the decisions of MNEs may depend on not only the strength of IPR abroad (Biancini & Bombarda, 2021; Naghavi et al., 2015) but also domestic IPR protection in the home country, which affects the relative attractiveness of domestic outsourcing compared to internal and especially external offshoring. In particular, stronger domestic IPR may motivate firms to reshore if the vulnerability to imitation at home is less than it is in the former offshoring destination. This stimulus is expected to be higher when firms face a relatively weak domestic IPR system, which is more frequent in developing countries.

Based on these arguments, the following hypothesis is proposed:

Hypothesis 1: Stronger IPR protection in a country will reduce offshoring flows from this country (1.a), especially when the country is developing (1.b).

Another growing phenomenon that calls for reconsidering the role of IPR systems beyond the traditional North-South framework is nearshoring, that is, the practice of moving offshoring operations to nearby countries, which are often at similar stages of development. Nearshoring facilitates stronger regional economic and trade relations, fostering greater economic integration and cooperation (Pietrobelli & Seri, 2023). It also supports sustainability and social responsibility since shorter supply chains can reduce carbon footprints and enhance environmental sustainability. Additionally, working with neighbouring countries can promote the enforcement of stricter labour and ethical practices, allowing businesses to respond more quickly to changes in demand and unforeseen problems. This in turn will improve adaptability, reduce costs and times and mitigate

geopolitical risks and vulnerabilities associated with global supply chains. Thus, nearshoring may partly explain the considerable volume of offshoring flows observed among advanced industrialised economies.

To explain this empirical regularity, Grossman & Rossi-Hansberg (2012) propose a theoretical model of task trade between countries with similar relative factor endowments and technological capabilities but different wages and aggregate output of final goods. In the model, firms produce different goods by performing a continuum of tasks, each of which generates local spillovers and has a different offshoring cost.³ In the equilibrium, the most expensive tasks to offshore are not traded. Among the remaining tasks, those with relatively higher offshoring costs concentrate in the country with higher wages and greater aggregate output. The model also predicts that the pattern of specialisation in tasks would be associated with relative wages. This could apply to situations in which manual (non-routine) tasks are better organised remotely than interactive or analytical tasks.

In Grossman & Rossi-Hansberg's (2012) model, imitation is not considered, so IPR protection does not seem to play a role. However, if imitation risk were introduced and such risk depended on the task 'composition' of offshored goods, differences in IPR protection across countries might also be relevant in explaining which tasks are offshored to each country. In this sense, the empirical literature suggests that developed countries are specialised in non-routine tasks (relative to developing countries), which are more difficult to imitate than routine tasks. Thus, regardless of the stage of development of origin countries, imitation risk is expected to be lower when destination countries of offshored tasks are developed countries. Consequently, we may expect a strengthening of IPR systems in these countries to affect offshoring flows relatively less than in the case of developing destination countries. Therefore, the following hypothesis is presented:

Hypothesis 2: Strengthening IPR protection in the destination country of offshoring flows will have a greater positive impact on these flows if that country is developing rather than developed, regardless of the development stage of the origin country.

³ Davis & Weinstein (2001) posit that trade within the North does not depend only on specialisation due to economies of scale and product differentiation. Factor endowments also matter if patterns of net factor service trade are systematically related to endowment differences and the magnitudes of factor service trade are economically large.

3. Database and variables definition

The main objective of this study is to test whether the status of origin and destination countries of offshoring flows as developed or developing influences the impact of strengthening IPR on the magnitude of these flows within manufacturing industries. To perform this test, we combine different sources to construct a database that includes annual information for the period 2000-2011 and where the unit of observation is defined at the origin country-destination country-industry (ODI) level.⁴

Specifically, our measure of offshoring is taken from Canavire-Bacarreza, Chica & Tamayo (2019), who construct this indicator using data from Comtrade and the input-output (IO) matrices published by the OECD on its official website. From Comtrade, these authors obtain the level of imports in dollars that (origin) country h obtains from industry i in (destination) country d in year t , $M_{hdi,t}$. From the IO tables, they extract two variables: the consumption level of country h in period t for industry i , $G_{h,t}^i$, and the dollar value of inputs that industry i in country h obtains from the same industry in year t , $a_{h,t}^{ii}$. With this information, they define a *narrow* measure of offshoring that focuses on intra-industry transactions and is computed as follows:

$$O_{hdi,t} = a_{h,t}^{ii} \frac{M_{hdi,t}}{G_{h,t}^i}$$

This expression denotes the dollar value of inputs that industry i in country h imports from the same industry in country d at time t . As Canals & Şener (2014) state, “in more general terms, a *narrow* measure that focuses on intra-industry transactions can better proxy for the extent of within-multinational firms activity and arm’s length subcontracting activity, two types of activities that are closely associated with offshoring, as opposed to direct purchases of intermediate goods outside the boundaries of the firm that do not involve an immersed contractual relationship and/or technological exchange.” (p. 21) In addition to this, we rely on the *narrow* measure (as opposed to broader definitions) given the lack of a universally accepted definition of offshoring. For instance, imports of steel by the automotive industry are not often considered offshoring, whereas imports of auto parts for the same industry are.

⁴ The years used for this analysis are constrained by the dataset published by Canavire-Bacarreza et al., (2019).

Limited by the number of industries that appear in the IO tables constructed by the OECD, offshoring measures are available for 16 manufacturing industries at the NACE 2-digit level. The data cover a total of 60 origin countries and 76 destination countries. Each country is categorised as developed or developing based on the classification created by the United Nations (2000).⁵ This criterion is widely used in previous literature and includes all the countries analysed in this paper. The total sample contains 36 and 55 developing origin and destination countries, respectively. Similarly, it collects information from 24 and 21 developed origin and destination countries, respectively.

As is well known, offshoring flows increased considerably at the end of the 20th century in parallel with the decrease in transport and communication costs (Jones 2000). Figure 1 shows, under the measure used in our analysis, how the growing trend continued for much of the period 2000-2011. This growth is explained to a large extent by the Trade-Related Intellectual Property Rights Agreement (TRIPS) signed in 1995 and implemented in many countries after 2000 (Maskus & Yang, 2018).⁶ As a result, the potential effect of the agreement is evidenced after 2002, when offshoring flows increased steadily but fell in 2009, probably because of the global financial crisis, especially in terms of offshoring flows from developed countries. However, in the two subsequent years, they recovered pre-crisis levels. In addition, we can see that, during the whole period, offshoring flows from developed countries were substantially higher than those that originated in developing countries.

The distribution of observations with positive offshoring interactions within each industry also differs depending on the status of origin and destination countries as developing or developed. As shown in Figure 2, the proportion of interactions is substantially higher among developed countries than among developing countries. Over time, this proportion remained roughly constant between the years 2000 and 2011 for developed destination countries, while it increased in the case of developing destination countries, especially when offshoring flows also originated from developing countries. In addition, the evidence in Figure 3 suggests that there is considerable persistence in the decision to import intermediate inputs, which may be generated by the existence

⁵ See the complete list of countries in our sample in Table A.1 of the Appendix.

⁶ Maskus & Yang (2018) find evidence of an increasing effect of patent protection on exports of R&D-intensive goods. Thus, it is also plausible to observe an increase in offshoring flows since they are earmarked to some extent to produce such goods.

of sunk costs associated with the establishment of bilateral transactions between countries (Sanchis-Llopis et al., 2022).

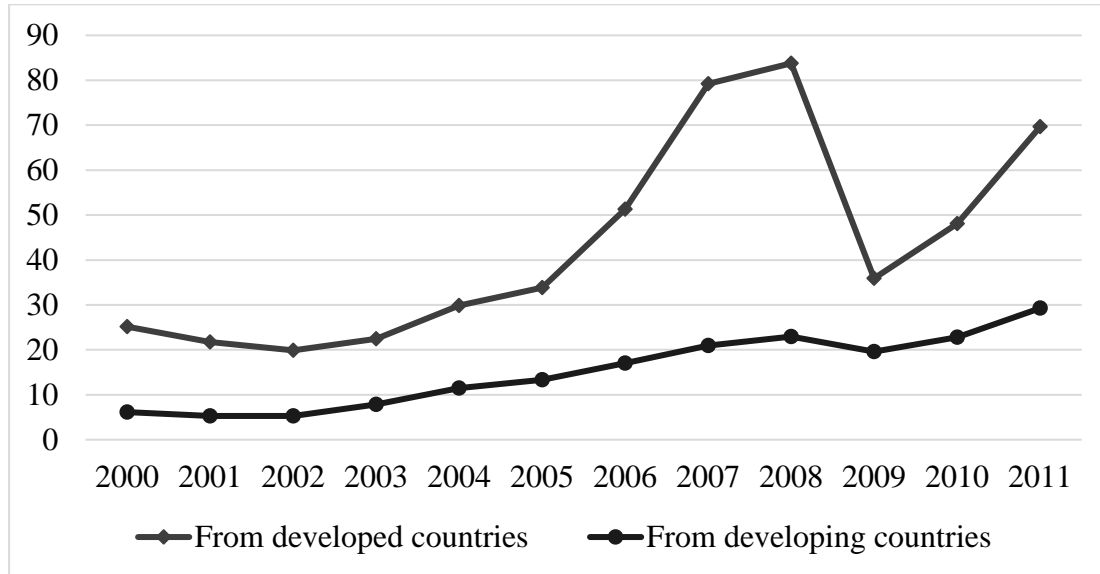


Figure 1. Annual averages of offshoring (million \$). Period 2000-2011

Indeed, the persistence of trade relationships has been increasingly reinforced by globalisation, which not only strengthens existing commercial ties but also facilitates the formation of new ones. As global markets become more integrated and technological advancements reduce communication and transaction costs, countries tend to maintain long-term trade partnerships. Helpman et al. (2008) argue that trading patterns are significantly influenced by initial entry costs and market familiarity, which contributes to the durability of trade relationships. Similarly, Eaton et al. (2011) show that firms that overcome the fixed costs of entering foreign markets are more likely to persist in those markets as a result of accumulated knowledge, established networks and trust. These findings highlight the shaping of present-day international commerce by historical trade connections.

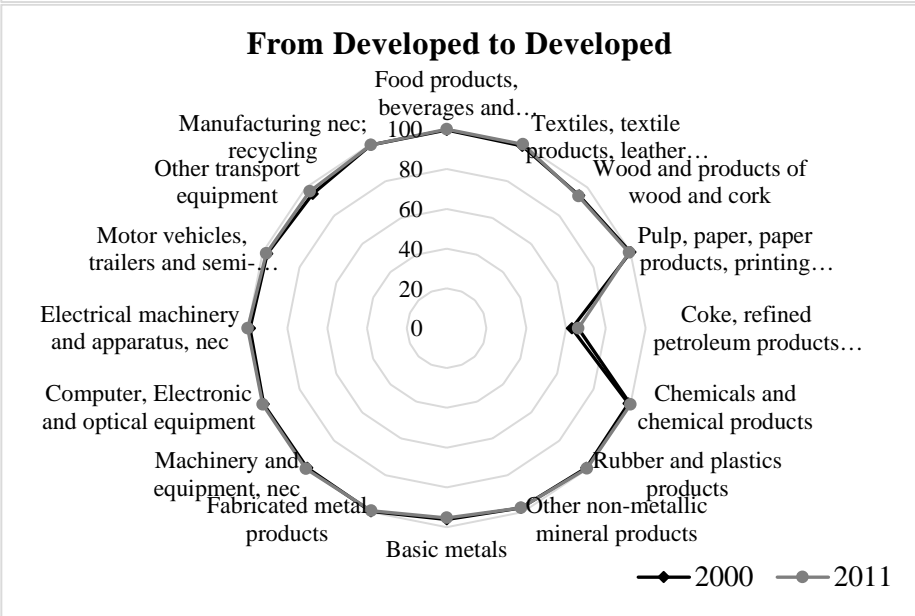
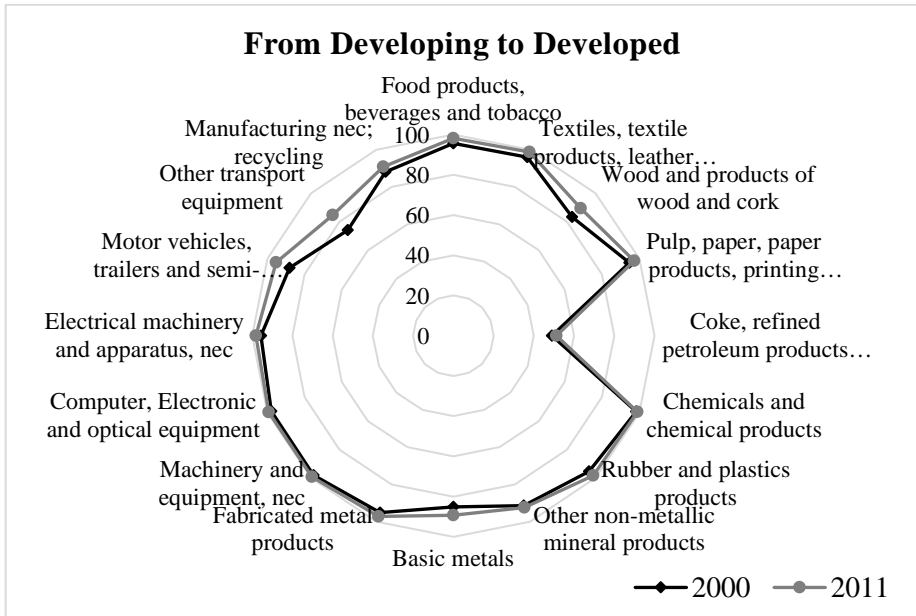
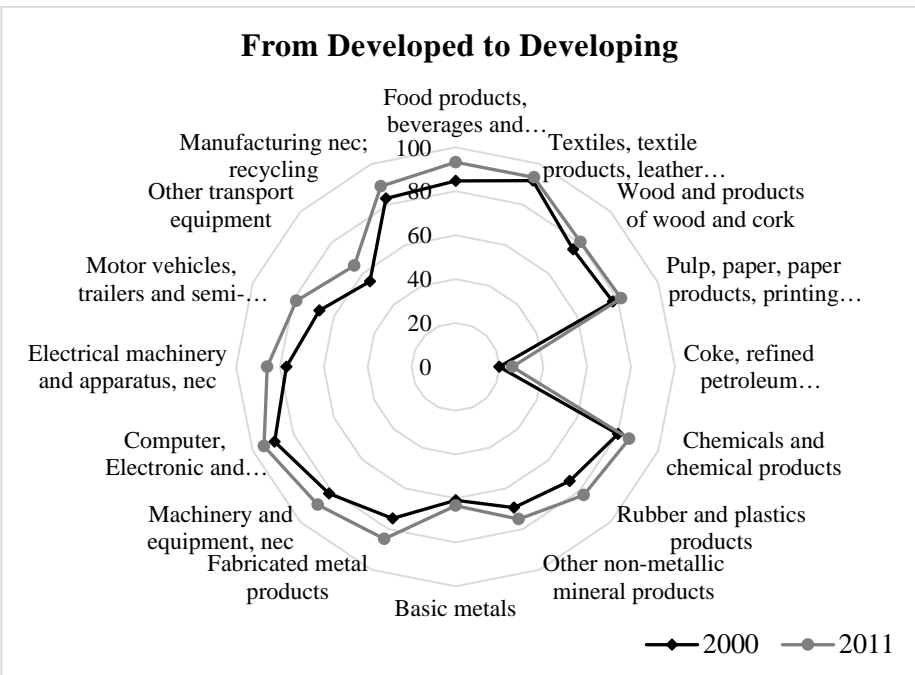
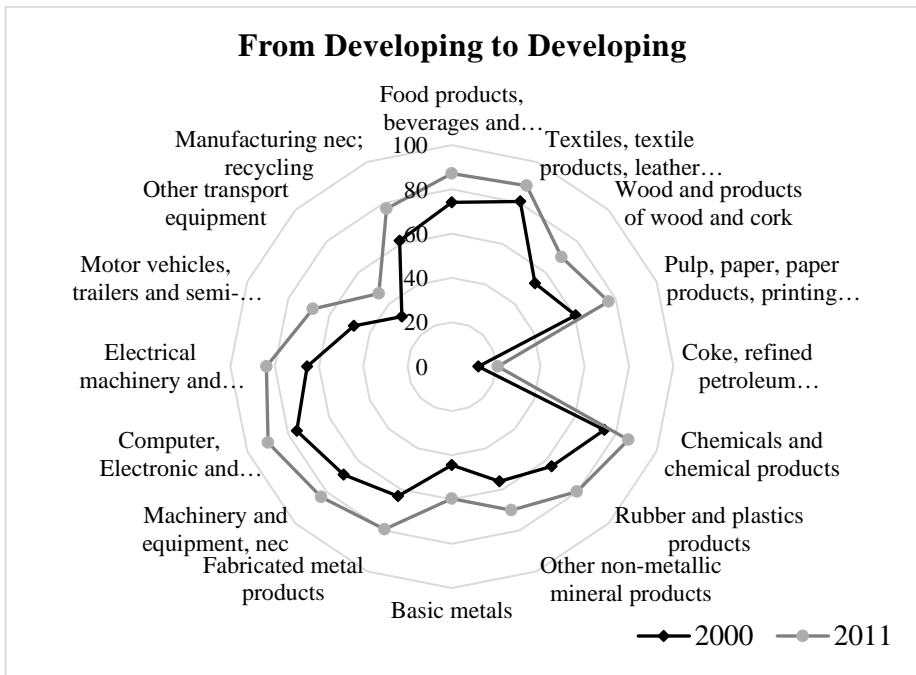


Figure 2. Percentage of observations with positive offshoring flows. Years 2000 and 2011.

In terms of technological content of offshoring flows, regardless of the stage of country development, the magnitude of these flows is greater in high-tech industries than in low-tech industries (Figure 3).⁷ Likewise, high-tech offshoring flows from developed countries are twice as large as those from developing countries, and in the case of low-tech industries, developed countries generate three times the volume of offshoring flows. These patterns clearly highlight the need to account for both the development stage of countries and the technological level of industries in the analysis.

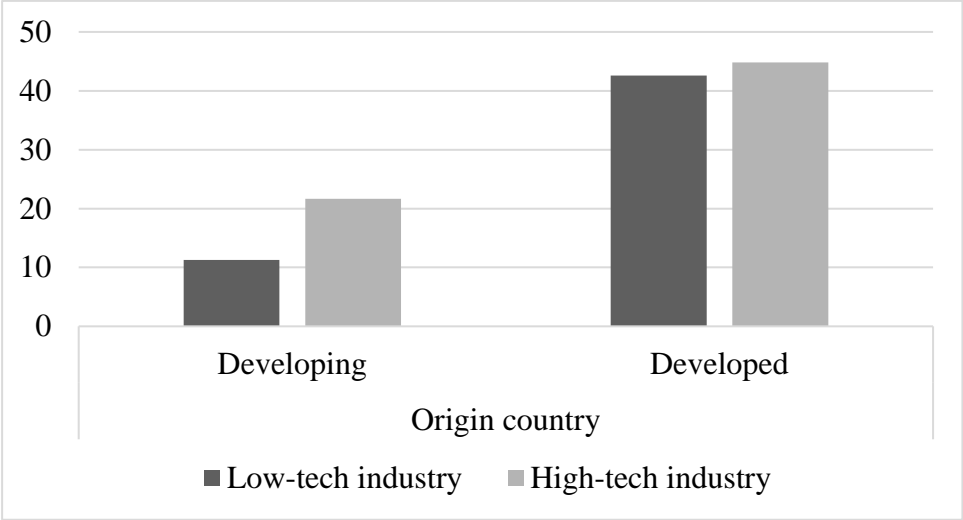


Figure 3. Averages of offshoring (million \$) by industry technological category and status of origin country development. Period 2000-2011

As for the strength of IPR protection, we use a measure taken from the Heritage Foundation, which is an American institution that formulates and promotes conservative public policies based on the principles of free enterprise, limited government intervention, individual freedom, etc. To guide its policies, every year the Heritage Foundation creates an Index of Economic Freedom composed of 12 indicators.⁸ One of them is associated with property rights and is calculated based on information from the Economist Intelligence Unit and the Department of Commerce, among other institutions. This component, which we use for the empirical analysis, measures the degree to which the laws of a country protect property rights and also the extent to which the government applies those laws. The index registers higher values if private property is guaranteed, the judicial system is efficient with respect to the fulfilment of contracts

⁷ Sectors are classified into high-tech and low-tech categories after making the correspondence between the NACE Rev. 2 classification and the ISIC Rev. 3 classification. See the classification in Table A.2 of the Appendix.

⁸ The Index of Economic Freedom and its construction are shown on <https://www.heritage.org/index/>.

and corruption is absent. As such, this index depends on not only the existence of laws and regulations that protect property rights but also the institutional quality of the country.

According to Figure 4, in our sample, developed countries that receive offshoring flows tend to have relatively stronger IPR. On the other hand, developing countries that receive offshoring flows usually have weaker institutional characteristics than the origin country. In terms of evolution, the behaviour of IPR declined slightly in developing destination countries, while it remained almost constant in the case of developed destination countries. This shows how differences in offshoring flows may be driven by cross-country variation in IPR protection.

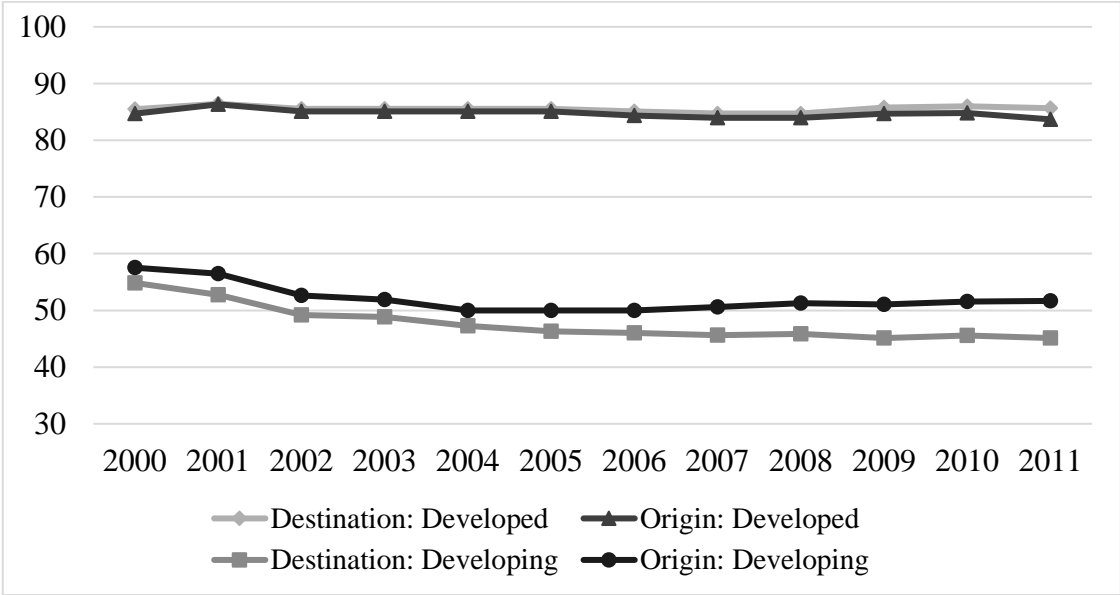


Figure 4. IPR by stage of development of origin and destination countries of offshoring flows. Period 2000-2011

Notice that countries with a high level of informality tend to have weaker institutions, so strengthening IPR may not have the expected effect given the low credibility of the enforcement. Although the component on property rights from the Heritage Foundation already incorporates the country’s institutional quality, we also consider the interaction between this component and the country’s formality rate as a robustness check. Data on countries’ informality is taken from the World Bank (Elgin et al., 2021), which measures the proportion of total economic activity accounted for by the informal sector. In this database, the informality rate ranges from 0 to 1, where higher values indicate a larger share of informal activity within

a country's economy. In our model, for ease of interpretation, we interact the property rights component with the formality rate (i.e., 1 minus the informality rate), so an increase in the interaction term can be interpreted as a "real" increase in IPR protection.

Furthermore, following the literature on offshoring flows, our database contains several time-variant variables that characterise origin and destination countries and are used as control variables in our estimations. In particular, for each country, we have information on the gross domestic product (GDP) and GDP per capita in millions of dollars, the official exchange rate relative to the US dollar and trade openness, which is calculated as the sum of exports and imports of goods and services as a percentage of GDP. These variables are obtained from the World Bank.

Similarly, we incorporate multiple time-invariant variables to account for cross-country differences that may significantly influence offshoring flows. For instance, access to the sea facilitates international commerce, while language barriers can hinder trade interactions. Likewise, former colonial ties often foster strong commercial relationships, and countries that possess similar legal systems and institutional frameworks are more likely to establish trade connections. To control for these factors, we rely on a set of variables from the GeoDist database, created by Mayer & Zignago (2011). For each country, it encompasses internal distance (*dist_int*) and a dummy variable for landlockedness (*landlocked*). Moreover, it includes variables that capture bilateral distance (*distw*), whether the country had a colonial relationship (*colony*), whether it is located on the same continent (*same_cont*), whether it shares a border (*contig*), whether it shares an official language (*comlang*), whether it had a common coloniser after 1945 (*comcol*) or whether it was once part of the same country (*smctry*). Finally, we also consider whether the countries have the same legal origins (*same_legal_origin*), which attempts to control for institutional similarities (La Porta et al., 2008).⁹

After merging all data sources, our final sample consists of a balanced panel of 564,096 observations at the ODI level for the period 2000-2011. These observations correspond to 48,352 ODI units with complete information on all variables considered in our model. Table 1 presents the descriptive statistics of the main variables in our model. Columns (1) and (2) show the mean values for the initial and final year in our sample, while Column (3) shows the averages for the whole period. We observe that offshoring flows increased on average during the period under analysis. Moreover, GDP, GDP per capita and trade openness exhibit similar

⁹ See the definition and descriptives of these variables in Table A.3 of the Appendix.

patterns in both origin and destination countries, which indicate increases in economic activity along with expansion in international trade. However, IPR protection weakened over time, although this pattern is less evident when using the adjusted measure that accounts for *de facto* enforcement (also see Figure 4).

Table 1. Descriptive statistics of the main variables

	Year 2000	Year 2011	Period 2000-2011			
	Mean	Mean	Mean	SD	Min	Max
O_{hd}^i (in millions)	14.3	46.7	27.3	351.0	0.0	39,519.9
IPR_h	69.2	65.5	66.1	23.1	10.0	95.0
IPR_d	61.9	54.5	56.5	22.9	0.0	95.0
$IPR_h^{adjusted}$	53.3	51.2	51.6	22.5	8.4	83.1
$IPR_d^{adjusted}$	44.1	40.0	40.7	22.2	0.0	83.1
GDP $_h$ (in billions)	782.7	1,006.7	896.4	2,071.6	5.2	15,204.0
GDP $_d$ (in billions)	345.5	463.5	402.8	1,125.1	0.9	15,204.0
GDP per capita $_h$	24,125.4	28,266.9	26,613.4	21,818.0	431.3	111,968.3
GDP per capita $_d$	16,186.9	19,303.9	17,916.6	21,562.4	553.6	111,968.3
Exchange rate $_d$	397.3	518.9	446.2	2,163.9	0.3	20,509.8
Exchange rate $_h$	305.1	309.4	339.9	1,278.6	0.5	10,389.9
Trade openness $_h$	89.1	105.8	95.2	67.6	19.8	441.6
Trade openness $_d$	86.7	99.5	92.8	63.1	19.8	441.6

Notes: h : origin country, d : destination country. All monetary variables are expressed in 2010 US.

4. Empirical model

As explained before, for our analysis, we consider a *narrow* or *intra-industrial* measure of offshoring flows, $O_{hdi,t}$, which indicates the volume of intermediates that country h imports from country d within industry i in year t . With this in mind, our empirical model relies on the long tradition of studies that estimate the determinants of trade flows using gravity equations (Gómez-Herrera, 2013). In this framework, we adopt different specifications and estimation methods designed to account for recurrent issues in this type of analysis: heteroskedasticity, trade persistence, zero-inflated flows and unobserved heterogeneity.

First, we handle O_{hdi} as a variable censored at zero and formulate the equation of the determinants of offshoring flows as a tobit model (Tobin, 1958). More formally, we use the following econometric model:

$$O_{hdi,t} = \begin{cases} O_{hdi,t}^* & \text{if } O_{hdi,t}^* > 0 \\ 0 & \text{if } O_{hdi,t}^* \leq 0 \end{cases} \quad [1]$$

$$O_{hdi,t}^* = \beta_1 IPR_{h,t-1} + \beta_2 IPR_{d,t-1} + \mathbf{X}_{hd,t-1} \boldsymbol{\beta}_3 + \delta_i + \lambda_t + \mu_{hdi} + \varepsilon_{hdi,t}$$

where O_{hdi}^* is a latent variable and IPR_h and IPR_d correspond to the strength of intellectual property rights for the origin and destination countries, respectively. \mathbf{X}_{hd} is a vector of time-variant and time-invariant control variables which refer to both origin and destination countries. It includes macroeconomic variables (GDP, GDP per capita, exchange rate and trade openness) and geographical features of the countries involved in offshoring transactions. δ_i and λ_t represent industry and time fixed effects, respectively. Finally, μ_{hdi} stands for the permanent unobserved heterogeneity, and ε_{hdi} is the disturbance term, which is assumed to be normally distributed.

Given the panel structure of our database, we estimate Equation [1] using a random effects (RE) tobit model under the assumption that unobserved individual effects are uncorrelated with the regressors. The model includes time-invariant control variables to mitigate multicollinearity concerns arising from the low time variance of IPR measures. In addition, the offshoring measure enters the model in its log-transformed form, $\log(O + 1)$, to address the normality and

homoskedasticity assumptions of the error term while preserving zero observations within the estimation sample.¹⁰

However, as is well known, the use of this transformation leads to biased coefficients (Gómez-Herrera, 2013). As an alternative, following Santos-Silva & Tenreyro (2006) and Yotov et al. (2016), we perform a fixed effects Poisson Pseudo-Maximum Likelihood (FE PPML) estimator.¹¹ In this case, the equation to be estimated is the following:

$$O_{hdi,t} = \exp(\beta_1 IPR_{h,t-1} + \beta_2 IPR_{d,t-1} + \mathbf{X}_{hd,t-1} \boldsymbol{\beta}_3 + \delta_i + \mu_{hdi}) + \varepsilon_{hdi,t} \quad [2]$$

The PPML methodology is preferred to the tobit estimation since it does not impose strong parametric assumptions on the error term (e.g., log normality and homoskedasticity), avoids performing logarithmic transformations on the dependent variable (thereby preventing the loss of observations) and incorporates zero trade flows into the estimation (Head et al., 2010). Unlike standard Poisson models, the PPML estimator does not require the error variance to equal the mean of the dependent variable. This feature makes PPML suitable for a wide range of applications where data dispersion is substantial (Gourieroux et al., 1984). In fact, the PPML method is robust against heteroskedasticity of any form, ensuring efficient estimates even in the presence of variability in data dispersion (Santos-Silva & Tenreyro, 2006). Furthermore, PPML coefficients offer a straightforward economic interpretation as they can be understood as multiplicative effects on the dependent variable (Head & Mayer, 2014). Thus, empirical evidence indicates that PPML provides more accurate predictions than log-linear models by properly handling zero values and maintaining robustness against heteroskedasticity. This predictive accuracy is particularly important for economic policy formulation based on gravity models (Yotov et al., 2016).

Finally, we also consider sectoral offshoring flows as the result of a two-stage decision. First, firms from one country decide whether or not to purchase intermediate inputs from foreign providers within the same industry. Second, they decide the intensity of these purchases. According to this, we observe offshoring flows between countries h and d within industry i if some firm in country h finds it profitable to start buying intermediate inputs within that industry from country d . In this sense, it might also be relevant to estimate the determinants of the

¹⁰ Since the magnitude of offshoring flows is large, the addition of one unit is negligible; therefore, the variable is interpreted approximately as the percent change in offshoring flows.

¹¹ We conduct the estimations using the *ppmlhdfe* stata command developed by Correia et al. (2023), which allows for PPML regressions with high-dimensional fixed effects.

probability of censoring in isolation, that is, the probability of observing positive import flows at the ODI level. We formalise this through the following selection equation:

$$DO_{hdi,t} = \begin{cases} 1 & \text{if } \pi_{hdi,t}^* = \gamma_1 DO_{hdi,t-1} + \gamma_2 IPR_{h,t-1} + \gamma_3 IPR_{d,t-1} + \mathbf{X}_{hd,t-1}' \boldsymbol{\gamma}_4 + \delta_i + \lambda_t + \mu_{hdi} + u_{hdi,t} > 0 \\ 0 & \text{if } \pi_{hdi,t}^* = \gamma_1 DO_{hd,t-1} + \gamma_2 IPR_{h,t-1} + \gamma_3 IPR_{d,t-1} + \mathbf{X}_{hd,t-1}' \boldsymbol{\gamma}_4 + \delta_i + \lambda_t + \mu_{hdi} + u_{hdi,t}^i \leq 0 \end{cases} \quad [3]$$

where $DO_{hdi,t}$ is a binary variable that takes the value 1 when positive offshoring flows are reported in year t and 0 otherwise. If the latent variable $\pi_{hdi,t}^*$ is bigger than a constant threshold (which can be zero), then we observe a positive offshoring flow from firms in country h to country d within industry i . In this equation, we include $DO_{hdi,t-1}$ to account for the potential persistence in the probability of importing intermediate inputs, as suggested by the evidence in Figure 2. Following Wooldridge (2005), we estimate this equation as a dynamic RE probit specification where unobserved heterogeneity is modelled in terms of initial conditions and exogenous variables.¹²

Conditional on having positive offshoring flows, we can observe the intensity of these flows. To obtain the unconditional effect of IPR on offshoring flows, we should jointly estimate the selection and the intensity equations. However, to our knowledge, there is no widely accepted econometric procedure that combines the intensity equation with Wooldridge's (2005) approach for dynamic RE models within a selection model framework. For this reason, in our last exercise, we just focus on the sample with positive flows and estimate the determinants of these flows through an FE log-linear model. Estimated coefficients from this model are interpreted as marginal effects conditional on observing positive offshoring flows.

In all specifications, independent time-variant variables are lagged one period to alleviate simultaneity problems. Nonetheless, endogeneity concerns may still arise when we analyse the relationship between offshoring flows and IPR protection in destination countries. This is because the magnitude of offshoring attracted by a country may influence its inclination to strengthen IPR, thereby introducing a potential issue of reverse causality. Moreover, endogeneity may emerge from omitted confounding variables that simultaneously affect both offshoring and IPR protection.

¹² As initial conditions, we include the temporal means of the time-variant variables so that they vary only across trading countries.

We believe that reverse causality is not a major concern in our framework because the decision about the quantity of intermediate inputs to purchase is made at the firm level, while changes in IPR protection are determined by public authorities at the country level. These two decisions require different timing to be implemented. We think that strengthening IPR as a response to offshoring volumes takes longer to implement than the annual change in firms' imports, especially if incentives to offshore differ substantially according to the technological level of the industry.

Indeed, on average, our measure of IPR enforcement does not show significant improvements over the period analysed and even decreases in the case of developing countries (Figure 4). However, during these years, not only did offshoring flows grow substantially, but the number of ODI units with positive offshoring values increased (Figure 3). This suggests that offshoring flows do not cause contemporaneous changes in IPR at this level and that we can consider lagged IPR to be a predetermined variable.

In addition, because of data availability, previous studies on the relation between offshoring and IPR focus mainly on a specific set of firms or countries, so they cannot account for the stage of economic development of countries involved in offshoring transactions as a confounding factor. However, economic development, which in general implies technological development, might contribute to attracting high levels of offshoring flows and at the same time be driving the design and enforcement of IPR. Industries might also respond differently to countries' development depending on their technological component. For instance, the optical equipment industry works differently from the basic metals industry: while the former relies on high-precision infrastructure and highly skilled personnel (typically found in developed countries with strong innovation networks), the latter mainly requires large factories with heavy machinery and a workforce that does not necessarily need advanced qualifications (probably affordable for developing countries). On the other hand, one would expect firms in high-tech industries to respond strongly to IPR reforms as they have greater incentives to mitigate the risk of imitation because of their high levels of investment in innovation and R&D.

In our analysis, we take advantage of the wide set of countries in our dataset to address concerns about potential confounders. We conduct separate estimates of our model for different subsamples, which are defined according to the status of the origin and destination country as developing or developed and the low-tech or high-tech level of the industry. The distribution

of observations across the sub-samples used in the empirical analysis is summarised in Table 2.

In particular, to test our Hypothesis 1, which focuses on the effect of strengthening IPR in origin countries, we estimate the model for sub-samples 1 to 4, i.e., for sub-samples defined in terms of the stage of development of origin countries. Accordingly, to test Hypothesis 2, which examines the effect of enforcing IPR in destination countries, we estimate the model for sub-samples 5 to 8, where ODI units are classified in terms of the stage of development of the countries that receive offshoring flows.

As shown in Table 2, the means and standard deviations of our key variables differ substantially among the sub-samples.¹³ The highest averages and the lowest dispersions in IPR measures correspond to sub-samples 3 and 4 in the case of IPR in origin countries and sub-samples 7 and 8 in the case of IPR in destination countries, that is, sub-samples where origin or destination countries are developed. In these sub-samples, we also find the greatest average volumes of offshoring.

Table 2. Offshoring and IPR by sub-samples

Sub-sample	Classifying criteria	No. O_{hd}^i observations (% of zero values) (*)	No. ODI units (*)	O_{hd}^i (in millions)		IPR_h		IPR_d	
				Mean	SD	Mean	SD	Mean	SD
<i>h</i> = developing									
1	<i>i</i> = low-tech	177,130 (26.8%)	15,316	11.3	164.7	52.1	19.8	57.4	23.2
2	<i>i</i> = high-tech	106,278 (21.4%)	9,568	21.7	241.7	52.1	19.8	57.4	23.2
<i>h</i> = developed									
3	<i>i</i> = low-tech	139,390 (19.9%)	12,092	42.6	567.2	84.7	10.6	55.3	22.5
4	<i>i</i> = high-tech	83,634 (15.7%)	7,551	44.8	296.5	84.7	10.6	55.3	22.5
<i>d</i> = developing									
5	<i>i</i> = low-tech	242,100 (28.8%)	20,601	15.0	288.6	66.9	22.9	47.7	18.1
6	<i>i</i> = high-tech	145,260 (24.5%)	12,939	19.1	229.1	66.9	22.9	47.7	18.1
<i>d</i> = developed									
7	<i>i</i> = low-tech	74,420 (7.5%)	6,807	56.9	623.3	63.8	23.7	85.5	9.0
8	<i>i</i> = high-tech	44,652 (3.1%)	4,180	73.1	326.1	63.8	23.7	85.5	9.0

Notes: *h*: origin country, *d*: destination country, *i*: industry. (*): Observations from 2000 are not considered for these calculations because time-variant explanatory variables are included in the model with one lag.

¹³ Notice that the mean values of the IPR measures vary only across countries. They do not differ between low-tech and high-tech industries.

5. Results

In this section, first, we present the results of estimating the determinants of offshoring flows for the whole sample, which combines all ODI units into a single dataset. We also re-estimate the same equations by splitting the sample into low- and high-tech industries in order to evaluate the relevance of the technological component of the industries to analyse the impact of IPR protection. Second, we compare these baseline results with those obtained for the sub-samples based on the stage of development of origin and destination countries. Finally, we re-estimate the models using the measure of IPR protection adjusted for the country's institutional strength (formality rate) to provide robust results and thoroughly test our hypotheses.

5.1. *Baseline results*

Table 3 reports the results of estimating the four econometric models explained in Section 4 for the whole sample. In Column (1), the estimates from the RE tobit model indicate that strengthening IPR protection in the origin country decreases offshoring flows, which is aligned with our Hypothesis 1.a. In other words, if a country improves IPR protection, firms will have less incentive to move their production processes to other countries. Conversely, the effect of IPR in the destination country is positive, which suggests that, when foreign countries strengthen their IPR protection, firms find offshoring their production processes more attractive.

The results highlight the important role of the control variables in determining offshoring flows. First, the estimates show that GDP of both origin and destination countries is a key predictor: offshoring is more prevalent larger economies. Similarly, countries with higher GDP per capita are more likely to import intermediate inputs from countries with lower GDP per capita, which suggests that most offshoring flows go from developed to less developed countries. In addition, firms in countries with a weak currency (i.e., a high exchange rate) send more offshoring flows, especially to countries with strong currencies, as this reflects relative economic strength. Finally, the statistical significance of trade openness indicates that countries that are more integrated in global markets tend to engage in offshoring relationships.

Table 3. Determinants of offshoring. Whole sample.

Dependent variable	$\text{Log}(O_{hdi,t} + 1)$ (1)	$O_{hdi,t}$ (2)	$DO_{hdi,t}$ (3)	$\text{Log}(O_{hdi,t})$ (4)
$IPR_{h,t-1}$	-0.0083*** (0.0008)	-0.0115*** (0.0028)	-0.0003** (0.0001)	-0.0059*** (0.0007)
$IPR_{d,t-1}$	0.0140*** (0.0007)	0.0012 (0.0026)	0.0002** (0.0001)	0.0043*** (0.0007)
GDP (in logs.) $_{h,t-1}$	1.7217*** (0.017)	1.0661*** (0.389)	0.3131*** (0.023)	3.0693*** (0.181)
GDP (in logs.) $_{d,t-1}$	2.7603*** (0.016)	0.2659 (0.525)	0.0947*** (0.011)	-0.3398*** (0.132)
GDP per capita (in logs.) $_{h,t-1}$	0.4130*** (0.026)	0.4116 (0.402)	-0.1201*** (0.023)	-0.9802*** (0.178)
GDP per capita (in logs.) $_{d,t-1}$	-0.1491*** (0.022)	1.0148** (0.510)	0.0552*** (0.012)	1.9668*** (0.133)
Exchange Rate (in logs.) $_{h,t-1}$	0.0201** (0.010)	-0.0029 (0.067)	-0.0023 (0.003)	0.0399*** (0.012)
Exchange Rate (in logs.) $_{d,t-1}$	-0.1378*** (0.009)	-0.1048 (0.073)	0.0028 (0.003)	0.0225 (0.027)
Trade Openness (in logs.) $_{h,t-1}$	0.9421*** (0.035)	1.2795*** (0.136)	0.0351*** (0.006)	0.6318*** (0.043)
Trade Openness (in logs.) $_{d,t-1}$	1.1491*** (0.031)	0.4692*** (0.103)	0.0151*** (0.005)	0.2820*** (0.037)
$DO_{hdi,t-1}$			0.0441*** (0.0016)	
Estimator	RE Tobit	FE PPML	Dynamic RE Probit	FE OLS
Time-invariant controls	Yes		Yes	
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes		Yes	
ODI FE		Yes		Yes
Initial conditions			Yes	
No. Observations	506,432	480,408	506,432	394,190

Notes: We report marginal effects in Columns (1), (3) and (4) and estimated coefficients in Column (2). Robust standard errors clustered by ODI in parentheses. *** p<0.01, ** p<0.05, *p<0.1. *h*: origin country, *d*: destination country, *i*: industry. All estimates include the constant.

However, these results should be taken with caution because of the strong assumptions of the RE tobit model. Indeed, under the FE PPML specification in Column (2), we observe that the IPR indicator of the destination country (and other control variables) are no longer significant, which suggests that ODI fixed effects absorb the potential impact of strengthening IPR protection and that the tobit model may not adequately account for all relevant sources of heterogeneity.

Nonetheless, the impact of IPR protection in the origin country is still relevant and negative, indicating that firms make their decisions based on conditions in the country in which they are based.

To deepen the analysis, in Columns (3) and (4) of Table 3, we present the estimates when we consider offshoring as the outcome of a two-stage decision. The results in Column (3) correspond to the estimation of Equation [3] for the probability of offshoring using the dynamic RE probit model, which includes time-invariant controls. The coefficient for the lagged dependent variable is statistically significant, indicating that, once offshoring flows between two countries are established, they tend to persist over time because of sunk costs generated by the investments required to set up part of the production process abroad. The estimates also indicate that IPR protection in both trading partners is relevant for explaining the probability of observing offshoring flows between these countries.

Results for the FE log-linear model in Column (4) show that IPR protection is also statistically significant in determining the intensity of offshoring flows (conditional on their occurrence). Moreover, most macroeconomic variables remain statistically significant even after controlling for fixed effects, which suggests that the economic conditions of trading partners play a crucial role in determining the intensity of offshoring flows.

Nevertheless, the results above overlook potential heterogeneities across industries. As explained in Section 2, previous literature has highlighted that the technological component in industries can determine how sensitive offshoring is to changes in IPR protection in destination countries. For instance, Canals & Şener (2014) and Naghavi et al. (2015) find that IPR are relevant factors for firms when offshoring is performed in high-tech industries or involves technology transfer since strong IPR protection mitigates the risk of dissipation of their intangible assets based on knowledge.

In this regard, in Table 4, we show the results of estimating the same specifications as in Columns (2) to (4) of Table 3 separately for low-tech and high-tech industries. Regardless of the technological level of the industry, the estimated coefficients highlight the importance of IPR regimes in destination countries for offshoring decisions, in terms of both the probability of offshoring and the intensity with which countries do so. Moreover, in line with previous literature,

the impact of IPR strengthening in the destination country on offshoring intensity (Columns (3) and (6)) is greater in high-tech industries. The results in Table 4 also confirm that higher levels of IPR protection in origin countries are linked to lower offshoring flows, although in this case the effect appears to be more influential for offshoring decisions in low-tech industries.

Table 4. Determinants of offshoring. Low-tech vs high-tech industries.

Dependent variable	<i>i</i> = Low-tech			<i>i</i> = High-tech		
	$O_{hdi,t}$ (1)	$DO_{hdi,t}$ (2)	$Log(O_{hdi,t})$ (3)	$O_{hdi,t}$ (4)	$DO_{hdi,t}$ (5)	$Log(O_{hdi,t})$ (6)
$IPR_{h,t-1}$	-0.0145*** (0.0041)	-0.0004*** (0.0002)	-0.0069*** (0.0009)	-0.0083*** (0.0028)	-0.0000 (0.0002)	-0.0043*** (0.0011)
$IPR_{d,t-1}$	-0.0011 (0.0034)	0.0002 (0.0001)	0.0035*** (0.0008)	0.0020 (0.0029)	0.0002* (0.0001)	0.0055*** (0.0011)
$DO_{hdi,t-1}$		0.0516*** (0.0023)			0.0322*** (0.0022)	
Estimator	FE PPML	Dynamic RE Probit	FE OLS	FE PPML	Dynamic RE Probit	FE OLS
Time-variant controls	Yes	Yes	Yes	Yes	Yes	Yes
Time-invariant controls		Yes			Yes	
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE		Yes			Yes	
ODI FE	Yes		Yes	Yes		Yes
Initial conditions		Yes			Yes	
No. Observations	295,664	316,520	241,210	184,744	189,912	152,980

Notes: We report estimated coefficients in Columns (1) and (4) and marginal effects in Columns (2), (3), (5) and (6). Robust standard errors clustered by ODI in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. *h*: origin country, *d*: destination country, *i*: industry. All estimates include the constant.

5.2. Exploring a different impact of IPR by stage of country development

In this subsection, we deepen the analysis by considering the stage of economic development of countries involved in offshoring transactions as a factor that might condition the effect of IPR systems on these flows. As explained in Section 4, our strategy consists of performing separate estimates for different sub-samples defined in terms of the developing or developed status of origin and destination countries and the low-tech or high-tech level of the industry (see sub-samples definitions in Table 2).

To test our Hypothesis 1, which addresses the effect of strengthening IPR in origin countries, we estimate our models for sub-samples defined in terms of the stage of development of these countries (sub-samples 1 to 4 of Table 2). Table 5 shows the results of the FE PPML estimation of Equation [2] for the determinants of offshoring, while Table 6 summarises the estimates of the dynamic RE probit model for the probability of offshoring and the FE log-linear model for the intensity of offshoring flows conditional on the existence of these flows. For simplicity, we show only estimated coefficients of our key variable, which is the IPR indicator in the origin country.¹⁴ To interpret the economic relevance of the results, when the coefficients are statistically significant, we also provide the estimated effect of a one-standard-deviation increase in this variable in the whole sample (1-SD-W) or in the specific sub-sample of analysis in each column (see standard deviations in Tables 1 and 2).¹⁵

Table 5. Determinants of offshoring by stage of development of *origin* country. FE PPML

Dependent variable:	$O_{hdi,t}$			
	$h = \text{Developing}$		$h = \text{Developed}$	
	$i = \text{Low-tech}$	$i = \text{High-tech}$	$i = \text{Low-tech}$	$i = \text{High-tech}$
	(1)	(2)	(3)	(4)
$IPR_{h,t-1}$	-0.0207*** (0.0048)	-0.0116** (0.0046)	-0.0101** (0.0049)	-0.0049* (0.0028)
Effect of 1-SD-W	-38.0%	-23.5%	-20.8%	-10.7%
Effect of 1-SD-S	-33.6%	-20.5%	-10.2%	-5.1%
Sub-sample	1	2	3	4
Time-variant controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
ODI FE	Yes	Yes	Yes	Yes
No. Observations	163,918	102,466	131,746	82,278

Notes: We report estimated coefficients in Columns (1) to (4) and marginal effects in Columns (5) to (8). Robust standard errors clustered by ODI in parentheses. *** p<0.01, ** p<0.05, *p<0.1. h : origin country, d : destination country, i : industry. 1-SD-W: one-standard-deviation increase of IPR_h in the whole sample. 1-SD-S: one-standard-deviation increase of IPR_h in the sub-sample. All estimates include the constant and the same explanatory variables as the estimation in Column (1) of Table 3.

¹⁴ Complete estimates are available from the authors upon request.

¹⁵ Although the dependent variable in the PPML model is expressed in levels, its exponential functional form enables the coefficients to be interpreted as approximate percentage changes in the expected value of the outcome variable (Yotov et al., 2016). Therefore, marginal effects are calculated using $(e^{\beta \Delta Z} - 1) * 100$. The same approach is used to interpret the coefficients in the FE log-linear model.

Table 6. Determinants of offshoring by stage of development of *origin* country. Dynamic RE PROBIT and FE OLS

Dependent variable:	$DO_{hdi,t}$				$Log(O_{hdi,t})$			
	$h = \text{Developing}$		$h = \text{Developed}$		$h = \text{Developing}$		$h = \text{Developed}$	
	$i = \text{Low-tech}$	$i = \text{High-tech}$	$i = \text{Low-tech}$	$i = \text{High-tech}$	$i = \text{Low-tech}$	$i = \text{High-tech}$	$i = \text{Low-tech}$	$i = \text{High-tech}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$IPR_{h,t-1}$	-0.0007*** (0.0003)	-0.0001 (0.0002)	-0.0000 (0.0003)	0.0005** (0.0003)	-0.0086*** (0.0011)	-0.0036** (0.0014)	-0.0061*** (0.0015)	-0.0075*** (0.0019)
Effect of 1-SD-W	-1.6 p.p.	-	-	1.1 p.p.	-18.0%	-8.0%	-13.1%	-15.9%
Effect of 1-SD-S	-1.1 p.p.	-	-	0.6 p.p.	-15.7%	-6.9%	-6.3%	-7.6%
Sub-sample	1	2	3	4	1	2	3	4
Time-variant controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-invariant controls	Yes	Yes	Yes	Yes				
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes				
ODI FE					Yes	Yes	Yes	Yes
Initial conditions	Yes	Yes	Yes	Yes				
No. Observations	177,130	106,278	138,400	83,040	129,606	82,501	111,604	70,479

Notes: We report marginal effects in columns. Robust standard errors clustered by ODI in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. h : origin country, d : destination country, i : industry. 1-SD-W: one-standard-deviation increase of IPR_h in the whole sample. 1-SD-S: one-standard-deviation increase of IPR_h in the sub-sample. p.p.: percentage points. The method of estimation is RE probit in Columns (1) to (4) and FE OLS in Columns (5) to (8). For each type of estimator, the specification includes the same explanatory variables as in Table 3.

The estimated coefficients in Table 5 confirm the negative effect of strengthening IPR in origin countries already present in Table 4, but also suggest that the role of this variable is more important in the case of developing countries, which is consistent with our Hypothesis 1.b. Regardless of the high-tech or low-tech character of the industry, an increase in the measure of IPR strength in the origin country (1-SD-W) decreases offshoring flows that originated in that country twice as much when it is developing as when it is developed.

Regarding the probability of offshoring, the results in Table 6 suggest that the strength of IPR in the origin country negatively affects the creation of offshoring links only in the case of low-tech industries in developing countries, while it has a positive impact in high-tech industries in developed countries. However, the magnitude of these effects is small (-1.6 p.p. and 1.1 p.p., respectively), suggesting that IPR protection is not a primary determinant in the formation of new trade relationships.

As for intensity, once offshoring links have been established, a strengthening of IPR at home reduces the volume of imports of intermediate inputs in all sub-samples, which is consistent with Hypothesis 1.a. The effect is especially relevant in low-tech industry offshoring flows from developing countries, where an increase in the IPR score by 1-SD-S decreases offshoring flows that originated in those countries by roughly 16% (Column (5) in Table 6).

Similarly, to test our Hypothesis 2, which addresses the enforcement of IPR systems in destination countries, we estimate our specifications for sub-samples 5 to 8 in Table 2, where ODI units are classified in terms of the stage of development of the countries that receive offshoring flows. The results of the FE PPML estimation in Table 7 confirm the absence of effect depicted in Table 4.¹⁶ However, as we explained before, this lack of effect could be due to the non-consideration of persistence in offshoring decisions. In fact, when considering this possibility (Columns (1) to (4) in Table 8), we find that enforcing IPR in destination countries positively affects the probability of offshoring to these countries if they are developing, while it has no effect in the case of developed countries, thus corroborating Hypothesis 2.

¹⁶ The effects of a 1-SD increase are not included because the estimated coefficients are not statistically different from zero at conventional levels.

In addition, within low-tech industries, once offshoring links have been established, an increase of 1-SD-W in the IPR measure of destination countries translates into an increase of more than 11% in the magnitude of offshoring flows regardless of the stage of development of these countries. Notice, however, that this 1-SD-W change in the IPR score may be much more difficult to achieve in the sub-sample of developed destination countries, where 1-SD-S is much smaller. Interestingly, transactions within high-tech industries are affected by IPR protection only in developing countries, which again is consistent with our Hypothesis 2.

All in all, these results indicate that IPR protection is relevant for offshoring flows, yet its effect varies according to the stage of development of trading partners and the technological level of the industry. However, our findings can be conditioned by the measure of IPR protection used for this analysis. Although the indicator taken from the Heritage Foundation considers institutional aspects, IPR protection can be further refined by incorporating *de facto* approximations of a country's institutional strength. We explore this issue in the next section.

Table 7. Determinants of offshoring by stage of development of *destination* country. FE PPML

Dependent variable:	$O_{hdi,t}$			
	$d = \text{Developing}$		$d = \text{Developed}$	
	$i = \text{Low-tech}$	$i = \text{High-tech}$	$i = \text{Low-tech}$	$i = \text{High-tech}$
	(1)	(2)	(3)	(4)
$IPR_{d,t-1}$	0.0009 (0.0041)	0.0044 (0.0046)	-0.0013 (0.0067)	-0.0038 (0.0031)
Sub-sample	5	6	7	8
Time-variant controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
ODI FE	Yes	Yes	Yes	Yes
No. Observations	222,422	139,781	73,242	44,963

Notes: We report estimated coefficients in Columns (1) to (4) and marginal effects in Columns (5) to (8). Robust standard errors clustered by ODI in parentheses. *** p<0.01, ** p<0.05, *p<0.1. *h*: origin country, *d*: destination country, *i*: industry. All estimates include the constant and the same explanatory variables as the estimation in Column (1) of Table 3.

Table 8. Determinants of offshoring by stage of development of *destination* country. Dynamic RE PROBIT and FE OLS

Dependent variable:	$DO_{hdi,t}$				$\text{Log}(O_{hdi,t})$			
	$d = \text{Developing}$		$d = \text{Developed}$		$d = \text{Developing}$		$d = \text{Developed}$	
	$i = \text{Low-tech}$	$i = \text{High-tech}$	$i = \text{Low-tech}$	$i = \text{High-tech}$	$i = \text{Low-tech}$	$i = \text{High-tech}$	$i = \text{Low-tech}$	$i = \text{High-tech}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$IPR_{d,t-1}$	0.0005*** (0.0002)	0.0004** (0.0002)	-0.0002 (0.0002)	-0.0000 (0.0001)	0.0050*** (0.0009)	0.0077*** (0.0012)	0.0049*** (0.0018)	-0.0028 (0.0025)
Effect of 1-SD-W	1.1 p.p.	0.9 p.p.	-	-	18.7%	19.3%	11.9%	-
Effect of 1-SD-S	0.7 p.p.	0.6 p.p.	-	-	14.5%	15.0%	4.5%	-
Sub-sample	5	6	7	8	5	6	7	8
Time-variant controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-invariant controls	Yes	Yes	Yes	Yes				
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes				
ODI FE					Yes	Yes	Yes	Yes
Initial conditions	Yes	Yes	Yes	Yes				
No. Observations	242,100	145,260	74,200	44,256	172,365	109,733	68,845	43,247

Notes: We report estimated coefficients in Columns (1) to (4) and marginal effects in Columns (5) to (8). Robust standard errors clustered by ODI in parentheses. *** p<0.01, ** p<0.05, *p<0.1. h : origin country, d : destination country, i : industry. 1-SD-W: one-standard-deviation increase of IPR_d in the whole sample. 1-SD-S: one-standard-deviation increase of IPR_d in the sub-sample. p.p.: percentage points. The method of estimation is RE probit in Columns (1) to (4) and FE OLS in Columns (5) to (8). For each type of estimator, the specification includes the same explanatory variables as in Table 3.

5.3. Robustness check. The role of informality

As a robustness check, we re-estimate our models using an adjusted measure of the strength of IPR systems in a country. This adjusted indicator is obtained as the interaction between the Heritage Foundation IPR indicator and the country's formality rate, which is computed from data on informal activities provided by the World Bank. We thus account for the fact that countries with a high level of informality tend to have weaker institutions, which may result in low credibility of IPR enforcement. This adjustment captures the *de facto* strength of IPR systems by incorporating institutional quality.

The main results of re-estimating the models by sub-samples with the refined measure of IPR protection are summarised in Tables 9 and 10. The former reports the estimates from the FE PPML model, while the latter presents the results from the RE probit and FE log-linear models. As in the previous sub-section, for each estimation, we only display the coefficient of the IPR measure that is relevant for testing our hypotheses. In both tables, panels A and B show the results for sub-samples 1 to 4 and 5 to 8, respectively.

In general, estimated coefficients confirm the same patterns depicted before, although the magnitude of the impacts (when present) differs. According to the estimates in panel A of Table 9, a 1-SD-W increase in the adjusted measure of IPR in the origin country leads to a larger reduction in offshoring flows than the original measure (Table 5). This reinforces the idea that firms' incentives to offshore are substantially reduced when enforcement mechanisms at home are credible.¹⁷ The effect is particularly strong for developing countries which import intermediate inputs within low-tech industries (Column (5) in panel A of Table 10). This finding is consistent with the notion that institutional strength is especially relevant in contexts where the baseline risk of weak protection is high.

As for Hypothesis 2, the results in panel B (Table 10) confirm that, after considering the possibility of persistence, stronger IPR enforcement in developing origin countries makes trade relationships with these countries more attractive to firms engaged in knowledge-intensive industries. In particular, a 1-SD-S increase in the adjusted indicator of IPR leads to an increase of 2.5 and 1.6 p.p. in the probability of establishing offshoring links for low- and high-tech industries,

¹⁷ To compute these impacts, standard deviations of the adjusted measure are taken from Table A.4 of the Appendix.

respectively. It should be noted that the impacts on the probability of offshoring, obtained with the synthetic indicator, more than double those depicted in Table 8 for the original measure of IPR. This suggests that the degree of informality is especially relevant for the establishment of offshoring flows.

Similarly, estimated coefficients in the FE log-linear specification (Columns (5) and (6) in Panel B of Table 10) confirm the positive effect of IPR strengthening on the intensity of offshoring flows towards developing countries. Estimates in Table 10 confirm the minor role played by IPR protection in developed countries as drivers of incoming offshoring flows. This indicates that, in contexts where institutions are already relatively strong and stable, further improvements in IPR enforcement may have a marginal or even negligible impact.

Table 9. Robustness check. Determinants of offshoring by stage of development of origin or destination country. FE PPML. Alternative measure of IPR enforcement.

Dependent variable:	$O_{hdi,t}$			
	(1)	(2)	(3)	(4)
Part A. Sub-samples by origin country				
	$h = \text{Developing}$		$h = \text{Developed}$	
	$i = \text{Low-tech}$	$i = \text{High-tech}$	$i = \text{Low-tech}$	$i = \text{High-tech}$
$IPR_{h,t-1}^{adjusted}$	-0.0219*** (0.0065)	-0.0153** (0.0065)	-0.0133** (0.0064)	-0.0055 (0.0035)
Effect of 1-SD-W	-38.9%	-29.1%	-25.9%	-
Effect of 1-SD-S	-29.9%	-22.0%	-14.2%	-
Sub-sample	1	2	3	4
No. Observations	155,248	96,936	127,846	79,799
Part B. Sub-samples by destination country				
	$d = \text{Developing}$		$d = \text{Developed}$	
	$i = \text{Low-tech}$	$i = \text{High-tech}$	$i = \text{Low-tech}$	$i = \text{High-tech}$
$IPR_{d,t-1}^{adjusted}$	0.0003 (0.0054)	0.0068 (0.0069)	-0.0006 (0.0078)	-0.0041 (0.0037)
Sub-sample	5	6	7	8
No. Observations	211,315	132,696	71,779	44,039

Notes: The numbers in each cell correspond to the estimated coefficient for $IPR^{adjusted}$ in the country of origin (Part A) or destination (Part B) in one of the sub-samples defined in Table 2. Robust standard errors clustered by origin-destination-industry in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. h : origin country, d : destination country. 1-SD-W: one-standard-deviation increase of $IPR^{adjusted}$ in the whole sample. 1-SD-S: one-standard-deviation increase of $IPR^{adjusted}$ in the sub-sample. p.p.: percentage points. All estimates include the same explanatory variables as in Column (2) of Table 3.

Table 10. Robustness check. Determinants of offshoring by stage of development of *origin* country. Dynamic RE PROBIT and FE OLS. Alternative measure of IPR enforcement.

Dependent variable:	$D_{-}O_{hdi,t}$				$\text{Log}(O_{hdi,t})$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Part A. Sub-samples by origin country								
	<i>h</i> = Developing		<i>h</i> = Developed		<i>h</i> = Developing		<i>h</i> = Developed	
	<i>i</i> = Low-tech	<i>i</i> = High-tech	<i>i</i> = Low-tech	<i>i</i> = High-tech	<i>i</i> = Low-tech	<i>i</i> = High-tech	<i>i</i> = Low-tech	<i>i</i> = High-tech
$IPR_{h,t-1}^{adjusted}$	-0.0011*** (0.0004)	-0.0002 (0.0004)	0.0001 (0.0009)	0.0007** (0.0003)	-0.0124*** (0.002)	-0.0044** (0.002)	-0.0070*** (0.002)	-0.0075*** (0.002)
Effect of 1-SD-W	-2.5 p.p.	-	-	1.6 p.p.	-24.3%	-9.4%	-14.6%	-15.5%
Effect of 1-SD-S	-2.1 p.p.	-	-	0.7 p.p.	-18.2%	-6.9%	-7.7%	-8.3%
Sub-sample	1	2	3	4	1	2	3	4
No. Observations	167,160	100,296	134,030	80,418	123,041	78,164	108,675	68,520
Part B. Sub-samples by destination country								
	<i>d</i> = Developing		<i>d</i> = Developed		<i>d</i> = Developing		<i>d</i> = Developed	
	<i>i</i> = Low-tech	<i>i</i> = High-tech	<i>i</i> = Low-tech	<i>i</i> = High-tech	<i>i</i> = Low-tech	<i>i</i> = High-tech	<i>i</i> = Low-tech	<i>i</i> = High-tech
$IPR_{d,t-1}^{adjusted}$	0.0011*** (0.0003)	0.0007** (0.0003)	-0.0002 (0.0002)	-0.0000 (0.0001)	0.0081*** (0.001)	0.0126*** (0.002)	0.0058*** (0.002)	-0.0032 (0.003)
Effect of 1-SD-W	2.5 p.p.	1.6 p.p.	-	-	19.7%	32.3%	13.7%	-
Effect of 1-SD-S	2.0 p.p.	0.7 p.p.	-	-	12.6%	20.2%	5.9%	-
Sub-sample	5	6	7	8	5	6	7	8
No. Observations	229,300	137,580	72,660	43,332	164,221	104,321	67,495	42,363

Notes: We report estimated coefficients in Columns (1) to (4) and marginal effects in Columns (5) to (8). The numbers in each cell correspond to the estimated coefficient for $IPR^{adjusted}$ in the country of origin (Part A) or destination (Part B) in one of the sub-samples defined in Table 2. Robust standard errors clustered by origin-destination-industry in parentheses. *** p<0.01, ** p<0.05, *p<0.1. *h*: origin country, *d*: destination country. 1-SD-W: one-standard-deviation increase of $IPR^{adjusted}$ in the whole sample. 1-SD-S: one-standard-deviation increase of $IPR^{adjusted}$ in the sub-sample. p.p.: percentage points. The method of estimation is RE probit in Columns (1) to (4) and FE OLS in Columns (5) to (8). For each type of estimator, the specification includes the same explanatory variables as in Table 3.

Overall, the findings support our hypotheses and reinforce the results from the previous subsection. In addition, the estimates in Tables 9 and 10 indicate that institutional quality enhances the credibility and effectiveness of IPR strengthening, particularly in developing countries. Thus, improvements in the *de facto* strength of a country's IPR system significantly increase the ability of firms to retain domestic production processes or attract them from abroad. Moreover, this implies that IPR reforms alone may not be enough to incentivise offshoring linkages unless they are accompanied by other institutional improvements.

6. Conclusions

Since the late 20th century, offshoring has become a central feature of global production, allowing firms to relocate parts of their operations abroad to reduce costs and improve efficiency. This shift has significantly affected labour markets, productivity and macroeconomic dynamics such as exchange rates and economic volatility. According to the literature, a key factor that influences offshoring flows is the strength of intellectual property rights in the destination country of these flows, particularly in high-tech sectors, where imitation risks are higher.

Theoretical models, especially within North-South frameworks, suggest that IPR affects both innovation and the risk of imitation, influencing firms' decisions to offshore. Depending on how these models treat imitation costs, innovation dynamics and FDI endogeneity, strengthening IPR in Southern countries can either encourage or discourage offshoring and innovation of Northern firms (Glass & Saggi, 2002; Glass, 2004; Benz, 2014).

In parallel, empirical literature shows that stronger IPR in destination countries generally encourage offshoring towards these countries, especially in R&D-intensive industries (Ivus & Park, 2019; Rodgers et al., 2019; Biancini & Bombarda, 2021; Canals et al., 2023). For the most part, this literature analyses the flows between multinational companies from developed countries (mainly the U.S.) and their subsidiaries in developing countries, overlooking trading relationships that exist between countries at similar stages of development, such as developed-to-developed or developing-to-developing flows. The growing importance of nearshoring also calls for re-evaluating the role of IPR in these contexts. Additionally, the rise of reshoring—bringing operations back home—suggests that firms may also weigh IPR protection in their origin countries;

as stronger domestic IPR enforcement may reduce the incentive to offshore relative to domestic outsourcing, particularly in developing economies.

This paper contributes to this discussion by analysing the role of IPR strengthening as a driver of offshoring flows between more than 60 countries with different levels of development. For our analysis, we use a narrow measure of offshoring defined in terms of the intra-industry trade of intermediate inputs between firms located in different countries for the period 2000-2011. Regarding IPR protection, we take a component on property rights used in the construction of the index of economic freedom, which is annually calculated by the Heritage Foundation. As a robustness check, we also use a measure of IPR protection adjusted for the country's institutional informality rate, which is taken from the World Bank.

We apply different estimation techniques to deal with econometric issues like heteroskedasticity, zero trade flows and unobserved heterogeneity. These include the estimation of FE PPML models, dynamic RE probit models for the probability of offshoring and FE log-linear models for offshoring intensity conditional on the existence of this trade flow. In addition, we perform sub-sample analysis to account for the stage of economic development of countries and the technological level of industries as confounding factors. The main results can be summarised as follows:

First, when using both proxies for IPR (with and without interaction with the formality rate), the main conclusions remain the same. In terms of magnitude, the effects (when present) on the probability of offshoring are significantly larger in the estimates that use the adjusted measure of IPR enforcement. Nevertheless, this pattern is found to be less pronounced when the results for offshoring intensity are analysed. These findings suggest that the degree of informality, or institutional quality, is relevant for firms in their offshoring decisions, implying that IPR reforms should be accompanied by institutional improvements to achieve greater effectiveness.

Second, the findings reveal a significant degree of persistence in offshoring probability: once offshoring relations are established between two countries, they tend to persist over time, likely because of sunk costs (i.e., the investments required to set up part of the production process abroad) and established commercial ties.

Third, in most specifications, higher IPR enforcement in a country leads to a significant reduction in outgoing offshoring flows from that country. This supports the idea that when domestic

protection is strong, firms are more likely to retain production locally. As expected, the role of domestic IPR is more relevant in the case of developing countries, where domestic firms more frequently face relatively weak IPR systems.

Fourth, stronger IPR protection in a country increases the probability of other countries' offshoring towards that country if it is developing. This effect is substantially higher within low-tech industries. By contrast, regardless of whether the industry is low-tech or high-tech, once the persistence in offshoring probability is accounted for, an increase in IPR protection in a developed country does not influence other countries' decisions to purchase intermediate inputs from that country.

Finally, conditional on the existence of offshoring flows towards a given developing country, a strengthening of IPR in that country increases the volume of those flows. In the case of developed countries, only incoming offshoring flows within low-tech industries are affected by changes in their IPR protection.

In summary, this paper finds robust evidence that the role of IPR protection as a driver of offshoring flows is shaped by the stage of economic development of trading countries. In particular, our results indicate that policymakers in developing countries should be concerned about strengthening their IPR if they want to receive higher offshoring flows. This is especially relevant in high-tech industries since strengthening IPR would generate greater technological diffusion, which consequently translates into higher economic growth rates in these countries. In turn, our findings suggest that stronger local IPR protection is also important if the policy goal is to retain firms' production processes within the country, thus avoiding job losses and brain drain, among other negative effects.

In this article, we build on the existing literature that has usually focused on offshoring flows from US multinationals. Our database not only allows us to corroborate traditional theoretical models but also enables the exploration of new hypotheses arising from the consideration of a wide set of developed and developing countries. However, the findings of this paper are constrained by the level of disaggregation of the IPR proxies, which are available only at the country–year level, whereas offshoring flows are measured at the country–industry–year level. As more granular data become available, more precise and robust results can be obtained. Likewise, such disaggregated

data would allow for the application of more advanced econometric techniques to better control for unobserved heterogeneity.

References

- Benz, S. (2012). *Trading tasks: a dynamic theory of offshoring*.
- Benz, S. (2014). *Essays on Offshoring, Wage Inequality and Innovation* (Issue 56). ifo Institute - Leibniz Institute for Economic Research at the University of Munich.
- Biancini, S., & Bombarda, P. (2021). Intellectual property rights, multinational firms and technology transfers. *Journal of Economic Behavior & Organization*, 185, 191–210. <https://doi.org/10.1016/j.jebo.2021.02.005>
- Branstetter, L. G., Fisman, R., & Foley, C. F. (2006). Do Stronger Intellectual Property Rights Increase International Technology Transfer? Empirical Evidence from U. S. Firm-Level Panel Data*. *The Quarterly Journal of Economics*, 121(1), 321–349. <https://doi.org/10.1093/qje/121.1.321>
- Branstetter, L. G., Fisman, R., Foley, C. F., & Saggi, K. (2011). Does intellectual property rights reform spur industrial development? *Journal of International Economics*, 83(1), 27–36. <https://doi.org/10.1016/j.jinteco.2010.09.001>
- Branstetter, L. G., & Saggi, K. (2011). Intellectual Property Rights, Foreign Direct Investment and Industrial Development. *Economic Journal*, 121(555), 1161–1191. <https://doi.org/10.1111/j.1468-0297.2011.02440.x>
- Canals, C., Klein, M. A., & Şener, F. (2023). Intellectual property-related preferential trade agreements and US offshoring to developing countries. *Review of International Economics*, 31(4), 1442–1475. <https://doi.org/10.1111/roie.12672>
- Canals, C., & Şener, F. (2014). Offshoring and intellectual property rights reform. *Journal of Development Economics*, 108, 17–31. <https://doi.org/10.1016/j.jdeveco.2014.01.001>
- Canavire-Bacarreza, G., Chica, C., & Tamayo, M. P. (2019). *Understanding Offshoring Worldwide: A New Dataset*. <https://doi.org/10.1080/09638199.2020.1804605>
- Correia, S., Guimaraes, P., & Zylkin, T. (2023). *PPMLHDFE: Stata module for Poisson pseudo-likelihood regression with multiple levels of fixed effects*. <https://econpapers.repec.org/RePEc:boc:bocode:s458622>
- Davis, D. R., & Weinstein, D. E. (2001). *Do Factor Endowments Matter for North-North Trade?* (Issue 8516). <https://doi.org/10.3386/w8516>
- Eaton, J., Kortum, S., & Kramarz, F. (2011). An anatomy of international trade: Evidence from French firms. *Econometrica*, 79(5), 1453–1498.
- Elgin, C., Kose, M. A., Ohnsorge, F., & Yu, S. (2021). *Understanding informality*.
- Feenstra, R. C. (2010). *Offshoring in the global economy: microeconomic structure and macroeconomic implications*. MIT Press.
- Ferrantino, M. (1993). The effect of intellectual property rights on international trade and investment. *Review of World Economics (Weltwirtschaftliches Archiv)*, 129(2), 300–331. <https://econpapers.repec.org/RePEc:spr:weltar:v:129:y:1993:i:2:p:300-331>
- Ginarte, J. C., & Park, W. G. (1997). Determinants of patent rights: A cross-national study. *Research Policy*, 26(3), 283–301. [https://doi.org/10.1016/S0048-7333\(97\)00022-X](https://doi.org/10.1016/S0048-7333(97)00022-X)
- Glass, A. J. (2004). Outsourcing under Imperfect Protection of Intellectual Property. *Review of*

- International Economics*, 12(5), 867–884. <https://doi.org/10.1111/j.1467-9396.2004.00487.x>
- Glass, A. J., & Saggi, K. (2002). Intellectual property rights and foreign direct investment. *Journal of International Economics*, 56(2), 387–410. [https://doi.org/10.1016/S0022-1996\(01\)00117-9](https://doi.org/10.1016/S0022-1996(01)00117-9)
- Gómez-Herrera, E. (2013). Comparing alternative methods to estimate gravity models of bilateral trade. *Empirical Economics*, 44, 1087–1111.
- Gourieroux, C., Monfort, A., & Trognon, A. (1984). Pseudo Maximum Likelihood Methods: Theory. *Econometrica*, 52(3), 681–700. <http://www.jstor.org/stable/1913471>
- Grossman, G. M., & Rossi-Hansberg, E. (2008). Trading tasks: A simple theory of offshoring. *American Economic Review*, 98(5), 1978–1997.
- Grossman, G. M., & Rossi-Hansberg, E. (2012). Task trade between similar countries. *Econometrica*, 80(2), 593–629.
- Head, K., & Mayer, T. (2014). Chapter 3 - Gravity Equations: Workhorse, Toolkit, and Cookbook. In G. Gopinath, E. Helpman, & K. Rogoff (Eds.), *Handbook of International Economics* (Vol. 4, pp. 131–195). Elsevier. <https://doi.org/10.1016/B978-0-444-54314-1.00003-3>
- Head, K., Mayer, T., & others. (2002). *Illusory border effects: Distance mismeasurement inflates estimates of home bias in trade* (Vol. 1). Citeseer.
- Head, K., Mayer, T., & Ries, J. (2010). The erosion of colonial trade linkages after independence. *Journal of International Economics*, 81(1), 1–14. <https://doi.org/10.1016/j.jinteco.2010.01.002>
- Helpman, E., Melitz, M., & Rubinstein, Y. (2008). Estimating trade flows: Trading partners and trading volumes. *The Quarterly Journal of Economics*, 123(2), 441–487.
- Ivus, O., & Park, W. (2019). Patent reforms and exporter behaviour: Firm-level evidence from developing countries. *Journal of the Japanese and International Economies*, 51, 129–147. <https://doi.org/10.1016/j.jjie.2019.02.002>
- Jones, R. W. (2000). Globalization and the Theory of Input Trade. In *MIT Press* (Vol. 1). <https://doi.org/10.2307/1061527>
- Kumar, N. (1996). Intellectual property protection, market orientation and location of overseas R&D activities by multinational enterprises. *World Development*, 24(4), 673–688. [https://doi.org/10.1016/0305-750X\(95\)00168-C](https://doi.org/10.1016/0305-750X(95)00168-C)
- Kumar, N. (2001). Determinants of location of overseas R&D activity of multinational enterprises: the case of US and Japanese corporations. *Research Policy*, 30(1), 159–174. [https://doi.org/10.1016/S0048-7333\(99\)00102-X](https://doi.org/10.1016/S0048-7333(99)00102-X)
- La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2008). The Economic Consequences of Legal Origins. *Journal of Economic Literature*, 46(2), 285–332. <https://doi.org/10.1257/jel.46.2.285>
- Lewin, A. Y., & Peeters, C. (2006). The Top-Line Allure of off-Shoring. *Harvard Business Review*, 22–24. <https://hbr.org/2006/03/the-top-line-allure-of-offshoring>
- Maskus, K. E., & Yang, L. (2018). Domestic patent rights, access to technologies and the structure of exports. *Canadian Journal of Economics/Revue Canadienne d'économique*, 51(2), 483–509. <https://doi.org/10.1111/caje.12328>
- Mayer, T., & Zignago, S. (2011). *Notes on CEPII's distances measures: The GeoDist database*.
- Naghavi, A., Spies, J., & Toubal, F. (2015). Intellectual property rights, product complexity and the organization of multinational firms. *Canadian Journal of Economics*, 48(3), 881–902. <https://doi.org/10.1111/caje.12161>
- Pedroletti, D., & Ciabuschi, F. (2023). Reshoring: A review and research agenda. *Journal of Business Research*, 164, 114005.
- Pietrobelli, C., & Seri, C. (2023). Reshoring, nearshoring and development. Readiness and

- implications for Latin America and the Caribbean. *Transnational Corporations*, 30(2), 37–70.
- Rapp, R., & Rozek, R. (1990). Benefits and Costs of Intellectual Property Protection in Developing Countries. *Journal of World Trade*, 75–102. <http://www.kluwerlawonline.com/document.php?id=TRAD1990033>
- Rodgers, P., Khan, Z., Tarba, S., Nurgabdeshev, A., & Ahammad, M. F. (2019). Exploring the determinants of location choice decisions of offshored R&D projects. *Journal of Business Research*, 103, 472–483. <https://doi.org/10.1016/j.jbusres.2017.11.009>
- Sanchis-Llopis, J. A., Mañez-Castillejo, J. A., & Gómez-Sánchez, A. M. (2022). *The dynamic linkages between exporting and importing in Colombian manufacturing*.
- Santos-Silva, J. M. C., & Tenreyro, S. (2006). The Log of Gravity. *The Review of Economics and Statistics*, 88(4), 641–658. <https://doi.org/10.1162/rest.88.4.641>
- Tamayo, M. P. (2014). The Offshoring Phenomenon. *Ecos de Economía*, 18(38), 157–182.
- Tobin, J. (1958). Estimation of Relationships for Limited Dependent Variables. *Econometrica*, 26(1), 24–36. <http://www.jstor.org/stable/1907382>
- United Nations. (2000). *World Economic Situation and Prospects 2000*. <https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/PDFs/WESP/2000wesp.pdf>
- Wooldridge, J. M. (2005). Simple solutions to the initial conditions problem in dynamic, nonlinear panel data models with unobserved heterogeneity. *Journal of Applied Econometrics*, 20(1), 39–54.
- Yotov, Y. V, Piermartini, R., Larch, M., & others. (2016). *An advanced guide to trade policy analysis: The structural gravity model*. WTO iLibrary.

Appendix

Table A.1. Country classification by stage of development and role in offshoring flows

		Stage of development	
		Developing	Developed
Role in offshoring flows	Only origin	Cambodia, Cyprus, Estonia, Saudi Arabia, Slovakia, Slovenia	Greece, Ireland, Malta
	Only destination	Barbados, Belize, Bolivia, Colombia, Costa Rica, Ivory Coast, Dominican Rep., Egypt, El Salvador, Gabon, Jamaica, Jordan, Kazakhstan, Kyrgyzstan, Lebanon, Libya, Mali, Mauritius, Mongolia, Namibia, Pakistan, Panama, Paraguay, Qatar, Rep. of Moldova, Senegal, Uruguay, Venezuela	
	Origin and destination	Argentina, Brazil, Bulgaria, Chile, China, Hong Kong SAR, Colombia, Costa Rica, Croatia, Czechia, Hungary, India, Indonesia, Israel, Latvia, Lithuania, Malaysia, Mexico, Morocco, Peru, the Philippines, Poland, Romania, the Russian Federation, Singapore, South Africa, Thailand, Tunisia, Turkey, Vietnam	Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the USA, the United Kingdom

Table A.2. Industry classification

Sector	Industry Code	Description	Low-Tech	High-Tech
1	C15T16	Food products, beverages and tobacco	X	
2	C17T19	Textiles, textile products, leather and footwear	X	
3	C20	Wood and products of wood and cork	X	
4	C21T22	Pulp, paper, paper products, printing and publishing	X	
5	C23	Coke, refined petroleum products and nuclear fuel	X	
6	C24	Chemicals and chemical products		X
7	C25	Rubber and plastics products	X	
8	C26	Other non-metallic mineral products	X	
9	C27	Basic metals	X	
10	C28	Fabricated metal products	X	
11	C29	Machinery and equipment, nec		X
12	C30T33X	Computer, electronic and optical equipment		X
13	C31	Electrical machinery and apparatus, nec		X
14	C34	Motor vehicles, trailers and semi-trailers		X
15	C35	Other transport equipment		X
16	C36T37	Manufacturing nec, recycling	X	

Notes: We use the NACE Rev. 2 classification. Source: Eurostat.

Table A.3. Definitions and main descriptives of time-invariant control variables

Variable	Definition	2000 – 2011	
		Mean	SD
$dist_{int_h}$	Average distance between producers and consumers in the country h (Head et al., 2002)	306.346	352.546
$dist_{int_d}$	Average distance between producers and consumers in the country d (Head et al., 2002)	249.849	254.961
$landlocked_h$	Dummy variable set equal to 1 if country h is landlocked.	0.113	0.316
$landlocked_d$	Dummy variable set equal to 1 if country d is landlocked.	0.151	0.358
$same_{cont_{hd}}$	Dummy variable set equal to 1 for countries in the same continent.	0.258	0.438
$contig_{hd}$	Dummy variable set equal to 1 for contiguous countries.	0.011	0.104
$comlang_{off_{hd}}$	Dummy variable set equal to 1 for countries with the same official language.	0.095	0.293
$colony_{hd}$	Dummy variable set equal to 1 for countries that have had a colonial link.	0.017	0.131
$comcol_{hd}$	Dummy variable set equal to 1 for countries that had a common coloniser after 1945.	0.022	0.147
$smctry_{hd}$	Dummy variable set equal to 1 for countries that were once part of the same country.	0.005	0.069
$distw_{hd}$	Distance between two countries weighted by population.	7,859.305	4,770.670
$same_{legal_origin_{hd}}$	Dummy variable set equal to 1 for countries with the same legal origins (La Porta et al., 2008).	0.298	0.458

Notes: h : origin country, d : destination country.

Table A.4. IPR adjusted by sub-samples.

	$IPR_h^{adjusted}$		$IPR_d^{adjusted}$	
	Mean	SD	Mean	SD
<i>Sub-samples 1-2: h = developing</i>	36.2	16.2	41.9	22.6
<i>Sub-samples 3-4: h = developed</i>	71.1	11.5	39.4	21.6
<i>Sub-samples 5-6: d = developing</i>	52.3	22.3	31.0	14.6
<i>Sub-samples 7-8: d = developed</i>	49.2	22.8	72.2	9.9

Notes: h : origin country, d : destination country.