ISSN No. 2454 - 1427

CDE
September 2022

Does Host Country Intellectual Property Protection Matter for Technology-Intensive Import Flows?

Ridwan Ah Sheikh
Email: ridwan@econdse.org
Department of Economics,
Delhi School of Economics

Sunil Kanwar
Email: sunil_kanwar@econdse.org
Department of Economics,
Delhi School of Economics

Working Paper No. 329

Centre for Development Economics
Delhi School of Economics
Delhi- 110007

Does Host Country Intellectual Property Protection Matter for Technology-Intensive Import Flows?

Ridwan Ah Sheikh [1]
Delhi School of Economics, University of Delhi
Sunil Kanwar [2]
Delhi School of Economics, University of Delhi

Abstract

Using disaggregated industry level data for 1976-2019, we find, unlike much of the received literature, that patent rights have a strong positive effect on developing country knowledge-intensive imports. Using the new gravity model of Anderson-van Wincoop, there is strong evidence of a market expansion effect across knowledge-intensive industries. The overall elasticity of knowledge-intensive imports w.r.t patent rights is 0.28, with considerable variation across industries, being 0.55 for electronics, 0.44 for rubber manufactures, and 0.32 for pharmaceuticals. This increase in imports appears to be (mainly) driven by quantity increases, not just price increases. Our results survive multiple robustness checks.

JEL Codes: F13, F14, O34

Keywords: Imports, Intellectual property rights, Gravity model, Multilateral resistance

[1]Corresponding Author: Department of Economics, Delhi School of Economics, University of Delhi, Delhi 110007, India; ridwan@econdse.org

[2]Department of Economics, Delhi School of Economics, University of Delhi, Delhi 110007, India; sunil_kanwar@econdse.org

1 Introduction

The last thirty years has witnessed a global trend towards a stronger intellectual property regime, largely due to stipulations of technologically advanced nations for the stronger protection of intellectual property rights (IPRs) all over the world, and especially in their export markets (Maskus 2012). Under the Trade Related Aspects of Intellectual Property Rights (TRIPS) agreement 1994, signatories were required to adopt and enforce minimum standards of intellectual property protection in a nondiscriminatory manner. Despite the passage of time, these policies remain contentious vis-à-vis trade. Given that imitation is a major channel of production transfer, Helpman (1993) argues that less developed countries (LDCs) stand to lose from stronger protection, both due to higher import prices and reduction in uncompensated technology transfer. Countering this claim, Branstetter et al. (2011) show that stronger protection has in fact increased multinational enterprise investment, innovation and production in LDCs.

In contrast with this point-counter point state of debate, several other theoretical and empirical studies conclude that stronger IPRs have an indeterminate effect on trade (Maskus and Penubarti 1995; Smith 1999; and Rafiquzzaman 2002). On the one hand, stronger IPRs provide exporting firms enhanced market power and induce them to operate more monopolistically, implying smaller exports to the foreign market. This is called the 'market power effect'. On the other hand, a stronger IP regime reduces imitation of foreign technology (via reverse engineering) by the importing countries, which induces foreign exporters to supply more to the reforming countries. This effect is called the 'market expansion effect'. Evidently, the market power and market expansion effects are mutually offsetting, rendering the effect of stronger IPRs on world trade flows an essentially empirical question. Furthermore, in 'large' markets we might also envisage a 'cost reduction effect' insofar as stronger IP laws in host countries reduce expenditure by foreign firms in deterring local imitation (Taylor 1993), and thereby raise the inducement to export to these host countries.

Using data for a sample of 115 countries spanning the period 1976-2019, we examine whether stronger patent rights in the 87 LDCs led to increased imports from the 28 high-income countries in the sample. This question is examined not just at the aggregate level, but also at the disaggregated knowledge-intensive industries' level, to confirm whether the overall result is broad-based or whether it rests on the response of only some sectors. Our empirical exercises are based on the conditional general equilibrium gravity specification recently developed by Anderson and van Wincoop (2003). We follow Baier and Bergstrand (2009a) in estimating this new gravity equation after effectively accounting for endogenous multilateral resistance.

This paper differs from previous studies in various ways. First, in contrast to studies that employ cross-section data (Maskus and Penubarti 1995; Smith 1999; Rafiquzzaman 2002; Co 2004; Falvey et al. 2009), we use panel data for an extended time period (1976-2019), which allows us to control for unobserved heterogeneity and also allows 'enough' time for bilateral trade flows to respond to the IPRs reform. The effect of stronger patent rights may become evident only over a prolonged time period, if institutions and innovation capacities take time to adjust (Park, 2008). The extended time period and cross-section dimensions of our sample, both at the aggregate and sector levels, allows us to analyze the 'full' effect of the reforms on trade flows. Second, most extant studies use the Ginarte-Park index of patent rights (Ginarte and Park 1997; Park 2008) as a measure of the relative strength of patent laws across countries. However, a major limitation of this index is that it is a de jure measure, reflecting the laws and agreements rather than actual or de facto enforcement in the country. To address this shortcoming, we follow Kanwar (2012) by augmenting the Ginarte-Park measure with the 'legal system and property rights' index developed by the Frazer Institute, which incorporates various aspects of legal enforcement and property rights in a country. Third, earlier studies that employ the traditional gravity models (Maskus and Penubarti 1995; Smith 1999; Rafiquzzaman 2002; Co 2004; Falvey et al. 2009) typically ignore the potential impact of multilateral resistance factors or barriers which each importer and exporter country faces in its trade with all its trading partners. In a seminal study, Anderson and van Wincoop (2003) argue that traditional gravity models lack a proper theoretical foundation, and the estimated parameters may suffer from omitted variable bias due to exclusion of theory-based endogenous multilateral resistance terms for exporters and importers. In this paper, we estimate the Anderson-van Wincoop new gravity model to account for the endogenous multilateral resistance factors.

2 A Brief Literature Review

The impact of TRIPS on global trade flows is often posed in a North-South framework, with the North as technology producer and the South as end user. The question that has attracted much attention in the recent past is: what role does the stronger patent regime in the TRIPS-compliant South play in attracting imports from the innovating North? The major empirical findings exhibit wide variation across studies. Maskus and Penubarti's (1995) study lent support to the view that trade reduction through the exercise of enhanced market power is more likely in patent-sensitive sectors than patent-insensitive sectors. This is starkly different from Ivus (2010) and Delgado et al. (2013). Furthermore, they find that while a stronger patent regime raises manufacturing imports into LDCs, this effect is particularly pronounced for LDCs with a larger market. Delgado et al. (2013) also found that the value of high-IP exports increased twice as much as that of low-IP exports. The imports of high-IP products also increased, but by less than the increase in exports, implying greater multilateral trade in the post-TRIPS era.

At the disaggregated level, they found the effect on imports to differ across product groups and income levels. Thus, the larger positive effect of TRIPS was in information technology imports, followed by chemicals. Among LDCs, the upper middle-income countries did not experience a significant increase in high-IP products, whereas the low and lower middle-income countries experienced a significant increase in such products.

Ivus (2010) found that strengthening patent rights in LDCs added about $35 billion (in 2000 US$) to the value of patent-sensitive exports from developed countries. While Smith (1999) concurred, she found that the magnitude and direction of the relationship depended on the threat of imitation. Thus, she found weak patent rights to be a barrier to US exports only to countries that posed a strong threat of imitation (e.g., China). Using a similar approach, Rafiquzzaman (2002) found that Canada exported more to countries with strong patent rights; thus, it exported more to high-income countries than to low-income countries, and this effect varied with the threat of imitation. Chen (2017) showed that the impact of IPRs on manufacturing imports is significantly stronger for R&D-intensive products. Awokuse and Yin (2010) found increased IPRs protection to stimulate Chinese imports, particularly for knowledge-intensive products. On the contrary, Campi and Duenas (2016) found that stronger IPRs had a negative and uneven effect on agricultural trade at different levels of disaggregation in the post-TRIPS period. Evidently, the evidence is rather mixed, and there is scope for improvement along the lines set out in the introductory section.

3 Overview of Patent Protection

We commence with the Ginarte-Park index of patent rights (Ginarte and Park 1997; Park 2008) as a proxy for the strength of intellectual property rights. It is based on five components of protection: coverage, duration, membership in international patent agreements, provisions for revocation post-grant, and enforcement mechanisms. Each component varies between 0 and 1, and their unweighted sum yields the overall index (GP), which ranges from 0 to 5, with higher values indicating stronger protection.[3] However, this index incorporates enforcement only to the extent that laws provide for preliminary injunctions, contributory infringement, and burden of proof reversal. But these de jure measures do not necessarily reflect the de facto enforcement of patent rights (Hu and Png, 2013). For example, in 2015 this index ranked Bolivia (4.01) and Ecuador (4.21) ahead of Greece (3.88) and Malaysia (3.22), yet the latter had relatively stronger enforcement of patent laws. To address this lacuna, we follow Kanwar (2012) and modify GP using the 'area-2' sub-index of Gwartney et al. (2021) entitled 'legal system and property rights' sub-index (hereafter the Frazer Index). This incorporates various aspects of legal enforcement and property rights in a country: [4] judicial independence, impartial courts, protection of property rights, military interference in rule of law and politics, integrity of the legal system, legal enforcement of contracts, regulatory cost of sale of physical property, and reliability of the police. Since it ranges from 0 to 10, we divide by 10 to rescale it to lie between 0 and 1, which matches the five components of the Ginarte-Park index. We then add the re-scaled 'Fraser index' to the GP, to obtain the modified patent rights index MODGP. Thus, $MODGP = GP + \frac{1}{10}(Frazer\ index)$, which lies between 0 and 6, with larger values indicating stronger protection. In contrast to GP which is a de jure measure reflecting laws and agreements, MODGP reflects de

[3] We thank Walter Park for providing us the updated index. It is available quinquennially from 1960 to 2015, and we use linear interpolation to compute it for the intervening years.

[4] This index is available quinquennially over 1970-2000, and annually thereafter. We linearly interpolate it to compute the figures for the intervening years before 2000.

facto or effective patent protection.

From the summary statistics in Table 1, note that the largest increase in patent protection occurred in 1995 (relative to 1990), when the TRIPS agreement was signed (GP increases 35% and MODGP increases 30%), and this increase continued in the post-TRIPS period. Figure 1 depicts these sharp increases. This increase in the level of patent protection (post-TRIPS) was largely exogenous, driven mainly by TRIPS compliance. However, this exogeneity may not hold in the pre-TRIPS period, when trade with high-income countries could well have provided LDCs the incentives to strengthen their IPRs regime (Ivus 2010; Kanwar and Sperlich 2020).

4 Model Specification

Earlier studies of the impact of stronger IPRs on trade (Maskus and Penubarti 1995; Smith 1999; Rafiquzzaman 2002; Co 2004; Falvey et al. 2009) employ the traditional cross-section gravity equation. Anderson and van Wincoop (2003) and Adam et al. (2007) show such models to be mis-specified, because it is not sufficient to consider just bilateral trade resistance or barriers to trade, but also multilateral trade resistance that each country faces vis-à-vis all its trading partners. Consequently, results based on traditional gravity models are likely to be subject to omitted variable bias.

In this study, we use the new gravity model proposed by Anderson and van Wincoop (2003). Utility maximization by each country subject to its budget constraint, the structure of trade costs, and a set of market clearing conditions yields the following equation of bilateral trade between countries i and j:

$$M_{ij} = \frac{Y_i Y_j}{Y^w} \left(\frac{t_{ij}}{P_i P_j} \right)^{1-\sigma} \tag{1}$$

where M_{ij} denotes the imports of country j from country i, Y_i and Y_j are national incomes (GDP) of i and j respectively, $Y^w = \sum_j Y_j$ is the world nominal income, t_{ij} (= 1 + ad valorem trade costs) reflects bilateral trade resistance, P_i and P_j are the Dixit-Stiglitz constant elasticity of substitution (CES) consumer price indices [5], and σ is the elasticity of

[5]Even if we treatP_i and P_j as consumer prices, which would require all trade costs to be pecuniary costs, there are still several measurement problems that make them unobservable from our viewpoint. For example, non-traded goods and nominal exchange rates, which are excluded from our model, have a

substitution between goods of exporter i and importer j. Denoting exporter and importer income shares as $\theta_i = \frac{Y_i}{Y^w}$ and $\theta_j = \frac{Y_j}{Y^w}$, respectively, some algebraic manipulation yields

$$P_i^{1-\sigma} = \sum_j \theta_j \, t_{ij}^{1-\sigma} \, P_j^{\sigma-1} \tag{2}$$

and

$$P_j^{1-\sigma} = \sum_i \theta_i \, t_{ij}^{1-\sigma} \, P_i^{\sigma-1} \tag{3}$$

Anderson and van Wincoop (2003) refer to P_i as the exporter's multilateral trade resistance (or outward trade resistance), for it indicates that exports from country i to country j depend on (bilateral) trade costs t_{ij} across all possible export markets, which is why we sum over j in equation (2). Similarly, P_j is the importer's multilateral trade resistance (or inward multilateral resistance), because it indicates that imports of country j from country i depend on (bilateral) trade costs t_{ij} vis-à-vis all suppliers, which is why we sum over i in equation (3).

According to gravity model (1), bilateral trade (controlling for size) depends on the bilateral trade barriers between countries i and j (t_{ij}) relative to the product of their multilateral resistance measures ($P_i \ P_j$). To appreciate that higher multilateral resistance of importer j raises its trade with i, note that for a given bilateral barrier between i and j, higher barriers between j and all its other trading partners (except i) will reduce the relative price of goods from country i and raise imports from i. Similarly, higher multilateral resistance of exporter i lower the demand for its goods and therefore its supply price p_j, which, for a given bilateral barrier between i and j, increases trade between them (Anderson and Van Wincoop 2003) [6]

Anderson and van Wincoop (2003) employ iterative nonlinear least squares to directly estimate the multilateral resistance terms P_i and P_j in a static setting, as functions of the observable determinants of trade barriers, whereas Head and Mayer (2014) propose estimating the model using "structurally iterated least squares". Both approaches, however,

significant impact on these price levels.

[6] The gravity structural equation system (1) to (3) provides a tractable 'conditional general equilibrium' framework operating via multilateral channels. The scenario is qualified as 'conditional', because output Y_i and expenditure Y_j are assumed to remain unchanged following changes in the bilateral trade cost factor t_{ij}. It is labelled 'general equilibrium' because it allows the effect of trade liberalization between two countries i and j to ripple through the rest of the world via multilateral resistance terms P_i andP_j.

are computationally burdensome in large panel datasets like ours. Olivero and Yotov (2012) demonstrate that multilateral resistance terms can be accounted for by including exporter-time and importer-time fixed effects in a dynamic gravity estimation framework with panel data. However, this would absorb the 'treatment' variable (the IPRs index), and other key control variables that vary across exporter-time and importer-time dimensions, making this approach unattractive. Wei (1996) approximates multilateral trade resistance by the 'remoteness index', constructed as a function of the ratio of bilateral distance to GDP, which is intended to measure a country's average weighted distance from its trading partners, where the weights are partner countries' share of world GDP (Head 2003). But this measure is atheoretic, and does not properly reflect the factors it purports to measure. Hummels (2001), Rose and van Wincoop (2001), Melitz (2008), and Feenstra (2015) advocate directional (exporter and importer) fixed effects in lieu of multilateral resistance terms, which would account for unobserved multilateral resistance factors that vary across importer and exporter dimensions, but would potentially ignore multilateral resistance terms that vary across both exporter-time and importer-time dimensions.

Baier and Bergstrand (2009a) propose approximating multilateral resistance terms P_i and P_j using a first-order Taylor series approximation that can be estimated using what they call "bonus-vetus" or good old OLS. In addition to tractability, this approach is more appropriate for panel data analysis, and accounts for the unobserved multilateral resistance terms with time-varying components without as such requiring inclusion of time and country fixed effects. They show that Monte Carlo simulations yield coefficient estimates that are virtually identical to those obtained from fixed effects and non-linear least squares by Anderson and van Wincoop (2003) and Head and Mayer (2014). Therefore, in this paper we adopt the Baier and Bergstrand (2009a) approach, which is outlined below.

Taking the log of gravity equation (1) and substituting $-ln\,(Y^w) = \alpha_o$ (because world income is constant across country-pairs), gives

$$ln\,M_{ij} = \alpha_o + ln\,(Y_iY_j) + (1-\sigma)\,ln\,(t_{ij}) - (1-\sigma)\,ln(P_i) - (1-\sigma)\,ln(P_j) \qquad (4)$$

The nonlinear outward multilateral resistance for an exporter given by equation (2) may be re-written as

$$e^{(1-\sigma)\, ln(P_i)} = \sum_j e^{ln\theta_j} e^{(1-\sigma)\, ln(t_{ij})} e^{(\sigma-1)\, ln(P_j)} \tag{5}$$

A linear approximation to (5) may be obtained by using a first-order log-linear Taylor series approximation, centered around a world with symmetric trade costs ($t_{ij} = t > 1$) substituting $t = P^2$ and $\sum_j \theta_j = 1$, the linear approximation of P_i from equation (5) is

$$ln\, P_i = \sum_j \theta_j\, ln(t_{ij}) - 1/2 \sum_i \sum_j \theta_i\, \theta_j\, ln(t_{ij}) \tag{6}$$

Similarly, the linear approximation of P_j from equation (3) is

$$ln\, P_j = \sum_i \theta_i\, ln(t_{ij}) - 1/2 \sum_i \sum_j \theta_i\, \theta_j\, ln(t_{ij}) \tag{7}$$

In (6) and (7), the nonlinear multilateral resistance terms P_i and P_j are expressed as the linear weighted sum of bilateral resistance t_{ij} , where the weights are income shares of countries i and j.

Substituting $ln\, P_i$ and $ln\, P_j$ from (6) and (7) into (4) yields

$$\begin{aligned} ln\, M_{ij} = \alpha_o + ln\,(Y_i\, Y_j) + (1-\sigma)\, ln\,(t_{ij}) - (1-\sigma) \sum_j \theta_j\, ln(t_{ij}) - (1-\sigma) \sum_i \theta_i\, ln(t_{ij}) \\ + (1-\sigma) \sum_i \sum_j \theta_i\, \theta_j\, ln(t_{ij}) \end{aligned} \tag{8}$$

Since the bilateral trade cost variable t_{ij} is unobserved, Baier and Bergstrand (2010) compute it as a log-linear sum of all the observable variables, i.e.

$$\begin{aligned} ln\,(t_{ij}) = \delta_1\, ln(pop_i\, .\, pop_j) + \delta_2\, ln(dist_{ij}) + \delta_3\, ln(FTI_j) + \delta_4\, contig_{ij} + \delta_5\, comlang_{ij} \\ + \delta_6\, col_{ij} + \delta_7\, comcol_{ij} + \delta_8\, ln(hc_j) + \delta_9\, ln(IPR_j) \end{aligned} \tag{9}$$

where pop denotes the population of country i (exporter) and country j (importer), $dist_{ij}$ measures the distance between the biggest cities of i and j weighted by the population,

FTI_j is the index of freedom to trade internationally which reflects country j's openness to trade, $contig_{ij}$ =1 if importer and exporter share a common border and = 0 otherwise, $comlang_{ij}$=1 if importer and exporter have the common official language and = 0 otherwise, col_{ij}=1 if i and j were ever in colonial relationship and = 0 otherwise, $comcol_{ij}$=1 if both had a common colonizer post-1945 and = 0 otherwise, hc_j is human capital in country j (based upon years of schooling and returns to education) and IPR_j is the measure of intellectual property rights in country j.
Substituting (9) into (8), and collecting terms, we get :

$$\begin{aligned} ln\, M_{ij} = \alpha_o + ln\,(Y_i\, Y_j) + (1-\sigma)\,\delta_1 ln\,(pop_i\,.\,pop_j) + (1-\sigma)\,\delta_2 ln\,(dist_{ij}) \\ +(1-\sigma)\,\delta_3 ln\,(FTI_j) + (1-\sigma)\,\delta_4\, contig_{ij} + (1-\sigma)\,\delta_5\, comlang_{ij} \\ +(1-\sigma)\,\delta_6\, col_{ij} + (1-\sigma)\,\delta_7\, comcol_{ij} + (1-\sigma)\,\delta_8\, ln(hc_j) \\ +(1-\sigma)\,\delta_9\, ln(IPR_j) - (1-\sigma)\,\delta_1\, MR(pop_i\,.\,pop_j) - (1-\sigma)\,\delta_2 MR(dist_{ij}) \\ -(1-\sigma)\,\delta_3 MR(FTI_j) - (1-\sigma)\,\delta_4 MR(contig_{ij}) - (1-\sigma)\delta_5 MR(comlang_{ij}) \\ -(1-\sigma)\,\delta_6 MR(col_{ij}) - (1-\sigma)\,\delta_7 MR(comcol_{ij}) \\ -(1-\sigma)\,\delta_8 MR(hc_j) - (1-\sigma)\,\delta_9 MR(IPR_j) \end{aligned} \tag{10}$$

where

$$MR(dist_{ij}) = \sum_j \theta_j\, ln(dist_{ij}) + \sum_i \theta_i\, ln(dist_{ij}) - \sum_i \sum_j \theta_i\, \theta_j\, ln(dist_{ij})$$

$$MR(IPR_j) = \sum_j \theta_j\, ln(IPR_j) + \sum_i \theta_i\, ln(IPR_j) - \sum_i \sum_j \theta_i\, \theta_j\, ln(IPR_j)$$

and similarly for other variables. To conform with the theory, the coefficient estimates for $ln(pop_i\,.\,pop_j)$ and $MR(pop_i\,.\,pop_j)$ are restricted to have identical but opposite signs, and this applies to other variables in (10) as well.
Baier and Bergstrand (2009a) go on to argue that including multilateral trade costs weighted by GDP shares ($\theta_i = \frac{Y_i}{Y^w}$ & $\theta_j = \frac{Y_j}{Y^w}$) would create endogeneity bias, and they recommend using equal weights ($\theta_i = \theta_j = 1/N$) instead, where N is the total number of

countries. That leads to slightly different expressions for multilateral resistance factors.[7] Let (1-σ)δ_i = $\hat{\delta_i}$, so that equation (10) can be rewritten as

$$ln\, M_{ij} = \alpha_o + \beta ln\,(Y_i\, Y_j) + \hat{\delta_1} ln\,\overline{(pop_i\, .\, pop_j)} + \hat{\delta_2} ln\,\overline{(dist_{ij})} + \hat{\delta_3} ln\,\overline{(FTI_j)} + \hat{\delta_4}\,\overline{contig_{ij}}$$
$$+\hat{\delta_5}\,\overline{comlang_{ij}} + \hat{\delta_6}\,\overline{col_{ij}} + \hat{\delta_7}\,\overline{comcol_{ij}} + \hat{\delta_8} ln\,\overline{hc_j} + \hat{\delta_9} ln\,\overline{IPR_j} + \epsilon_{ij} \quad (11)$$

where the variables with 'over bar' denote components of trade cost derived using a Taylor series approximation. For example, $ln\overline{(dist_{ij})}$ is defined as the exporter-by-year and importer-by-year 'double demeaned' $ln\,(dist_{ij})$,[8] and similarly for the other trade barrier variables in equation (11) and ϵ_{ij} is white noise process. The attractive feature of the structural gravity model is separability,[9] and we estimate equation (11) separately for each sector.

The coefficient of the IPRs variable is à priori ambiguous. A positive sign would provide support for a net market expansion effect, whereas a negative sign would suggest support for a net market power effect. With respect to human capital, presumably country j's imports would decrease, the greater its imitation ability, so that we expect $\hat{\delta_8}$ to be negative. Parameter β is expected to have a positive sign, such that growth in log product of GDPs of countries i and j stimulates imports. The coefficient on log product of population of countries i and j ($\hat{\delta_1}$) should be negative, [10] because larger nations

[7]
$$MR(dist_{ij}) = \frac{1}{N}\sum_j ln(dist_{ij}) + \frac{1}{N}\sum_i ln(dist_{ij}) - \frac{1}{N^2}\sum_i\sum_j ln(dist_{ij})$$
$$MR(IPR_j) = \frac{1}{N}\sum_j ln(IPR_j) + \frac{1}{N}\sum_i ln(IPR_j) - \frac{1}{N^2}\sum_i\sum_j ln(IPR_j)$$

[8]The R.H.S variables in equation-11 are "double demeaned" both for exporter dimension and importer dimension. For example:
$$ln\overline{(dist_{ij})} = ln\,(dist_{ij}) - MR(dist_{ij})$$
Substituting for $MR(dist_{ij})$ we get,
$$ln\overline{(dist_{ij})} = ln\,(dist_{ij}) - \frac{1}{N}\sum_j ln(dist_{ij}) - \frac{1}{N}\sum_i ln(dist_{ij}) + \frac{1}{N^2}\sum_i\sum_j ln(dist_{ij})$$

[9]Separability means that bilateral expenditure across countries both at aggregate and sectoral levels is separable from output and expenditure at country level (Larch and Yotov 2016).

[10]However, there is some ambiguity about the expected sign of population, because a larger population also provides economies of scale which may increase intra-industry trade and thus imports.

tend to have higher internal trade, that may discourage imports. Parameter $\hat{\delta_2}$ should be negative, as distance is a proxy for transportation cost which would reduce imports. Parameter $\hat{\delta_3}$ is expected to be positive, since exports from country i should increase with developing country j's degree of trade openness. A common border, language and colonial ties between i and j may lead to greater trade, so we expect $\hat{\delta_4}$, $\hat{\delta_5}$, $\hat{\delta_6}$, $\hat{\delta_7}$ to have positive signs.

5 Data and Variables

We are particularly interested in the impact of patent rights reform on imports into the knowledge-intensive manufacturing sectors. Our dependent variable pertains to imports by 87 developing countries from 28 high-income countries, across 7 technological intensive (or knowledge-intensive) industries over the period of 1976-2019. The reason is two-fold: First, these sectors involve significant investment in R&D, and patents are considered an important mechanism for protecting the industry's competitive advantage (Cohen et al. 2000). Second, the TRIPS legislation post-1994 set down relatively stricter standards of patent rights in these sectors than before. We determine the patent-intensive manufacturing industries as those with an above-mean patent intensity (US Patent and Trademark Office 2012, Delgado et al. 2013; Keenan et al. 2004), and hence those for which patents are an important instrument for rent appropriation (Cohen et al. 2000). Accordingly, these industries are: Electronics, Industrial Chemicals, Machinery (Non-electrical), Other Chemicals, Scientific and Professional Goods, Pharmaceuticals, and Rubber products.

The import data were drawn from the United Nations Commodity Trade Statistics (UNCOMTRADE 2021),[11] wherein products are classified as per the evolving Standard International Trade Classification, i.e. SITC Revisions 1 to 4.[12] While Revision 1 is too outdated, revisions 3 and 4 are available for much shorter time spans. Therefore, starting with SITC Revision 2, we retrieve the data on values of imports (in '000 US$) at the four-digit level, and then aggregate it to the two-digit product group level. We then use the product-industry concordance of Maskus et al. (1991) to match the two-digit product

[11]UNCOMTRADE data can be accessed at https://wits.worldbank.org/

[12]SITC Rev. 1-4 are available from 1962, 1976, 1988 and 2006, respectively.

groups with three-digit ISIC industries.[13] Therefore, our data on import values is at the three-digit ISIC level Revision 3.[14] We then use the US GDP price deflator to convert the nominal figures into constant 2012 dollars.

For the 'treatment variable', we use the two measures of patent protection detailed in section 3: (i) Ginarte-Park index GP, which is a de jure measure reflecting the laws and some international agreements on IPRs; and (ii) the modified Ginarte-Park measure MODGP, which incorporates the Frazer Institute's index of 'legal system of property rights' into the Ginarte-Park measure, [15] and reflects both the legal rights and their de facto enforcement.

To control for confounders, we include several control variables, data for which were taken from the Penn World Tables (PWT 10.0).[16] The imitative ability of importer countries depends on their human capital (HC) which is defined by their average years of schooling (Barro and Lee 2013), and returns to education (Psacharopoulos 1994). The log of the product of importer and exporter real GDP (at 2017 $US million) is used as a proxy for market size. Population (millions) in importer and exporter countries indicates scale. A country's integration with the world economy (FTI) is represented by the Area-4 subindex of the Economic Freedom database (Gwartney et al. 2021). Geographic distance between importer and exporter is based on data from Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). Finally, dummy variables based on CEPII data are created to reflect 'Contiguity', 'Common official language', 'Colony', and 'Common colony'.

6 Estimation Results

The scatterplot in Figure 2 indicates a positive association between log(Imports) and log(GP) for our sample of developing countries, and their correlation is 0.35. This correlation is somewhat stronger (0.37) when we use log(MODGP) in lieu of log(GP), as

[13]The industry concordance (Maskus et al. 1991) can be accessed at: https://www.macalester.edu/research/economics/page/haveman/Trade.Resources/tradeconcordances.html

[14]At any level of aggregation, some SITC categories fit into multiple ISIC categories, requiring an acceptable weighting scheme. Weights based roughly on the contribution of trade in the underlying three-digit SITC category to the total two-digit SITC trade in the US in 1984 are employed for this purpose (Maskus et al. 1991).

[15]Available at: https://www.fraserinstitute.org/studies/economic-freedom

[16]Penn World Tables v. 10 can be accessed at: https://www.rug.nl/ggdc/productivity/pwt/

is also evident from the scatterplot in Figure 3. These preliminary results suggest that it is the degree of effective enforcement of existing patent laws that enable countries to import more, not just the de jure measure of patent protection. We now proceed to show results more formally based of gravity model that incorporates multilateral resistance into equation of estimation.

6.1 Structural Gravity Estimation with Multilateral Resistance: Bonus-Vetus OLS

Table 2 presents the estimation results for equation (11), using GP as the IPRs measure. Row 1 reports parameter estimates at the aggregate level (i.e., the aggregate of the seven patent-sensitive industries), while subsequent rows report estimates at the disaggregated 3-digit ISIC sectoral level. The patent rights variable GP is strongly positive significant at the 1% level, both in the aggregate as well as for the individual industries (except industrial chemicals). This suggests the presence of a strong market expansion effect of host country patent rights on their imports. The overall elasticity of knowledge-intensive imports w.r.t patent rights is 0.28, with considerable variation across industries, being as high as 0.55 for Electronics, 0.44 for Rubber manufactures, and 0.32 for Pharmaceuticals. Our results stand in contrast with most of the prior literature. Thus, Maskus and Penubarti (1995) find that stronger host country patent rights have an insignificant effect on OECD export flows, both at the aggregate and disaggregated patent-sensitive industry levels. Co (2004) reports a similar insignificant effect for aggregate US R&D-intensive exports, while at the sectoral level the response is significantly negative for medicinal drugs and electrical components. The latter is in line with Fink and Primo-Braga (2005), who find a significantly negative impact on the probability that countries trade with each other in high-tech goods. Although, Rafiquzzaman (2002) found a positive significant response for Canadian exports, the elasticity is about half what we find for developing countries; moreover, the knowledge-intensive sectors did not exhibit a significant response. Finally, though Awokuse and Yin (2010) report a substantial positive response of China's imports both at the aggregate and knowledge-intensive category levels, their study is limited to China and may not apply to developing countries in general.

The control variables have the expected signs and are mostly significant at the 1% (or lower) level. Human capital is significantly negative at the 1% level, in the aggregate and for most sectors, indicating a strong negative effect of imitation ability on imports. However, in industries like pharmaceuticals, the coefficient on human capital is positive and significant. This might be because products in pharmaceuticals and other chemicals are difficult to copy through reverse engineering and may require complementary resources (Delgado et al. 2013). In such industries, human capital may have a positive effect on productivity and therefore a positive impact on trade (productivity link). Variables GDP and population confirm that the larger market size and productive capacity of LDCs are strong attractors for imports. The coefficient of the openness index is strongly positive significant, confirm the somewhat self-evident fact that fewer barriers imply more trade. Distance has a negative significant effect on imports for all sectors, indicating the importance of transport costs. The estimates on distance lie in the range of what Disdier and Head, (2008) found in their meta-analysis. Variables common language, colony, and common colony are strongly positive significant, in line with Melitz (2008) and Melitz and Toubal (2014), indicating the importance of historical links on (bilateral) trade. However, contiguity is mostly insignificant, indicating the relative unimportance for trade of 'being merely physically close'.

When we switch to the de facto patent rights measure MODGP, we find from Table 3, that the results strongly support those in Table 2, such that MODGP is strongly positive significant both in the aggregate and for 6 out of 7 patent sensitive sectors (being insignificant only for industrial chemicals). The elasticity of imports w.r.t MODGP in the aggregate is about 0.50, which is almost twice as large as the corresponding figure using GP. Elasticities for each of the industries are larger as well. This would suggest that the previous results using GP were probably subject to omitted variable bias, given that GP did not account for enforcement of the IPRs laws. Therefore, in the robustness exercises presented below, we prefer to employ MODGP as the IPRs measure.

6.2 Are the above results driven by changes in Quantity or Price?

The analysis in the previous section is based on the response of the value of imports. However, it could very well be the case that the exporting countries increased the price of their product in response to stronger patent rights in the (developing) importing countries, implying that the increase in the value of imports into the latter could be driven by prices and not quantities. This would also be inconsistent with the objective of stronger patent rights in developing countries inducing the import of knowledge-intensive products into developing countries. To address this limitation, we disentangle import value into quantity (Q) and prices (P), and re-estimate equation (11), first with import quantity as the dependent variable, and then with import price.

6.2.1 Re-estimation with Quantity as dependent variable

Ideally, one should consider the number of items traded as well as the amount, but the predominant share of traded product data (in UN Comtrade data) are by weight (kilograms),[17] so that we define the dependent variable as log(quantity in kilograms). Table 4 reveals that the IPRs variable continues to be significant for imports in all 7 industries. Further, the regression coefficient of the IPRs variable, and therefore the associated elasticity, become much smaller in 4 out of 7 industries. For instance, in the professional goods industry, while the elasticity of import value w.r.t IPRs was 0.46 (Table 3), it is about 0.22 for the quantity measure (Table 4). This is evidently the result of the removal of any 'price effect' and the downward-bias resulting from the fact that the unit weight of traded items has likely decreased over time (due to technological change). The upshot is, that the increase in value of imports (associated with a unit increase in IPRs) reported in the previous section, is likely driven (mainly) by an increase in import quantity and not just import price.

6.2.2 Patent rights enforcement and industry price indices

We now test whether the developed country exporters increased the prices of their patent-sensitive products in response to the strengthening of patent rights in developing countries. For this purpose, we use the UN COMTRADE data at the SITC 4-digit commodity level. The price (unit value) of each commodity k exported from country i to country j at year t is computed as the ratio of value by quantity. We classify 4-digit commodities into

[17] In our sample, 74% of quantity data is measured by weight in kilograms, 12% is missing, 11.02% is measured in number of items traded, and the remaining 3% is measured in other units (dozens, number of packages, volume in cubic meters, etc.).

corresponding industries. For example, electronics is composed of 37 commodities which are varieties of telecommunication, sound recording, and electrical machinery, household type equipment, apparatus and appliances. The industry price indices are computed as the weighted average of all the 4-digit commodity-specific unit prices belonging to industry s, where weights are shares of a commodity (k) in the total value of imports in an industry (s) in year (t). That is:

$$P_{ijt}^{s} = \sum_{k \in s} w_{ijt}^{k} \, p_{ijt}^{k}$$

Where, $p_{ijt}^{k} = \frac{p_{ijt}^{k} q_{ijt}^{k}}{q_{ijt}^{k}}$ and $w_{ijt}^{k} = \frac{p_{ijt}^{k} q_{ijt}^{k}}{\sum_{k \in s} p_{ijt}^{k} q_{ijt}^{k}}$. The imputed industry price indices P_{ijt}^{s} are in nominal US dollars, and we convert them into 2012 dollars using the US GDP price deflator.

We re-estimate our baseline gravity model equation (11) for each industry, using the log of the imputed industry price index as the dependent variable (Table 5). We find that stronger patent rights have an insignificant effect on prices in 4 out of 7 sectors, and a negative significant effect in industrial chemicals; but a positive significant effect in the electronics, and machinery (non-electrical) industries. It appears, therefore, that in the former 5 sectors, the increase in the value of imports was driven by (mostly) quantity increases, whereas for the latter 2 sectors, both quantities and prices increased in response to stronger property rights in the importing developing countries. Further, given that we observed the stronger market expansion effects in the electronics and machinery sectors (see Table 3), that leaves room for the quantity effects to have been large in these two sectors.

7 Robustness check

7.1 Controlling for Multilateral Resistance using Remoteness Indexes: OLS Estimation

To allow for multilateral resistance factors in the estimation of the gravity equation, some researchers use an atheoretical approach, where multilateral resistance terms are approximated by exporter and importer remoteness indexes. These are constructed as the weighted average of the ratios of bilateral distance to Gross Domestic Product, where the weights are partner country's share in world GDP. Following Head (2003), we measure remoteness as:

$$Rem_{it} = ln\left(\sum_j Dist_{ij}\right) \times \frac{E_{jt}}{Y_t} \quad and \quad Rem_{jt} = ln\left(\sum_i Dist_{ij}\right) \times \frac{Y_{it}}{Y_t}$$

where E_{jt} and Y_{it} is country j's aggregate expenditure and country i's domestic production, respectively, proxied by their respective GDP. The $Dist_{ij}$ is bilateral distance between i and j based on the CES index. The estimation equation then becomes (Wei 1996; Baier and Bergstrand 2009b):

$$\begin{aligned} ln\ M_{ij} = \alpha_0 + \beta ln(Y_i\ Y_j) + \delta_1 ln(pop_i\ pop_j) + \delta_2 ln(dist_{ij}) + \delta_3 ln(FTI_j) + \delta_4(Contig_{ij}) \\ +\delta_5(comlang_{ij}) + \delta_6(col_{ij}) + \delta_7(comcol_{ij}) + \delta_8 ln(hc_j) + \delta_9 ln(IPR_j) \\ +\lambda_1 ln(Rem_{it}) + \lambda_2 ln(Rem_{jt}) + \epsilon_{ij} \end{aligned} \tag{12}$$

where the new control variables are the remoteness measures.

The OLS estimates of equation (12) are displayed in Table (6), using MODGP as the IPRs measure. MODGP has a strong positive significant effect on level of r&d intensive import flows both at the aggregate (elasticity 0.37) and the industrial levels. These results are in sync with previous results, and provide strong evidence of a significant market expansion effect of stronger patent rights on developing countries patent sensitive import flows.

The importer remoteness index is positive significant at both the aggregate and disaggregated sector levels, supporting the theory that regions that are more isolated/remote from the rest of the world tend to trade more with each other. However, the exporter remoteness index is positive but insignificant at aggregate product group level and negative and significant for most of the sectors, which is inconsistent with the theory. In view of this result, and the fact that these indexes bear little resemblance to their theoretical counterparts of the multilateral resistance terms P_i and P_j (Head and Mayer 2014), we prefer the Baier and Bergstrand approach employed in section 6.

7.2 Controlling Multilateral Resistance Using Directional Importer and Exporter Fixed Effects

Since the remoteness indexes used in section 7.1 were deficient, we consider an alternative robustness check to better account for multilateral resistance factors in a structural gravity setting. Let the gravity relationship be

$$M_{ij} = exp\{\mathbf{x_{ij}}\,(t)\,\beta\}\,\eta_{ij}(t) \tag{13}$$

where M_{ij} denotes imports of country j from country i, $\mathbf{x_{ij}}(t)$ is the covariate vector used in the previous exercises, η_{ij} is the error term. Specification (13) is estimated using two alternative techniques: (i) a fixed effects within-estimator, and (ii) a Poisson pseudo-maximum likelihood (PPML) estimator with high dimensional fixed effects, since heteroskedasticity often plagues trade data.

7.2.1 Fixed Effects Estimation

Random effects assumes that unobserved heterogeneity is orthogonal to $\mathbf{x_{ij}}$, but in our case, it is likely that country-specific time-invariant factors are not random, including other observed or unobserved factors (environmental, historical, geographic), which makes fixed effects estimation preferable. The Hausman specification test also supports fixed effects. However, with fixed effects the time-invariant factors (contiguity, common language, colony, common colony, distance) are dropped from estimation. The estimator however retains year fixed effects to control for macroeconomic shocks and time-specific trends.[18]

Table 7 informs us that MODGP is positive and strongly significant at the aggregate level (elasticity 0.57). The effects however tend to be stronger at disaggregated industry level like Electronics with an elasticity of 0.84, followed by Rubber manufactures 0.71, Industrial chemicals 0.58, Professional goods 0.55, etc. These results again provide strong

[18]The fixed effects estimator also drops time-invariant exporter γ_i and importer γ_j fixed effects, therefore does not properly account for outward multilateral and inward multilateral resistance. However, if we want to retain these origin and destination fixed effects to approximate multilateral resistance terms, then random effect model is more appropriate. Moreover, the log-linearization may create additional problems in presence of zero trade flows, Santos Silva and Tenreryo (2006), but the data in our case does not contain any such observation ($M_{ij} > 0$).

support for the market expansion effect of IPRs on the level of developing country patent sensitive import flows. The results indicate that de facto IPRs laws play a strong role in driving import flows. The control variables are significant and have the expected signs on the whole.

7.2.2 Poisson Pseudo-Maximum Likelihood Estimation with High Dimensional Fixed effects

Silva and Tenreyro (2006) show that in the presence of heteroskedasticity, estimates obtained by applying OLS after log-linearizing models such as equation (1) yield biased estimates of the true elasticities. Moreover, a log specification would drop the observations with zero trade flows. Finally, we include importer and exporter fixed effects to account for inward and outward multilateral resistance terms, Anderson and van Wincoop (2003); Hummels (2001); Feenstra (2015). In such a case, the number of parameters to be estimated depends upon the number of countries (N) included in the sample and therefore give rise to "incidental parameter problem", where the consistent estimates of the model cannot be obtained. In general, the maximum likelihood estimator (MLE) in nonlinear panel data models with fixed effects is biased and inconsistent when T (the length of the panel) is fixed but the number of parameters to be estimated grows with the N, Lancaster (2000); Greene (2004). However, fixed effects Poisson regression is immune to incidental parameter problem, Greene (2004); Santos Silva and Tenreryo (2022), as such provides an additional advantage over other estimation techniques under gravity model framework. For all these reasons, the Poisson Pseudo-Maximum Likelihood (PPML) specification with high dimensional fixed effects is superior, and that is what we use to estimate gravity equation (13). The RESET test is performed by checking the significance of additional regressor constructed as $\mathbf{x_{ij,t}}\hat{\beta}$ where, $\mathbf{x_{ij,t}}$ is the vector of covariates and $\hat{\beta}$ denotes the corresponding vector of estimated parameters. At aggregated product group level, the test accepts the hypothesis that the coefficient of test variable is 0, with a p-value of 0.203. Therefore, RESET test provides no evidence of model misspecification of gravity model estimated using PPML with high dimensional fixed effects. The model estimated using Poisson regression also passes the RESET test at disaggregated sectoral level in our case.

The parameter estimates from specification (13) using PPML estimator with high dimensional fixed effects are reported in Table 8. The elasticity of imports with respect to IPRs variable is insignificant at aggregate product level but positive and significant in 4 out of 7 patent sensitive sectors. The effect is again stronger in Electronics products with an elasticity of 0.64 followed by Rubber products 0.58, Pharmaceuticals 0.46 and Other chemicals 0.41. However, in sectors like Industrial chemicals, Machinery and Professional goods, we did not find significant incidence of market expansion effect using PPML estimator. The coefficients of control variables are significant and have expected sign, for example., speaking common language increase patent intensive import flows by an average of [exp(0.339)-1] $\times$ 100 = 40%. The PPML estimates of the effects of distance, common language, colony are significantly smaller in absolute value relative to prior estimators. These results are in line with Santos Silva and Tenreryo (2006), who found that OLS greatly exaggerates the role of colonial ties and geographic proximity. The results are stronger than those using the de jure measure GP (reported in Table 2). These results provide further evidence that not only do stronger patent rights induce larger import flows, but additionally that it is not just the patent laws but also their effective enforcement that enhance import flows.

8 Conclusion

The effect of strengthening intellectual property rights on bilateral trade flows is contentious and does not have a straightforward answer. This indeterminacy is because of two offsetting forces – the market power and market expansion effects – and the resultant depends on which of the two forces is stronger. The issue has been empirically investigated mostly from the perspective of the sensitivity of the exports of a single developed country to the patent policy of host countries, using cross-sectional data. However, there is scant literature that examines this issue from the perspective of developing nations. Given the diversity in economic size and structure amongst developing countries, this paper examines the impact of IPRs protection on the level of imports into 88 developing countries with heterogeneous import capabilities and imitation abilities, across 7 patent sensitive industries. A large panel dataset is used to control for country-specific unobserved heterogeneity. In addition, while most of the previous studies either use the subjective Rapp and Rozek index or the Ginarte-Park index as the measure of patent rights, both of which are de jure measures of IPRs protection and do not really account for the enforcement dimension of patent laws, we employ a modified version of the Ginarte-Park measure that corrects for this shortcoming and reflects the de facto or effective degree of enforcement of patent rights. Furthermore, much of the previous literature uses the traditional gravity model to study the issue at hand, which completely ignores the multilateral resistance factors at work. Accordingly, we employ the new gravity model of Anderson and van Wincoop (2003) which approximates the nonlinear multilateral resistance factors using a first-order Taylor series approximation. The use of alternative measures of multilateral resistance factors and other robustness checks further strengthen our empirical evidence. We find that knowledge-intensive imports (from developed countries) into the developing countries respond positively to the strengthening of host country patent laws. Further, we go beyond the received literature to establish that this market expansion effect is driven (mainly) by an increase in import quantity, and not just an increase in import prices. We did not, however, find any incidence of the market power effect, either at the aggregate level or at the disaggregated sectoral level. We find that the market expansion effects are not solely driven by changes in prices, but also (perhaps mainly) driven by changes in quantities traded. Furthermore, our results indicate that de jure laws as reflected by the Ginarte-Park index are of relatively little importance in driving import flows. What appears to matter more is the enforcement that nations undertake as reflected in our modified Ginarte-Park measures. This implies that prior results obtained using the de jure IPRs measure likely suffer from omitted variable bias. Our results stand in sharp contrast to Chen (2017) who did not find the impact of de jure and de facto intellectual property rights to be significantly different. Insofar as imports are a major factor contributing to knowledge-spillovers (by facilitating learning by importing and reverse engineering), the evidence from this study helps identify the policy-relevant factors for encouraging innovation, economic growth and standards of living in the host economy.

References:

Adam, C., D. Cobham (2007). Modelling multilateral trade resistance in a gravity model with exchange rate regimes. Oxford University working paper. August.

Anderson, J. E. and E. van Wincoop. (2003). Gravity with gravitas: A solution to the border puzzle. *American Economic Review*, 93(1):170-192.

Awokuse, T. O. and H. Yin. (2010). Does stronger intellectual property rights protection induce more bilateral trade? Evidence from China's imports. *World Development*, 38(8):1094-1104.

Baier, S. L. and J.H. Bergstrand. (2009a). Bonus vetus ols: A simple method for approximating international trade-cost effects using the gravity equation. *Journal of International Economics*, 77(1):77-85.

Baier, S. L. and J.H. Bergstrand. (2009b). Estimating the effects of free trade agreements on international trade flows using matching econometrics. *Journal of International Economics*, 77(1):63-76.

Baier, S. L. and J.H. Bergstrand. (2010). Approximating general equilibrium impacts of trade liberalizations using the gravity equation. In P.A.G. van Bergeijk and S. Brakman (eds.), *The Gravity Model in International Trade: Advances and Applications*. pp. 88-134.

Barro, R. J. and J.W. Lee. (2013). A new data set of educational attainment in the world, 1950-2010. *Journal of Development Economics*, 104(1):184-198.

Branstetter, L., R. Fisman, C.F. Foley and K. Saggi. (2011). Does intellectual property rights reform spur industrial development?*Journal of International Economics*, 83(1):27-36.

Campi, M. and M. Duenas. (2016). Intellectual property rights and international trade of agricultural products. *World Development*, 80:1-18.

Chen, W. (2017). Do stronger intellectual property rights lead to more r&d-intensive imports? *The Journal of International Trade & Economic Development*, 26(7):865-883.

Co, C. Y. (2004). Do patent rights regimes matter? *Review of International Economics*, 12(3):359-373.

Cohen, W.M., R.R. Nelson, and J.P. Walsh. (2000). Protecting their intellectual assets: Appropriability conditions and why U.S. manufacturing firms atent (or not). *NBER Working Paper No. 7552*, Washington, D.C.

Delgado, M., M. Kyle and A.M. McGahan. (2013). Intellectual property protection and the geography of trade. *The Journal of Industrial Economics*, 61(3):733-762.

Disdier, A.-C. and Head, K. (2008). The puzzling persistence of the distance effect on bilateral trade. *The Review of Economics and Statistics*, 90(1):37-48.

Falvey, R., N. Foster and D. Greenaway. (2009). Trade, imitative ability and intellectual property rights. *Review of World Economics*, 145(3):373-404.

Feenstra, R. C. (2015). *Advanced International Trade: Theory and Evidence*. Princeton University Press.

Fink, C. and C.A. Primo-Braga. (2005). How stronger protection of intellectual property rights affect international trade flows. In C. Fink and K.E. Maskus (eds), *Intellectual Property and Development: Lessons From Recent Economic Research*. Washington, DC, The World Bank.

Ginarte, J. C. and W.G. Park. (1997). Determinants of patent rights: A cross-national study. *Research Policy*, 26(3):283-301.

Greene, W. (2004). Fixed effects and bias due to the incidental parameters problem in the tobit model. *Econometric Reviews*, 23(2), 125-147.

Gwartney, J., R. Lawson, J. Hall and R. Murphy. (2021). Economic Freedom Dataset, published in Economic Freedom of the World: 2021 Annual Report. Fraser Institute. www.fraserinstitute.org/economic-freedom/dataset.

Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica*, pages 1251-1271.

Head, K. (2003). Gravity for beginners. University of British Columbia, Vancouver, B.C.

Head, K. and Mayer, T. (2009). Illusory border effects: distance mismeasurement inflates estimates of home bias in trade. In P.A.G. van Bergeijk and S. Brakman (eds.), *The Gravity Model in International Trade: Advances and Applications*. pp. 165-192.

Head, K. and T. Mayer. (2014). Gravity equations: Workhorse, toolkit, and cookbook.

In G. Gopinath, E. Helpman and K. Rogoff (eds.), *Handbook of International Economics*, volume 4, pages 131-195.

Helpman, E. (1993). Innovation, imitation, and intellectual property rights. *Econometrica*, 61(6):1247-1280.

Helpman, E. and P. Krugman. (1987). *Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition, and The International Economy*. MIT press.

Hu, A.G. and I.P. Png. (2013). Patent rights and economic growth: Evidence from cross-country panels of manufacturing industries. *Oxford Economic Papers*, 65(3):675-698.

Hummels, D. (2001). Towards a geography of trade costs, University of Chicago. Unpublished manuscript, Chicago, IL.

Ivus, O. (2010). Do stronger patent rights raise high-tech exports to the developing world? *Journal of International Economics*, 81(1):38-47.

Kanwar, S. (2012). Intellectual property protection and technology licensing: The case of developing countries. *Journal of Law and Economics*, 55(3):539-564.

Kanwar, S., and Hall, B. H. (2017). The market value of R&D in emerging economies: Evidence from India. *The BE Journal of Economic Analysis & Policy*, 17(1): 1-22.

Kanwar, S. and S. Sperlich. (2020). Innovation, productivity and intellectual property reform in an emerging market economy: Evidence from India. *Empirical Economics*, 59(2):933-950.

Keenan, M., O. Saritas, I. Kroener. (2004). A dying industry – or not? The future of the European textiles and clothing industry. *Foresight* 6 (5), 313-322.

Lancaster, T. (2000). The incidental parameter problem since 1948. *Journal of Econometrics*, 95(2), 391-413.

Larch, M. and Y.V. Yotov. (2016). General equilibrium trade policy analysis with structural gravity. *WTO Working Paper ERSD-2016-08*. Economic Research and Statistics Division. World Trade Organization. Geneva.

Maskus, K. E. (2012). Private rights and public problems: The global economics of intellectual property in the 21st century. Peterson Institute for International Economics. Washington, DC.

Maskus, K. E. and M. Penubarti. (1995). How trade-related are intellectual property rights? *Journal of International Economics*. 39(3-4):227-248.

Maskus, K.E., 1989. Comparing international trade data and product and national characteristics data for the analysis of trade models. In: Hooper, P., Richardson, J.D. (Eds.), *International Economics Transaction: Issues in Measurement and Empirical Research*. University of Chicago Press, Chicago, IL, pp. 17-56.

Melitz, J. (2008). Language and foreign trade. *European Economic Review*, 52(4):667-699.

Melitz, J. and F. Toubal. (2014). Native language, spoken language, translation and trade. *Journal of International Economics*, 93(2):351-363.

Olivero, M. P. and Y.V. Yotov. (2012). Dynamic gravity: Endogenous country size and asset accumulation. *Canadian Journal of Economics*. 45(1):64 - 92.

Park, W. G. (2008). International patent protection: 1960-2005. *Research Policy*, 37(4):761-766.

Park, W.G. and D.C. Lippoldt. (2008). Technology transfer and the economic implications of the strengthening of intellectual property rights in developing countries. *OECD Trade Policy Papers 62*, OECD Publishing.

Psacharopoulos, G. (1994). Returns to investment in education: A global update. *World Development*, 22(9):1325-1343.

Ramsey, J.B. (1969). Tests for specification errors in classical linear least-squares regression analysis. *Journal of the Royal Statistical Society*: Series B (Methodological), 31(2), 350-371.

Rapp, R. T. and Rozek, R. P. (1990). Benefits and costs of intellectual property protection in developing countries. *Journal of World Trade*, 24(1):75-102.

Rafiquzzaman, M. (2002). The impact of patent rights on international trade: Evidence from Canada. *Canadian Journal of Economics*. 35(2):307-330.

Rose, A. K., and E. van Wincoop. (2001). National money as a barrier to international trade: The real case of currency union. *American Economic Review*. 91(2): 386-390.

Silva, J. S. and S. Tenreyro. (2006). The log of gravity. *Review of Economics and*

Statistics. 88(4):641-658.

Santos Silva, J. M. C., & Tenreyro, S. (2022). The log of gravity at 15. *Portuguese Economic Journal*, 1-15

Smith, P. J. (1999). Are weak patent rights a barrier to US exports? *Journal of International Economics*, 48(1):151-177.

Taylor, M. S. (1993). TRIPS, trade, and technology transfer. *Canadian Journal of Economics*, 26(3): 625-637.

UNCOMTRADE (2021). The United Nations Commodity Trade Statistics Database. Available online at - http://comtrade.un.org/.

U.S. Department of Commerce. (2012). Intellectual property and the U.S. economy: Industries in focus. Economics and Statistics Administration and the United States Patent and Trademark Office.

Wei, S.-J. (1996). Intra-national versus international trade: How stubborn are nations in global integration? *NBER Working Paper No. 5531*, Washington, D.C.

Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data.* MIT Press.

Table 1: Descriptive statistics

Variables	*Years*									
	1976	1980	1985	1990	1995	2000	2005	2010	2015	2019
$Real\ imports_t$	137.77 (735.77)	172.34 (981.47)	123.13 (615.62)	162.08 (1079.9)	258.43 (2253.45)	241.09 (3161.55)	361.82 (3821.85)	495.42 (5378.37)	500.99 (5929.91)	532.30 (4647.59)
GP_j	1.261 (0.692)	1.325 (0.722)	1.410 (0.702)	1.573 (0.647)	2.122 (0.766)	2.639 (0.725)	2.977 (0.696)	3.094 (0.690)	3.182 (0.740)	3.246 (0.828)
$MODGP_j$	1.655 (0.697)	1.722 (0.724)	1.820 (0.704)	1.972 (0.659)	2.569 (0.818)	3.098 (0.795)	3.450 (0.763)	3.572 (0.753)	3.649 (0.803)	3.717 (0.880)
$Population_j$	35.772 (121.606)	38.764 (130.365)	42.906 (142.228)	47.480 (156.517)	51.561 (167.805)	55.476 (178.123)	59.295 (187.705)	63.212 (196.951)	67.240 (205.558)	70.459 (211.974)
FTI_j	4.073 (2.165)	3.893 (2.144)	3.922 (2.034)	4.599 (1.791)	5.977 (1.625)	6.584 (1.229)	6.530 (1.245)	6.728 (1.127)	6.662 (1.306)	6.735 (1.386)
$Human\ Capital_j$	1.519 (0.408)	1.579 (0.430)	1.684 (0.457)	1.849 (0.535)	1.965 (0.560)	2.075 (0.582)	2.178 (0.599)	2.271 (0.605)	2.382 (0.611)	2.470 (0.621)
$RGDPNA_j$	127083.5 (243234.8)	150652.3 (301983)	170763.4 (374607.8)	243686.4 (553507.3)	270466.6 (630979.6)	324031.5 (784406.5)	424467.3 (1124409)	559385.5 (1663466)	691701 (2172190)	786984.3 (2468584)
$Population_i$	27.563 (47.103)	28.320 (48.661)	29.222 (50.633)	30.163 (52.669)	31.211 (54.888)	32.251 (57.591)	33.377 (59.816)	34.661 (62.060)	35.610 (64.023)	36.235 (65.354)
$RGDPNA_i$	658681.7 (1273001)	750808.5 (1448876)	857010.7 (1697230)	1024506 (2011851)	1141726 (2262195)	1349223 (2740882)	1503556 (3085645)	1582391 (3215526)	1728412 (3574416)	1871164 (3899745)

Notes: Descriptive statistics refer to untransformed variables. Standard deviations given in parenthesis below the mean. Subscripts i and e denote importer and exporter country, respectively.Imports (‘000 US$ 2012); Population (million); Real GDP at constant national prices (RGDPNA, million US$); Ginarte-Park index (GP); Modified GP index (MODGP); FTI (Trade Openness index); Human Capital (index).

Figure 1: Ginarte-Park and Modified Ginarte-Park indices

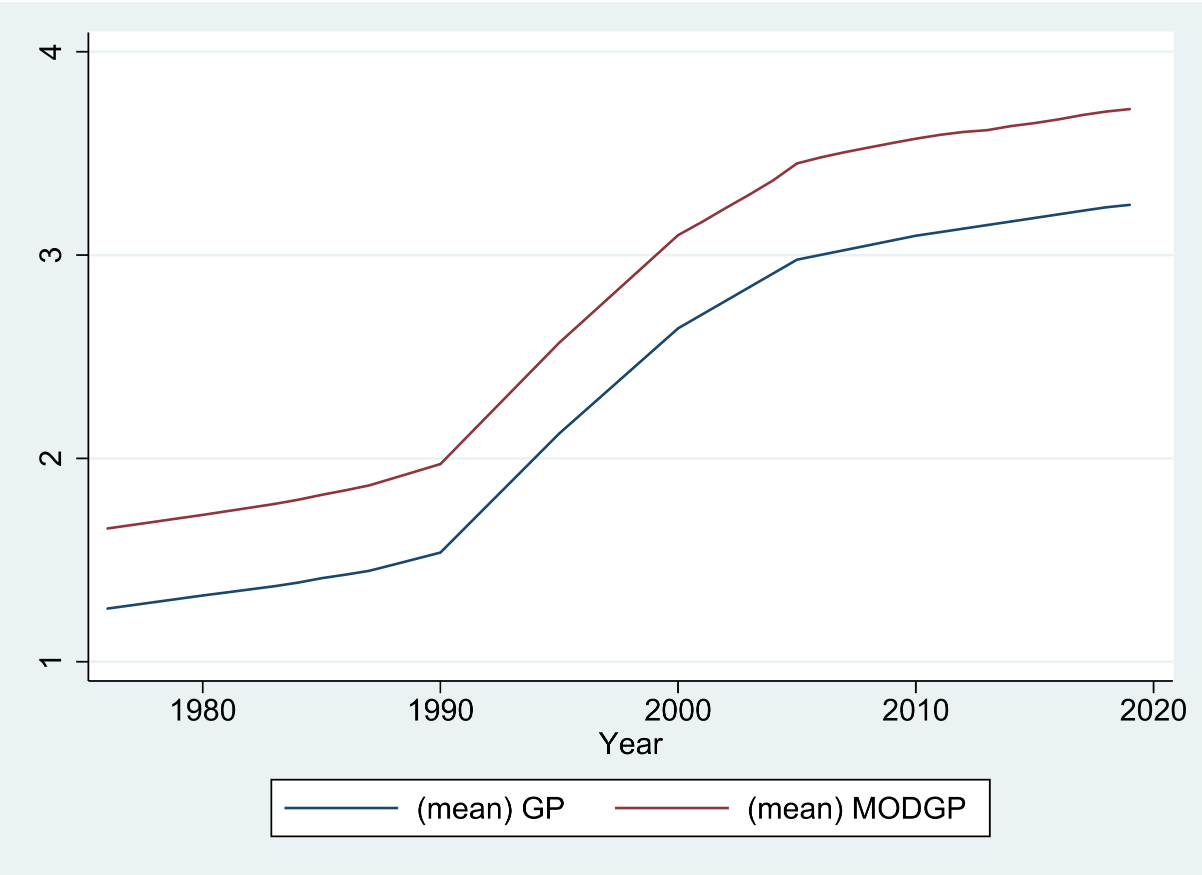

Figure 2: Scatter plot of log(Imports) on log(GP)

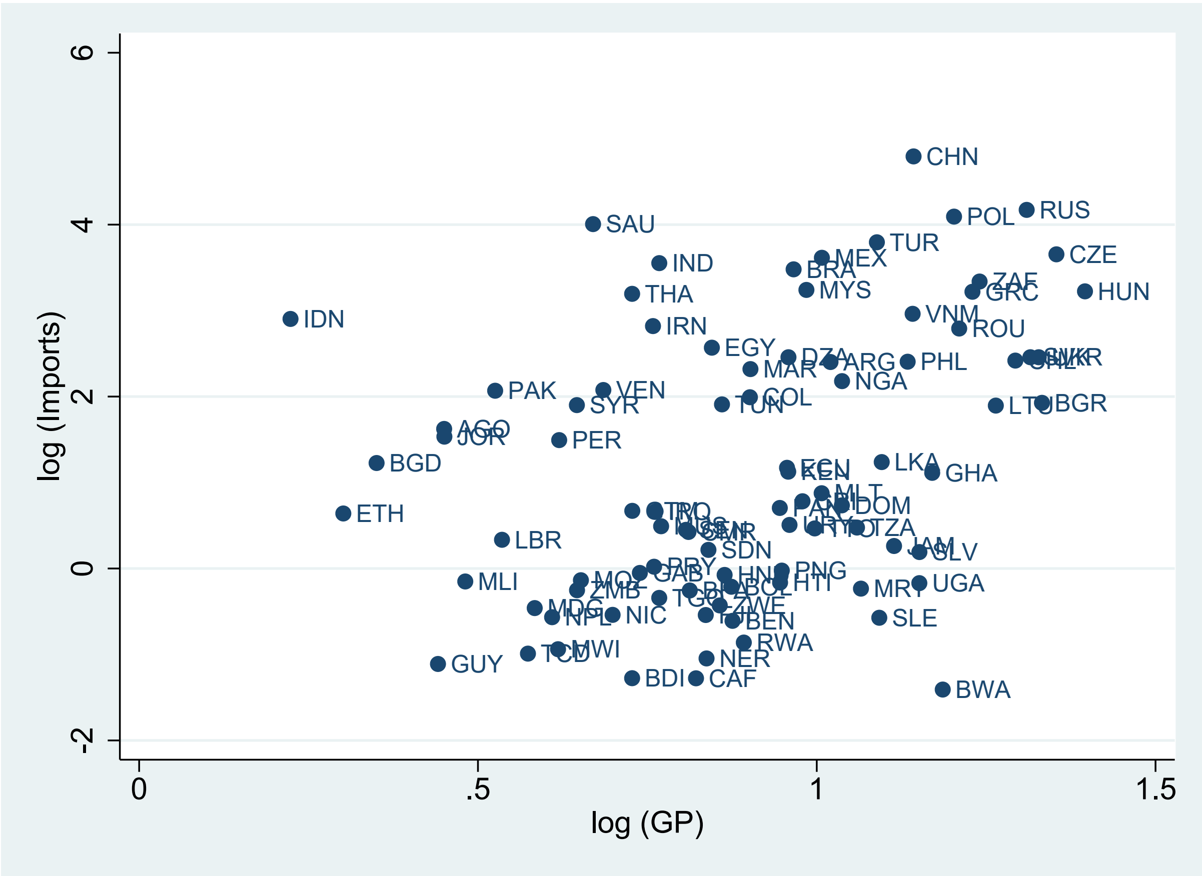

Figure 3: Scatter plot of log(Imports) on log(MODGP)

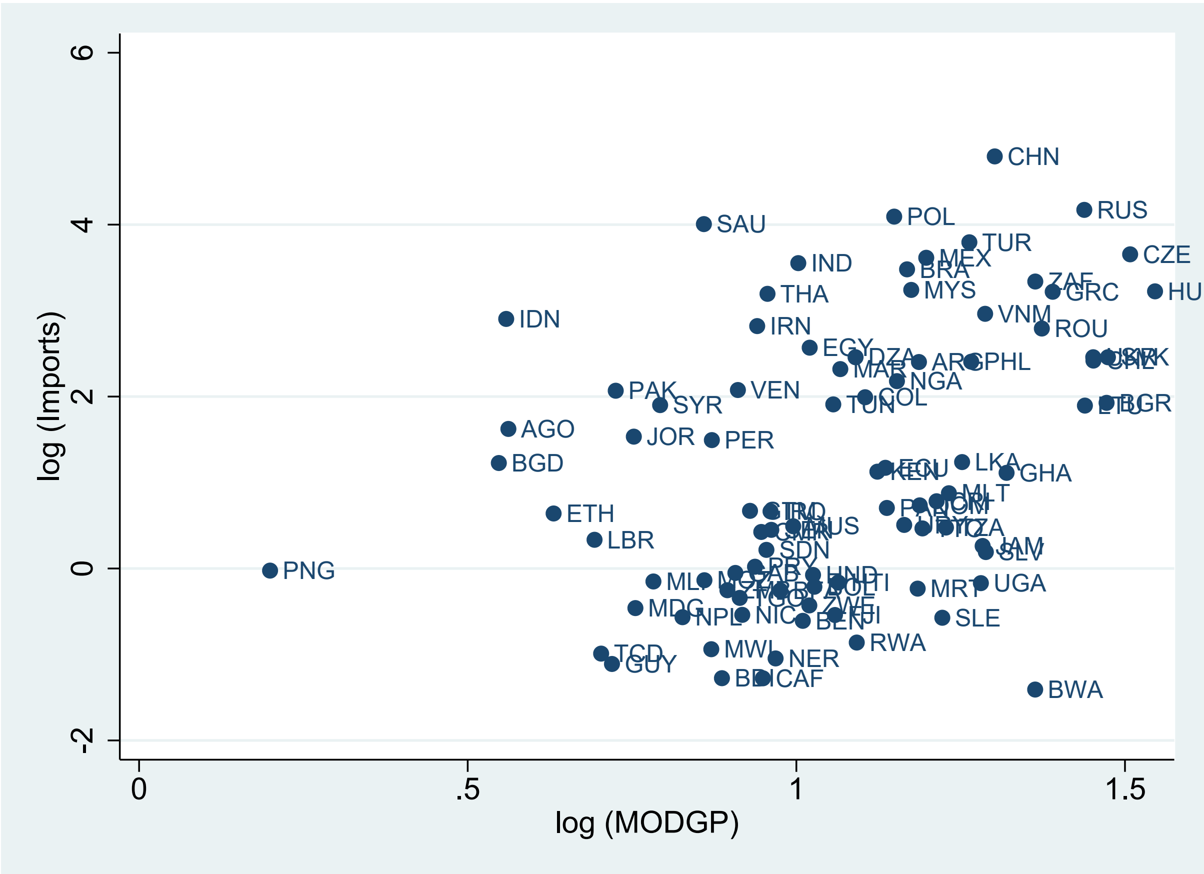

Table 2: Gravity Equation OLS Estimates with multilateral resistance

Sectors	*IPRs measure Ginarte-Park Index: GP*											
	Cons.	*ln GDP*	$\overline{\text{ln GP}}$	$\overline{\text{ln HC}}$	$\overline{\text{ln FTI}}$	$\overline{\text{ln Dist.}}$	$\overline{\text{ln POP}}$	$\overline{\text{Contig.}}$	$\overline{\text{Comlang.}}$	$\overline{\text{Col.}}$	$\overline{\text{Comcol.}}$	*Obs.*
All products	-30.18***	1.062***	0.280***	-2.045***	0.0799*	0.266***	0.0476	2.840***	0.745***	1.030***	1.333***	
	(0.512)	(0.0222)	(0.0419)	(0.194)	(0.0328)	(0.0375)	(0.0972)	(0.630)	(0.139)	(0.219)	(0.261)	410473
Electronics	34.69***	1.054***	0.552***	-2.655***	0.196***	-1.594***	-0.113	-1.218	0.561***	1.359***	0.357	
	(4.147)	(0.0271)	(0.0651)	(0.280)	(0.0481)	(0.112)	(0.127)	(0.832)	(0.141)	(0.220)	(0.320)	60063
Industrial chemicals	33.23***	1.089***	-0.00558	-3.078***	-0.108	-1.755***	0.375**	-1.302*	0.286	1.024***	0.234	
	(3.386)	(0.0310)	(0.0527)	(0.273)	(0.0561)	(0.0802)	(0.144)	(0.529)	(0.151)	(0.211)	(0.260)	59436
Machinery (Ne)	28.73***	1.175***	0.229***	-3.109***	0.194***	-1.574***	0.313**	-1.036	0.559***	1.146***	0.589	
	(4.078)	(0.0247)	(0.0528)	(0.239)	(0.0463)	(0.104)	(0.121)	(0.640)	(0.133)	(0.206)	(0.305)	62893
Other chemicals	21.38***	1.095***	0.256***	-0.855***	0.0294	-1.422***	0.0108	-0.637	0.474**	1.139***	0.772**	
	(3.768)	(0.0288)	(0.0519)	(0.255)	(0.0443)	(0.102)	(0.120)	(0.664)	(0.161)	(0.244)	(0.296)	59082
Professional goods	22.78***	1.205***	0.225***	-2.093***	0.104**	-1.403***	0.0603	-0.714	0.409**	1.304***	1.137***	
	(3.796)	(0.0234)	(0.0503)	(0.217)	(0.0369)	(0.102)	(0.0976)	(0.673)	(0.141)	(0.221)	(0.298)	62134
Pharmaceuticals	19.10***	0.986***	0.321***	0.589*	0.0181	-1.249***	-0.538***	-1.005	0.458*	1.473***	1.139**	
	(3.691)	(0.0310)	(0.0576)	(0.288)	(0.0468)	(0.116)	(0.131)	(0.830)	(0.179)	(0.254)	(0.373)	53266
Rubber Manufactures	38.60***	0.984***	0.443***	-2.200***	0.0456	-1.582***	-0.803***	-0.453	0.440**	0.964***	0.434	
	(3.492)	(0.0323)	(0.0606)	(0.303)	(0.0448)	(0.103)	(0.149)	(0.732)	(0.164)	(0.247)	(0.300)	53599

Notes:The dependent variable is log of real imports. Variables ln(GDP) and ln(POP) denote the log product of real GDP and population for countries i and j respectively. Figures in parenthesis are cluster robust standard errors. The *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ denote statistical significance at 1%, 5% and 10% levels respectively.

Table 3: Gravity Equation OLS Estimates with multilateral resistance

Sectors	IPRs measure Modified Ginarte-Park Index : MODGP											
	Cons.	*ln GDP*	$\overline{ln\ MODGP}$	$\overline{ln\ HC}$	$\overline{ln\ FTI}$	$\overline{ln\ Dist.}$	$\overline{ln\ POP}$	$\overline{Contig.}$	$\overline{Comlang.}$	$\overline{Col.}$	$\overline{Comcol.}$	*Obs.*
All products	-29.72***	1.050***	0.501***	-2.217***	0.0912**	0.261***	0.0138	2.841***	0.747***	1.033***	1.333***	
	(0.520)	(0.0223)	(0.0569)	(0.194)	(0.0318)	(0.0376)	(0.0984)	(0.633)	(0.139)	(0.219)	(0.262)	411112
Electronics	35.02***	1.039***	0.909***	-2.926***	0.206***	-1.600***	-0.157	-1.216	0.562***	1.363***	0.355	
	(4.165)	(0.0274)	(0.0841)	(0.278)	(0.0464)	(0.112)	(0.129)	(0.836)	(0.141)	(0.219)	(0.321)	60145
Industrial chemicals	34.11***	1.080***	0.152	-3.261***	-0.0729	-1.759***	0.332*	-1.298*	0.288	1.029***	0.232	
	(3.407)	(0.0310)	(0.0784)	(0.275)	(0.0548)	(0.0805)	(0.146)	(0.530)	(0.152)	(0.211)	(0.261)	59543
Machinery (Ne)	29.46***	1.160***	0.489***	-3.345***	0.233***	-1.579***	0.264*	-1.048	0.560***	1.147***	0.586	
	(4.103)	(0.0251)	(0.0778)	(0.242)	(0.0464)	(0.105)	(0.123)	(0.642)	(0.134)	(0.205)	(0.306)	62980
Other chemicals	21.52***	1.088***	0.410***	-0.958***	0.0288	-1.424***	-0.0100	-0.626	0.475**	1.141***	0.774**	
	(3.766)	(0.0289)	(0.0661)	(0.255)	(0.0425)	(0.102)	(0.120)	(0.665)	(0.161)	(0.244)	(0.296)	59184
Professional goods	23.44***	1.191***	0.463***	-2.294***	0.128***	-1.408***	0.0168	-0.712	0.410**	1.304***	1.136***	
	(3.814)	(0.0236)	(0.0706)	(0.219)	(0.0363)	(0.102)	(0.0992)	(0.678)	(0.141)	(0.220)	(0.298)	62232
Pharmaceuticals	18.97***	0.981***	0.459***	0.516	0.00754	-1.248***	-0.549***	-0.997	0.459*	1.475***	1.143**	
	(3.681)	(0.0310)	(0.0723)	(0.289)	(0.0451)	(0.116)	(0.130)	(0.829)	(0.179)	(0.253)	(0.372)	53352
Rubber Manufactures	38.66***	0.976***	0.660***	-2.330***	0.0260	-1.588***	-0.817***	-0.458	0.441**	0.966***	0.433	
	(3.494)	(0.0323)	(0.0724)	(0.301)	(0.0423)	(0.103)	(0.150)	(0.732)	(0.164)	(0.246)	(0.300)	53676

Notes: Dependent variable is log of real imports. Variables ln(GDP) and ln(POP) denote the log product of real GDP and population for countries i and j, respectively. Figures in parenthesis are cluster robust standard errors. Superscripts ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 4: Gravity Equation OLS Estimates with multilateral resistance
Dependent Variable: Ln(Q), where Q is import quantity(KG's)

Sectors	*IPRs measure Modified Ginarte-Park Index : MODGP*											
	Cons.	*ln GDP*	$\overline{ln\ MODGP}$	$\overline{ln\ HC}$	$\overline{ln\ FTI}$	$\overline{ln\ Dist.}$	$\overline{ln\ POP}$	$\overline{Contig.}$	$\overline{Comlang.}$	$\overline{Col.}$	$\overline{Comcol.}$	*Obs.*
Electronics	43.20***	1.051***	0.574***	-2.267***	0.310***	-1.809***	0.0997	-1.237	0.690***	1.342***	0.287	
	(4.272)	(0.0280)	(0.104)	(0.351)	(0.0682)	(0.111)	(0.144)	(0.880)	(0.161)	(0.249)	(0.341)	57598
Industrial chemicals	55.30***	1.160***	0.234*	-4.246***	0.0867	-2.216***	0.499**	-1.982**	0.247	1.199***	0.436	
	(3.888)	(0.0348)	(0.0921)	(0.323)	(0.0590)	(0.0927)	(0.163)	(0.634)	(0.191)	(0.250)	(0.310)	58608
Machinery (Ne)	35.44***	1.264***	0.220*	-2.131***	0.581***	-1.731***	0.291*	-0.814	0.648***	1.112***	0.552	
	(4.313)	(0.0255)	(0.0907)	(0.306)	(0.0648)	(0.106)	(0.146)	(0.671)	(0.148)	(0.240)	(0.326)	61318
Other chemicals	45.29***	1.085***	0.444***	-2.106***	0.132*	-1.939***	0.184	-1.032	0.652***	1.033***	0.809**	
	(3.821)	(0.0293)	(0.0764)	(0.272)	(0.0514)	(0.101)	(0.130)	(0.715)	(0.173)	(0.265)	(0.293)	57971
Professional goods	37.32***	1.169***	0.219**	-1.418***	0.191***	-1.686***	0.126	-0.591	0.491**	1.182***	1.104***	
	(3.810)	(0.0235)	(0.0754)	(0.259)	(0.0479)	(0.100)	(0.110)	(0.678)	(0.151)	(0.239)	(0.295)	60732
Pharmaceuticals	36.43***	0.843***	0.174*	1.339***	-0.147*	-1.618***	-0.366**	-1.459	0.610***	1.413***	1.426***	
	(3.738)	(0.0306)	(0.0871)	(0.344)	(0.0717)	(0.115)	(0.142)	(0.927)	(0.175)	(0.289)	(0.366)	50892
Rubber Manufactures	52.99***	1.056***	0.753***	-1.658***	0.0804	-1.861***	-0.902***	-0.757	0.571**	1.086***	0.570	
	(4.020)	(0.0372)	(0.0963)	(0.380)	(0.0654)	(0.118)	(0.173)	(0.769)	(0.198)	(0.280)	(0.350)	52067

Notes: Dependent variable is log of import quantity measures as net weight in KG's. Variables ln(GDP) and ln(POP) denote the log product of real GDP and population for countries i and j, respectively. Figures in parenthesis are cluster robust standard errors. Superscripts ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 5: Gravity Equation OLS Estimates with multilateral resistance
Dependent Variable: Ln(P), where P is imputed import prices

Sectors	*IPRs measure Modified Ginarte-Park Index : MODGP*											
	Cons.	*ln GDP*	$\overline{ln\ MODGP}$	$\overline{ln\ HC}$	$\overline{ln\ FTI}$	$\overline{ln\ Dist.}$	$\overline{ln\ POP}$	$\overline{Contig.}$	$\overline{Comlang.}$	$\overline{Col.}$	$\overline{Comcol.}$	*Obs.*
Electronics	-23.43***	0.00925	0.290***	-1.274***	0.297***	0.166***	0.556***	0.120	-0.00795	-0.220*	-0.0442	
	(1.849)	(0.0111)	(0.0672)	(0.213)	(0.0551)	(0.0410)	(0.0838)	(0.433)	(0.0740)	(0.111)	(0.138)	58472
Industrial chemicals	-28.63***	0.135***	-0.205**	1.299***	-0.0317	0.607***	-0.203*	0.599	0.0500	0.0226	-0.0857	
	(2.076)	(0.0193)	(0.0698)	(0.237)	(0.0459)	(0.0588)	(0.0888)	(0.346)	(0.111)	(0.152)	(0.188)	53674
Machinery (Ne)	-23.69***	0.390***	1.381***	2.203***	0.144	-0.0658	-0.0898	-0.131	0.0110	-0.132	0.111	
	(3.341)	(0.0195)	(0.114)	(0.391)	(0.0879)	(0.0751)	(0.141)	(0.522)	(0.128)	(0.214)	(0.197)	59981
Other chemicals	-22.64***	-0.0370**	-0.0691	1.248***	-0.0949***	0.353***	0.0494	0.248	-0.0653	0.0116	-0.0401	
	(1.379)	(0.0114)	(0.0370)	(0.146)	(0.0259)	(0.0363)	(0.0571)	(0.225)	(0.0710)	(0.0818)	(0.131)	56412
Professional goods	-12.88***	-0.0460**	-0.0451	-1.762***	0.298***	0.223***	0.164	-0.218	-0.0768	-0.0615	0.226	
	(2.007)	(0.0162)	(0.0600)	(0.239)	(0.0402)	(0.0499)	(0.0991)	(0.333)	(0.120)	(0.149)	(0.211)	52806
Pharmaceuticals	-25.56***	0.172***	0.0615	0.305	0.190***	0.395***	0.0729	0.483	-0.159	-0.108	-0.228	
	(2.044)	(0.0145)	(0.0645)	(0.265)	(0.0517)	(0.0568)	(0.0942)	(0.323)	(0.0936)	(0.162)	(0.164)	50936
Rubber Manufactures	-22.88***	-0.00562	0.0492	0.944***	-0.0624	0.204***	0.383***	-0.100	0.0293	-0.228**	0.0283	
	(1.269)	(0.0105)	(0.0546)	(0.165)	(0.0444)	(0.0321)	(0.0669)	(0.223)	(0.0639)	(0.0842)	(0.114)	52363

Notes: Dependent variable is log of real imputed import prices, ln(GDP) and ln(POP) denote the log product of real GDP and population for countries i and j, respectively. Figures in parenthesis are cluster robust standard errors. Superscripts ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 6: Gravity Equation OLS Estimates with multilateral resistance proxied by remoteness indices

Sectors	*IPRs measure Modified Ginarte-Park index: MODGP*													
	Cons.	*ln GDP*	*ln MODGP*	*ln HC*	*ln FTI*	*ln Dist.*	*ln POP*	*Contig.*	*Comlang.*	*Col.*	*Comcol.*	*ln* REM_i	*ln* REM_j	*Obs.*
All products	-13.60***	0.994***	0.371***	-1.713***	0.0656*	-1.269***	-0.0347	-0.767	0.155	1.649***	-0.314	0.00196	0.145***	
	(0.911)	(0.0401)	(0.0577)	(0.153)	(0.0318)	(0.0522)	(0.0495)	(0.599)	(0.108)	(0.177)	(0.203)	(0.0242)	(0.0257)	411112
Electronics	-12.32***	0.818***	0.647***	-2.267***	0.147**	-1.262***	0.0936	-0.0660	0.172	1.497***	-0.284	0.105**	0.160***	
	(1.283)	(0.0521)	(0.0842)	(0.208)	(0.0464)	(0.0658)	(0.0573)	(0.807)	(0.129)	(0.202)	(0.277)	(0.0332)	(0.0380)	60145
Industrial chemicals	-6.345***	0.931***	0.174*	-1.274***	-0.0320	-1.248***	0.257***	-0.284	0.136	1.109***	-0.0373	-0.167***	0.00204	
	(1.366)	(0.0597)	(0.0805)	(0.211)	(0.0558)	(0.0570)	(0.0703)	(0.497)	(0.136)	(0.198)	(0.274)	(0.0370)	(0.0387)	59543
Machinery (Ne)	-16.83***	1.045***	0.259***	-2.376***	0.184***	-1.316***	0.0675	-0.622	0.407***	1.192***	-0.477	0.0594	0.248***	
	(1.104)	(0.0492)	(0.0776)	(0.185)	(0.0466)	(0.0587)	(0.0586)	(0.561)	(0.122)	(0.185)	(0.252)	(0.0312)	(0.0333)	62980
Other chemicals	-14.72***	1.130***	0.289***	-0.735***	0.0139	-1.399***	-0.157*	-1.745***	0.287*	1.934***	-0.124	0.00346	0.107**	
	(1.186)	(0.0532)	(0.0679)	(0.205)	(0.0427)	(0.0554)	(0.0616)	(0.521)	(0.126)	(0.189)	(0.225)	(0.0328)	(0.0356)	59184
Professional goods	-19.17***	1.154***	0.285***	-1.644***	0.113**	-1.218***	-0.0648	-1.022	0.350**	1.391***	-0.236	-0.0427	0.244***	
	(1.049)	(0.0444)	(0.0708)	(0.176)	(0.0369)	(0.0588)	(0.0517)	(0.578)	(0.115)	(0.184)	(0.234)	(0.0292)	(0.0331)	62232
Pharmaceuticals	-13.67***	1.026***	0.320***	-0.144	-0.00840	-1.288***	-0.272***	-2.184**	-0.0266	2.515***	-0.618*	-0.0159	0.140***	
	(1.320)	(0.0568)	(0.0740)	(0.219)	(0.0450)	(0.0651)	(0.0636)	(0.746)	(0.136)	(0.198)	(0.250)	(0.0307)	(0.0385)	53352
Rubber Manufactures	-8.840***	0.819***	0.527***	-2.375***	0.0397	-1.089***	-0.0587	0.337	-0.119	1.778***	-0.365	-0.0948**	0.100*	
	(1.419)	(0.0585)	(0.0762)	(0.226)	(0.0432)	(0.0698)	(0.0631)	(0.661)	(0.138)	(0.217)	(0.266)	(0.0352)	(0.0394)	53676

Notes: Dependent variable is log of real imports. Variables ln(GDP) and ln(POP) denote log product of real GDP and population for countries i and j, respectively. Figures in parenthesis are cluster robust standard errors. Superscripts ***, **, and * denote statistical significance at 1%, 5% and 10% levels, respectively.

Table 7: Gravity Equation – Fixed Effects Estimates

Sectors	IPRs measure Modified Ginarte-Park index: MODGP							
	Cons.	*ln GDP*	*ln MODGP*	*ln HC*	*ln FTI*	*ln POP*	*Year FE's*	*Obs.*
All products	-25.74***	1.136***	0.571***	-1.030***	0.0998**	-0.0946		
	(1.272)	(0.0520)	(0.0656)	(0.228)	(0.0340)	(0.115)	Yes	411112
Electronics	-26.58***	1.175***	0.842***	-1.246***	0.110*	-0.0920		
	(1.910)	(0.0775)	(0.0994)	(0.350)	(0.0498)	(0.144)	Yes	60145
Industrial chemicals	-32.40***	1.264***	0.583***	-0.664*	0.0625	0.479**		
	(1.835)	(0.0790)	(0.0900)	(0.323)	(0.0583)	(0.155)	Yes	59543
Machinery (Ne)	-32.95***	1.377***	0.545***	-1.550***	0.224***	0.334*		
	(1.586)	(0.0671)	(0.0903)	(0.293)	(0.0501)	(0.135)	Yes	62980
Other chemicals	-23.07***	1.071***	0.416***	-0.833**	0.0585	-0.158		
	(1.677)	(0.0695)	(0.0754)	(0.313)	(0.0455)	(0.137)	Yes	59184
Professional goods	-30.43***	1.296***	0.550***	-1.219***	0.170***	-0.0181		
	(1.443)	(0.0599)	(0.0807)	(0.269)	(0.0388)	(0.110)	Yes	62232
Pharmaceuticals	-12.64***	0.799***	0.347***	-0.177	-0.00938	-0.870***		
	(1.901)	(0.0770)	(0.0840)	(0.348)	(0.0479)	(0.153)	Yes	53352
Rubber manufactures	-16.47***	0.858***	0.711***	-1.085**	0.0488	-0.836***		
	(2.046)	(0.0816)	(0.0854)	(0.369)	(0.0448)	(0.170)	Yes	53676

Notes: Dependent variable is log of real imports. Variables ln(GDP) and ln(POP) denote log product of real GDP and population for countries i and j, respectively. Figures in parenthesis are cluster robust standard errors. Superscripts ***, **, and * denote statistical significance at 1%, 5% and 10% levels, respectively. The fixed effects estimation absorbs the time-invariant variables like contiguity; common language; colony; common colony and distance.

Table 8: Gravity Equation Estimates: Poisson Pseudo-Maximum Likelihood High-Dimensional Fixed Effects

Sectors	*IPRs measure-Modified Ginarte-Park index: MODGP*														
	Cons.	*ln GDP*	*ln MODGP*	*ln HC*	*ln FTI*	*ln Dist.*	*ln POP*	*Contig.*	*Comlang.*	*Col.*	*Comcol.*	*Time FE's*	*Exporter FE's*	*Importer FE's*	*Obs.*
All products	-3.850	1.050***	0.313	-0.730*	0.222**	-0.891***	-1.202***	-0.315**	0.339***	0.418***	-0.773*	Yes	Yes	Yes	411115
	(2.333)	(0.0764)	(0.167)	(0.324)	(0.0793)	(0.0361)	(0.185)	(0.117)	(0.0848)	(0.100)	(0.368)				
Electronics	-6.410	1.404***	0.644**	-1.205	0.211	-0.815***	-1.995***	-0.165	0.440**	0.513***	-1.106***	Yes	Yes	Yes	60145
	(4.101)	(0.133)	(0.244)	(0.866)	(0.113)	(0.0456)	(0.314)	(0.174)	(0.138)	(0.155)	(0.322)				
Industrial chemicals	-6.852*	0.921***	0.249	-0.502	0.314**	-1.057***	-0.317	-0.253	0.226	0.355**	-0.679	Yes	Yes	Yes	59544
	(2.798)	(0.0996)	(0.137)	(0.450)	(0.0999)	(0.0462)	(0.193)	(0.146)	(0.128)	(0.114)	(0.514)				
Machinery (Ne)	-1.752	0.948***	0.217	-0.991**	0.317***	-0.845***	-1.029***	-0.258*	0.366***	0.405***	-0.663	Yes	Yes	Yes	62980
	(2.313)	(0.0810)	(0.163)	(0.316)	(0.0768)	(0.0475)	(0.200)	(0.123)	(0.0979)	(0.110)	(0.391)				
Other chemicals	-5.483*	1.121***	0.414***	-0.343	-0.0249	-0.948***	-1.352***	-0.555***	0.288**	0.463***	-0.677	Yes	Yes	Yes	59184
	(2.245)	(0.0982)	(0.113)	(0.297)	(0.0608)	(0.0433)	(0.222)	(0.122)	(0.107)	(0.0967)	(0.388)				
Professional goods	-13.00***	1.363***	0.394	-1.257*	0.280*	-0.841***	-1.205***	-0.518**	0.372***	0.483***	-0.0521	Yes	Yes	Yes	62233
	(2.624)	(0.0869)	(0.206)	(0.517)	(0.111)	(0.0597)	(0.207)	(0.160)	(0.0873)	(0.135)	(0.283)				
Pharmaceuticals	-7.895*	1.199***	0.464***	-0.351	-0.207***	-0.637***	-1.686***	-0.538**	0.260*	0.573***	-0.355	Yes	Yes	Yes	53353
	(3.108)	(0.151)	(0.127)	(0.378)	(0.0608)	(0.0614)	(0.282)	(0.170)	(0.133)	(0.136)	(0.405)				
Rubber Manufactures	0.424	0.903***	0.580***	-1.592***	0.0692	-0.869***	-1.398***	0.387*	0.245*	0.154	-0.853	Yes	Yes	Yes	53676
	(3.030)	(0.100)	(0.124)	(0.416)	(0.0876)	(0.0820)	(0.243)	(0.177)	(0.123)	(0.156)	(0.506)				

Notes: Dependent variable is real imports in levels (untransformed). Variables ln(GDP) and ln(POP) denote log product of real GDP and population for countries i and j, respectively. Figures in parenthesis are cluster robust standard errors. Superscripts ***, **, and * denote statistical significance at 1%, 5% and 10% levels, respectively.