Institutional setting and networks effect on international trade.
Three essays in international trade.

A dissertation presented by

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To my family

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Introduction

The aim of this thesis is exploring the role of different measures of proximity on some topics related to international trade. Nowadays, new technologies permit to collect many data on relationships while technical improvements, as spatial econometrics, MCMC, network analysis, latent class and simulation models, allow us to analyze them. Complexity is attracting growing interest among scholars, in an attempt to develop and estimate models better suited to the reality. Non-homothetic utilities and network models are heading in such a direction.

After years of globalization and markets integration, we are seeing an increasing number of popular protest movements claiming for autonomy and independence, both at regional and national level. Political efforts to create global structures or deals are rejected by most of the population, when large differences (cultural, behavioral or financial) with other people are perceived. In this framework, to understand the role of proximity is crucial to build acceptable economic policies and to guarantee an efficient and persistent economic and social integration. From a policy perspective, to reduce the various form of distance considering differences among people or institutions is essential to achieve lasting political solutions.

With this thesis, we shed light on some effects of proximity on trade. We focus on how institutional setting (institutional proximity) and network structure (declined in cognitive and social proximity) influence the geography of international trade. In the last decade, heterogeneous effects have been discovered in many fields of international economics; scholars have introduced social setting and, in recent years, network effects to explain observed economic phenomena that can not be modelled in a classical and homogeneous framework. La Porta, Lopez-de Silanes, Shleifer and Vishny (LLSV, 1997, 1998) are among the first to provide evidence on how the social contest (measured by the legal origin system) affects many economic outputs. Impacts range from labor markets (Botero et al., 2004) to financial system (La Porta et al., 2002) and trade output (Nunn, 2007). More recently, a nascent literature on the role that social networks play in international trade and macroeconomics has emerged. Acemoglu et al. (2016) provide fresh evidence about the role of input-output and geographic networks on the propagation of macroeconomic shocks. Calvò-Armengol and Jackson (2007) show that both wages and employment are influenced by agents' network. Combes, Lafourcade and Mayer (2005) reveal how social and business networks facilitate trade between regions and Chaney (2014), modelling the trade patterns as an international network, introduces social interactions in a dynamic trade model.

The contribution of this work is threefold: 1) to solve an open question referring to an ambiguous effect on trade, originating from legal families, 2) to find new evidences of network effects on the currency denomination of trade, in a bargaining framework 3) to propose a new gravity model of trade, adding to the Chaney (2008) model of trade with heterogeneous firms spatially correlated preferences, to explain network evidence found by previous scholars.

This thesis collects three original empirical articles, which are presented as separate chapters:

- The Olympic effect: legal families matter (joint work with professor Rico Maggi, to be submitted to a journal of applied economics);
- Network position and the currency denomination of trade (joint work with professors Mark David Witte and Luigi Ventura, to be submitted to the Journal of International Money and Finance);
- Spatially correlated preferences in international trade (single authored article, to be submitted to a journal of international economics).

In the first chapter, co-authored with professor Rico Maggi, we contribute to the debate on the effect of the Olympic Games on trade in several ways. Supporters of mega-events state that hosting a mega-event influences national reputation, increasing tourism and gaining exposure on the international stage. For instance, Preuss (2004) argues the Seoul Olympic Games in 1988 were designed to raise international awareness of Korean manufactured goods, to promote Korean exports. Rose and Spiegel (2011) find a significant, positive and large permanent effect (an increase of about 35%) on exports for countries bidding for or hosting a Summer Olympic. The effect is shown to be similar for World Cup hosting countries and for the Summer Olympic Games unsuccessful bidders. According to Rose and Spiegel (2011), exports' increase is attributable to liberalization policies pursued by countries after the bidding. These countries, bidding for a Summer Olympic, anticipate to the world their intention to liberalize; bidding is therefore a "burning money policy[1]" that signals to private investors the future intents of the country. Other economists have expressed skepticism about the advantage to host a mega-event, because the large costs of the events seem not to be compensated by subsequent revenues. Siegfried and Zimbalist (2000) and Coates and Humphreys (2003) assert that the projects related to mega-events are comparable to "white elephants[2]" and any benefits derived from infrastructure

[1] The signal is informative because sending the signal is only attractive to the set of countries that sincerely intend to pursue liberalizations; only countries that in the future will be in good fiscal condition are supposed to send this kind of signal.
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investments may be achieved independently of the games.

Bista (2017) questions the robustness of the Rose and Spiegel (2011) Olympic effect. Implementing a different estimation technique, such as the Poisson Pseudo Maximum Likelihood (PPML) estimator, in order to control for the presence of zero trade flows and for the heteroskedasticity bias[3] in the log-linearization of the gravity equation (Santos Silva and Tenreyro, 2006), find no robust positive effects on exports. The results of Bista (2011, 2017) suggest that some heterogeneity of the Olympic effect may be at play, given that different estimation techniques provide different results. The impact on exports could depend on some characteristics of the countries and considering all the bidding or hosting countries as a whole potentially conceals the real outcome.

In this chapter, we extend the results of Rose and Spiegel (2011) and the findings by Bista (2017) proposing a source of heterogeneity for the Olympic effect: the institutional channel. Following a large body of literature started with La Porta, Lopez-de Silanes, Shleifer and Vishny (LLSV, 1997, 1998), we identify in the legal origin system the source of this heterogeneity. We show that the standard errors estimated by Rose and Spiegel (2011) for the Olympic effect are strongly downward biased and we propose a tri-way clustering method in order to correctly account for the error correlation structure. We prove that the Olympic effect is only a member of the broader Mega-events effect and that some identification issues arise trying to identify different permanent effects on exports for each kind of Mega-event. After countries bid for a Mega-event, we observe growing exports only for civil law countries, where governments pervasively influence economy and capital allocation, while in common law countries, where the legal system provides "a priori" a more efficient regulatory framework for the private sector, exports are not affected by the biddings. The positive effect of civil law countries is then confirmed using the Colombia world cup withdrawal and Copa América assignation as exogenous shocks. Investigating the source of this heterogeneity, we find different liberalization behaviors among legal families after bidding for the event. Common law countries, having ex-ante lower trade tariffs than civil law countries, primarily liberalize capital controls that affect negatively trade, whereas civil law countries substantially reduce trade tariffs, strengthening international trade.

[3] As Santos Silva and Tenreyro (2006) state, log-linearization of an exponential model in the presence of heteroskedasticity leads to inconsistent estimates. This is because the expected value of the logarithm of a random variable depends on higher-order moments of its distribution. Therefore, if the errors are heteroskedastic, the transformed errors will be generally correlated with the covariates.

In the second chapter, co-authored with professors Mark David Witte and Luigi Ventura, we apply a new index of bargaining power in communications network to the choice of invoicing currency. Our bargaining index is derived implementing the Calvo-Aremngol (2001) index in a weighted and directed network.

Our aim is to understand whether the exporter and importer's sector bargaining powers (defined by the relative trade positions in the network of communications) have a role in the currency choice. As in Calvo-Armengol (2001), the bargaining power measure determines how the place of a player in the network affects her bargaining strength relative to the others, and thus captures the asymmetries induced by the communication structure that restricts pairwise meetings. We propose a model where the importer and exporter bargain for the invoicing currency with outside options. The equilibrium solution is a mixed strategy based on the Kalai and Smorodinsky (1975) solution. Importer and exporter's outside options are proxied by our network bargaining power measures that express the probability to be selected as a player in the trade network. With this work, we contribute to the strand of literature that underlines the role of strategic interaction among firms in the invoicing currency decision, started by Bacchetta and Van Wincoop (2005). These two authors show how the level of competition faced by firms in the foreign market, as reflected by market share and product differentiation, has direct implications in the choice of the invoicing currency. In the Bacchetta and Van Wincoop (2005) general equilibrium model, the producer sets univocally the invoicing currency in the producer (exporting) or local (importing) currency, based on its profit maximization[4]. Other authors subsequently broaden the strategic interaction to the consumers' side. In an empirical work on a set of Swedish firms, Friberg and Wilander (2008) add new elements to the currency invoicing literature. In their study, they focus on the process of negotiation between the customer and the producer, discovering that negotiations are important for both the price and currency choice. Goldberg and Tille (2013) propose a theoretical model in which individual exporters and importers bargain over the transaction price and ensuing exposure to exchange rate fluctuations. One of their main conclusions is that both price and invoicing currency are influenced by the full market structure, including the level of fragmentation and heterogeneity across importers and exporters. In an analysis of Canadian import transactions, Goldberg and Tille (2016) confirm empirically that importer concentration and transaction size are important determinants of the currency denomination choice. Devereux et al. (2017) introducing market share on both sides of the trading relationship, develop a new

[4] One of their main findings was that higher exporter market shares and trading differentiated goods increase the likelihood of PCP.

model of trade pricing where pass-through of exchange rates to import prices and the choice of currency invoicing depend on the market structure. They discover a U-shaped relationship between exporter market share and the probability to price in the destination market currency and a positive relationship between importer market share and invoicing in the importer currency. We add to this literature by showing that the currency determination is a complex process where both importer and exporter network characteristics play a role. In doing so, we move well beyond the simple use of the sector market share as we consider the asymmetric structure of trade with the other trading partners as a proxy for the communication structure.

The contribution of this work is relevant, given that the invoicing currency has been shown by many scholars to play a critical role in the new open economy macroeconomics literature. For example, the exchange rate volatility (Devereux and Engel, 2002) and the impact of the exchange rate on the economy are influenced by the currency denomination of trade (Engel, 1999, Chari et al. 2002, Devereux and Engel, 2003, Engel, 2003, and Obstfeld, 2002). Invoicing in the producer (PCP) or importer (LCP) currency influences the pass-through of exchange rate changes to the import price. As a result, see Corsetti and Pesenti (2005), the optimal monetary policy is different based on the degree of pass-through[5], and thus on the invoicing regime. Connections with foreign markets and multiple customers should be therefore a crucial element of the foreign policy.

With highly disaggregated Italian export and import customs data for the year 2010, we document a significant impact on the invoicing currency decision of our bargaining power index. Importers (exporters) with greater bargaining power tend to price their traded goods in the local (producer) currencies. The result is robust to the inclusion of geographical characteristics and many other control variables, as sectoral market shares. As discussed in the literature, the invoicing currency decision seems to depend not only on the characteristics of the exporter, but also on the importer's features (particularly its other supply options). These empirical findings support the existence of some bargaining process for the currency denomination of trade, as proposed in our model.

In the third chapter of this thesis (single-authored), I incorporate the empirical evidence of "extended gravity" and spatial exporter effects into the gravity model of trade with heterogeneous firms

[5] If all the exporting firms use PCP then the Corsetti and Pesenti (2005) model simplifies into a dynamic version of Obstfeld and Rogoff (2000) model and the optimal monetary policy replicates the flexible-price equilibrium while if the price is set in the local (importer) currency then the national welfare is maximized when exporters' revenues are stabilized in their own currencies and a fixed exchange rate is preferred.

developed by Chaney (2008). Introducing country pairs and spatially correlated preferences in the consumers' utility, I explain most of the network effects found by previous scholars.

The dynamic of firms' exports have received a great deal of attention in recent years. Das et al. (2007), modelling firms' exporting decision with sunk entry costs and plant level heterogeneity in export profits on a set of Colombian industries, find that entry costs are substantial and producers do not begin to export unless the present value of their expected future export profit stream is large. Eaton et al. (2008), using transaction level data, observe that many Colombian firms enter foreign markets every year, selling small quantities to a single neighbour country, and almost half of them cease to export in the following year. The firms who survive expand their presence in the exporting market and a sizeable fraction of them expands to other markets, depending on the initial foreign market. The empirical findings of Eaton et al. (2008), where many firms are jumping into and out of foreign markets, seem to be incompatible with large sunk costs, unless we assume a two-tiered entry cost structure or serially correlated productivity and product quality shocks. Moreover, Das et al. (2007) model does not explain the sequential exporting finding described above. Nguyen (2012) and Albornoz et al. (2012) proposed two models to rationalize this empirical evidence. The former presents a model where demand is uncertain and imperfectly correlated among markets; consequently, firms chose to sequentially export in order to slowly learn about the possibility to succeed in new markets. The latter suppose that firms are uncertain about their export profitability but success factors are highly persistent over time and across destinations; therefore, entry in a foreign market allows firms to learn about their profit potentials in future and different markets. These new expectations are taken into account in firms' exporting decision and lead to a process of sequential exporting. Similar to the previous authors, Eaton et al. (2014) develop a new search and learning model, where buyers reveal the appeal of the firm's product in a market, affecting the firm's propensity and cost to search for new clients. Chaney (2014), modelling the trade patterns as an international network, provides a further explanation for sequential entering: firms export into markets where they have a contact, similar to social interactions (Jackson and Rogers, 2007). New contacts (trading partners) are searched both directly, using the existing network of contacts in the local market, and indirectly, searching remotely from foreign markets. The predictions of the Chaney's model are then confirmed on a sample of French exporters, whose exports are geographically distributed in accordance with the model.

More generally, standard gravity models do not capture the total spatial correlation of trade, because they predict trading patterns to be less spatially correlated than they are in reality. Defever et al. (2015) provide robust causal evidence of extended gravity effects: using exports of a sample of Chinese firms after import liberalizations in US, EU and Canada, they prove that the probability of a firm to export to a country increases by about two percentage points for each additional prior export destination sharing a border with the new country. Morales et al. (2017) quantify the impact of the extended gravity variables (sharing a border, continent, language or similar income between new and previous foreign markets) on export entry costs, using a sample of Chilean firms. They find the sunk cost of entry into foreign markets to be lower, from -19% to -38%, for markets having similarities with a prior export destination.

With this paper, we provide a framework to reconcile the extended gravity and sequential exporting findings with the traditional gravity model of trade. We extend the Chaney (2008) model of trade with heterogeneous firms by adding an unobserved preference parameter in the consumer's utility. We model consumers' preference as country pair and good specific. As a result, we can shape trade flows as a function of the ratio between the consumers' preference parameter and fixed cost. Modelling the preference parameter or fixed cost as spatially dependent, we are able to derive an equation of trade that internalizes the reinforced spatial pattern correlation of the exporter. Consequently, sequential entering emerges simply adding the time dimension to the fixed cost of entry or to the preference parameter, which can be related to the geographical distribution of previous exports[6].

We chose to spatially model the preference parameter supported by several findings in empirical economics and marketing (Yang and Allenby, 2003; Rossi et al., 2005; Bradlow et al., 2005). Spatial correlated preferences can explain many phenomena discovered by international trade scholars, such as the residual spatial correlation of traditional gravity model, the correlation over time and across destinations of export profitability and the "social network" effect discovered by Combes et al. (2005). The spatial correlation parameter is then estimated for a subset of sectors through Monte Carlo Markov chain (HMC) method. To identify the parameter, the ratio of exports in a custom union is used as the dependent variables to cancel out the fixed cost to export.

[6] Sequential entering can even emerge only considering preferences correlated over time.

To the best of our knowledge, we are the first to investigate explicitly the impact of preferences on international trade, modelling them as being spatially dependent. We are the first to stress the importance of the spatial structure of exports from a demand perspective.

Our results confirm bilateral trade being dependent from the spatial distribution of exports to other countries; both the probability to enter in a market and the value exported increase the higher are the exports to countries close to the foreign market. More specifically, the probability to export to the foreign market is higher if its consumers import similar products (belonging to the same SITC class) from countries already reached by the exporter. Introducing spatially correlated preferences in the Chaney (2008) model of trade we are able to explain these findings. Consumers in different countries have similar preferences and are influenced by consumption's decisions of their neighbours. Our results are confirmed in a structural estimation of the model on a subset of products and countries. We identify the spatial correlation parameter of consumers' preferences considering, in a custom union, the ratio of export to the same country from different countries, in order to control for observed and unobserved fixed costs to export, using a Monte Carlo Markov Chain (HMC) estimator.

Introducing further complexity to earlier economic models to explain some new empirical findings, the results of this thesis confirm the crucial role of proximity on the three previous topics. Institutional distance, as well as cognitive and communication or social distance, exhibit robust impact on the geography (and currency denomination) of trade. These results can explain recent patterns that are emerging in international economics, as Mega-events biddings of emerging economies (Brazil, Qatar, Azerbaijan), big countries' preference for bilateral agreement with smaller countries and the emerging of global/local brand managements that are product category specific.

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Chapter 1: The Olympic effect: legal families matter[7].

Davide Arioldi, Rico Maggi

ABSTRACT

Rose and Spiegel (2011), applying a log-linear gravity model, discover positive and permanent effects on exports of countries hosting the Summer Olympics. Similar effects are found for unsuccessful bidders and for countries hosting World Cups or Universal Exhibitions. Rose and Spiegel (2011) propose that countries notify to private investors their intention to liberalize bidding for a Summer Olympic. Bista (2017), using a different estimation technique (PPML, as proposed by Santos Silva and Tenreyro in 2006), questions the previous results, finding non-significative effect on export. With this work, we show that the standard errors estimated by Rose and Spiegel (2011) are downward biased and we propose a tri-way clustering method to correctly account for the error correlation structure. Moreover, we find some heterogeneity in the results of Bista (2017) that supports the Rose and Spiegel's (2011) liberalization model. We identify in the legal origin system the source of this heterogeneity. We discover that only export in civil law countries is affected by the bidding. Ours results are robust to different estimation techniques and are confirmed when we include others kinds of Mega-Events (World Cups and Expos) in our analysis. An exogenous shock is then considered: the Colombia Copa América withdraw in 1982 and the 1999 assignation. Investigating why legal families matter, we found different liberalization behaviours among countries after bidding for a Mega Event. Common law countries, having ex-ante lower trade tariffs respect to civil law countries, primarily liberalize capital controls that ambiguously affect trade, while civil law countries reduce trade tariffs.

JEL classification: F14, F20, F50, K15, Z2.

Keywords: International trade, Olympic Games, Mega Events, Liberalizations, Legal Origin.

[7] This chapter is based on Arioldi, Davide, and Rico Maggi (2017), The Olympic effect: legal families matter. Presented at the RSA Congress, Izmir. *To be submitted to an international journal.*

1.1 Introduction

The debate on the effect of hosting a mega-event has received an increasing attention in recent years. Many economists have expressed skepticism about the advantage to host a mega-event, because the large cost of the event is not compensated by subsequent revenues. Siegfried and Zimbalist (2000) and Coates and Humphreys (2003) assert that the projects related to mega-events are comparable to "white elephants [8]" and any benefits derived from infrastructure investment may be achieved independently of the events. On the other hand, some supporters of mega-events state that hosting a mega-event influences national reputation, increasing the tourism and gaining exposure on the international stage. For instance, Preuss (2004) argues the Seoul games in 1988 were designed to raise international awareness of Korean manufactured goods, to promote Korean export.

Rose and Spiegel (2011) find a significant, positive and large permanent effect on exports for countries bidding for or hosting a Summer Olympic; according to Rose and Spiegel, the export's increase is attributable to liberalization policies pursued by the countries after the bidding. These countries, bidding for a Summer Olympic, signal to the world their intention to liberalize; bidding is therefore a "burning money policy[9]" that signals to private investors the future intents of the country[10]. According to Rose and Spiegel (2011), countries hosting a Summer Olympic experience an export's growth of about 35%. The effect is similar for World Cup hosting countries and for the Summer Olympic Games unsuccessful bidders.

The robustness of the Rose and Spiegel (2011) Olympic effect is then questioned by Bista (2017) who, using a Poisson Pseudo Maximum Likelihood (PPML) estimator to control for zero trade flows and to avoid the heteroskedasticity bias in the log-linearization of the gravity model of trade[11], finds no robust

[8] Structures that are operational only during the mega-event, with no utility afterward.

[9] The signal is informative due to the fact that sending the signal is only attractive to the set of countries that sincerely intend to pursue liberalizations; only countries that in the future will be in good fiscal condition are supposed to send this kind of signal.

[10] In the RS setting, Governments chose whether to liberalize maximizing theirs utilities, considering that liberalization policies increase the revenue of the exporting sector (raising domestic export-sector prices) and decrease the revenue of the importing sector (lowering domestic import-sector prices) and that the cost of hosting the event is supported by the importing and exporting sector with different weights. Nations evaluate gains to the export sector in different ways but they cannot convincingly reveal theirs valuations to the potential investors. Solving this model, Rose and Spiegel (2011) show that a separating equilibrium exists; countries that send the signal liberalize and countries neither send the signal nor liberalize. According to this model, bidding for a Summer Olympic is always follow by liberalization policies; other behaviours are out of the equilibria because of the expected cost of hosting the event.

[11] As Santos Silva and Tenreyro (2006) state, log-linearization of an exponential model in the presence of heteroskedasticity leads to inconsistent estimates. This is because the expected value of the logarithm of a random variable depends on higher-

positive effect on export. Moreover, using product-level data, Bista (2011) proves that the Olympic effect is positive and consistent only for the intensive margin of trade of hosting countries while both hosts and candidates countries experience a permanent decrease at extensive margin[12]. Furthermore, the positive effect on the intensive margin is positive only for hosting countries while is negative for unsuccessful candidates; however, these results are not confirmed estimating the model with a log-linearized OLS. Bista concludes: "the traditional log-linear model exaggerated the impact of hosting or bidding for mega-events on exports" as a consequence "the Olympic effect is not robust to empirical specification and sample selection issues" and "the candidates do not experience any increase in exports at both margins, casting doubt on the signalling effect".

The results of the PPML estimations suggest that some heterogeneity of the Olympic effect may be at play. PPML estimates show that the average elasticity of trade to the Olympic effect is zero when we correct for the heteroskedasticity bias, but this should not be true for the whole set of countries as shown by OLS estimates. The impact on exports may depend on the characteristics of the countries[13] and considering all the bidding or hosting countries as a whole may conceal the real outcome. In this paper, we extend the results of Rose and Spiegel (2011) and the findings by Bista (2017) discovering some heterogeneity in the Olympic effect due to different institutional settings. We expect to find a smaller effect on exports after liberalizations in countries with an ex-ante pro-market attitude, given that investments in the exporting sector are already higher thanks to previous market liberalization policies and lighter state-owned structure. Countries whose governments have a priori major control of the economy are instead expected to experience a higher increase of exports, given their larger autarky level.

We chose to exploit the legal families' theory to identify groups of countries with these different characteristics[14]. From a theoretical point of view, fixed and variable exporting costs are expected to decrease more in Civil law respect to Common law countries after market liberalizations, because of the previous different autarky level.

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order moments of its distribution. Therefore, if the errors are heteroskedastic, the transformed errors are correlated with the covariates.

[12] The increase of the intensive margin of trade at a product level data is the increase of the exporting value for existent relationships. The decrease of the extensive margin is the decrease of the number of trading relationships at a product level.

[13] For instance, Common law countries may exhibit smaller effects after liberalizations, given that investments in the exporting sector are already higher, thanks to better contract enforcement and "ease to do business".

[14] A large number of empirical and theoretical papers have been written about the institutional and structural macroeconomic differences between civil and common law countries or among French, German and British legal origin countries.

1.2 Why should legal families influence the Olympic effect?

We introduced the legal origin of a country[15] because, as showed by La Porta (1998) and Djankov at al. (2006), legal origin has the characteristics of a good instrument for business regulation[16] and economic government attitude.

Not controlling for the legal and regulatory structure may produce bias in the computation of the Olympic effect, because the economic and legal framework influences the results of liberalization policies. Conditioning the Olympic effect to the legal origin system of a country permits to control for this different settings.

Legal system influences the economy through two main channels: the political and the adaptability channel. The political channel focuses on the power of the State while the adaptability channel highlights differences in the ability of legal systems to evolve with changing conditions.

The "political channel" contends that legal traditions differ in terms of the priority they attach to private property rights versus the rights of the State. French and German civil codes in the 19th century were constructed to solidify State power by placing the "prince above the law" (Hayek, 1960). Over time, State dominance of the judiciary produced legal traditions focusing more on the power of the State and less on the rights of individual investors (Mahoney, 2001). The political channel stresses that the civil law tradition promotes the development of institutions that advance State power. Thus, the political channel highlights the degree to which the State controls the judicial system and the institutions, emphasizing the difference between common and civil law countries. The higher level of State power in civil law countries has produced different economic structures during the years. Civil law countries have revealed a higher state ownership of the media, higher government ownership of banks, higher share of

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[15] The majority of researchers identify two main secular legal traditions: common law and civil law countries. The former embrace all the countries which legal system is originated from the British Common law; the latter from the French law countries (the "pure" civil law, originated from Roman law code). German law countries (which laws are based on the French civil code but with greater judicial law making power) are a special case: theirs codes were originated from Roman law but then they developed some elements common to the British legal system. Others marginal legal families are Scandinavian law countries (their code is less derivative of Roman law than German or French) and socialist countries (countries that adopted the socialist law after the Russian revolution, reverting then to French or German law after the fall of the Communism in 1989).

[16] Countries with a heavier level of business regulation (civil law countries) are expected to suffer a higher increase of business activity (export) after loosening their economic ties. Business regulation is strictly linked to the adaptability channel.

public owned companies, heavier reliance on conscription, more entry and labor regulation, more legal formalism and less security of property right (La Porta et al. 2008).

Instead, the "adaptability" channel stresses that legal traditions differ in their ability to evolve with changing conditions (Hayek, 1960). Legal traditions that adapt efficiently to minimize the gap between the contracting needs of the economy and the legal system's capabilities more effectively foster financial development than more rigid systems (Merryman, 1985). An influential, though not unanimous, strand of the comparative law literature holds that the Common law evolves efficiently as judges respond case-by-case to unforeseen and changing conditions. French legal origin countries (the pure civil law) are more likely to develop inefficiently rigid legal systems than British Common law and German civil law countries with adverse repercussions for financial development and contract enforcement. The difference between French and German law countries ground on the Savigny's vision of legal science; Germany, rejecting the French deviation, accepted the need for jurisprudence and sought to create a responsive legal doctrine. Adopters of the German code, therefore, obtained a legal system specifically designed to evolve with changing conditions, similarly to common law countries. According to this corollary, French civil law countries have more rigid legal systems than German countries. Nowadays, German civil law and British common law countries have significantly better-developed financial intermediaries and markets and better property right protection than French civil law countries.

In conclusion, legal traditions that strengthen the power of State relative to private property rights tend to hinder the development of free, competitive economies while legal traditions that efficiently adapt to changing conditions, by eliminating inefficient laws and creating more efficient ones, support economies (e.g. contract enforcement). La Porta et al. (2008) describe legal origin "as a style of social control of economic life", where "common law stands for the strategy of social control that seeks to support private market outcomes, whereas civil law seeks to replace such outcomes with state-desired allocations". Mirjan R. Damaška (1986) labeled civil law as "policy implementing" and common law as "dispute resolving".

La Porta, Lopez-de Silanes, Shleifer and Vishny (LLSV, 1997, 1998) are the first to prove the consequences of the legal origin system on the juridical and economic framework. They study the impact of legal origin system on the investor protection (outside shareholder and outside senior creditors) using primarily corporate and bankruptcy laws[17]. LLSV (1997,1998) verify empirically that the protection of outside investors is superior in common law countries rather than in civil law countries and that the worst protection is supplied by the French legal origin system. Then, using legal origins as an instrument for legal rules show that the legal investor protection is a sturdy predictor of financial development. Others papers demonstrate that the consequences of legal origin on laws and rules are not limited to finance: regulation of labor markets - Botero et al. (2004), government ownership of banks - La Porta et al. (2002), government ownership of the media - Djankov et al. (2003), the burden of entry regulations - Djankov et al. (2002) and also military conscription - Mulligan and Shleifer (2005), are affected by the legal origin system. Civil law countries, having heavier government control, ownership and regulation develop higher formalism in laws, rules and procedures (Djankov et al. 2003) that are negative for several aspects of the economy, resulting in greater corruption, larger unofficial economy and higher unemployment.

Differences in the legal system are proved to affect also trade, through the enforcement of contracts[18] (Nunn, 2007) and similarity[19] (Islam and Reshef, 2014). Moreover, countries with better contract enforcement tend to export goods with complex production structure, in which several contractors are involved. Nunn (2007) find empirical evidence supporting this idea: civil law countries, that are worse at enforcing contracts (Djankov et al. 2003; Hayek 1960; La Porta et al. 2008), export relatively less goods produced in contract-intensive industries, compared to common law countries. According to the theory of comparative advantage, the different structure of exports between civil and common law countries is due to their diverse legal procedures. In the civil legal system, legal procedures are heavily regulated, resulting in higher expected duration, less congruity, less trustworthiness and fairness decisions, as demonstrated by Djankov et al. (2003). The greatest level of legal formalism of civil law countries weakens the enforcing of contract, raising the risk and cost of doing business (Johnson, McMillan, and Woodruff, 2002a) and influencing the firm’s decision to underwrite international contracts or to locate investment in sectors that are relationship-specific (Grossman and Hart, 1986; Hart and Moore, 1990; Klein, Crawford and Alchian, 1978; Williamson, 1979, 1985, Johnson et al.,2002b).

[17] The investor protection promotes financial development as argued by Robert Clark (1986) and Shleifer and Vishny (1997).

[18] Firms dislike uncertainty, because increase the risk of doing business; legal system that are able to reduce uncertainty decrease the cost of exchange, rising trade.

[19] A second, smaller effect, in which legal system influence trade is similarity. Sharing similar legal institutions reduce the cost of trade but the effect is not sufficient to ensure a higher level of trade if the quality of institution is low.

1.3 The impact of legal origin on the Olympic effect

To account for the influences of legal origin, we estimate the Summer Olympic effect for each legal family. We expect to find a stronger impact for countries which legal system is originated from the French code (the French legal origin system countries), whose governments have had a more coercive attitude respect to the governments of common law countries (the British legal origin system countries). The greater range of liberalizations occurring after the Olympics in the civil law countries should produce a stronger effect respect to the common law countries that have already developed pro-trade economies thanks to lower trade frictions[20].

The relatively smaller range of new liberalizations of the British countries and the larger competitive effect due to the increased openness of the civil law countries could instead weaken the effect on the common law countries' exports. Moreover, common law countries, producing and exporting goods that are complex (thanks to the better enforcement of contract), may be less sensitive to trade friction reductions, because the elasticity of substitution of the complex goods is smaller than the elasticity of the homogeneous goods. The Olympic effect for common law countries is therefore expected to be smaller respect to the civil law countries.

1.3.1 Empirical specification and data

Following the approach of Rose and Spiegel (2011), we exploit the standard and well-known empirical gravity model of trade for our analysis. In this model, the bilateral trade between two countries is a function of the "masses" (monadic characteristic of the country, as GDP) and of the friction between the two countries (dyadic characteristic as distance, shared border, presence of trade agreement, common language) plus a multilateral resistance term.

We specify the log-linear model of trade as:

$$ln(X_{ijt}) = \sum_{l=1}^{L} \gamma_l Host_{it} * LegalOriginSystem_i + \beta Z_{ijt} + \sum_{i=1}^{I} \alpha_i Exp_i + \sum_{j=1}^{J} \alpha_j Imp_j + \sum_{t=1}^{T} \alpha_t Year_t + \varepsilon_{ijt} \qquad (1.1)$$

[20] We potential set of market liberalization and, consequently, reduction of trading cost is larger in Civil law respect to Common law countries.

where the legal origin system is British (common law countries), French (the pure civil law countries) or German (the "hybrid civil law" countries); Scandinavian and Socialist countries are not included because of the low number of Olympics hosted by these countries[21]. The subscript i identifies the exporter country while the subscript j identifies the importer country and t denotes time. X_{ijt} is the real export from country i to country j (in millions of US dollars) at time t. *Host* is a binary variable equal to one if the country i (the exporter) host a Summer Olympic Games at or before the year t and zero otherwise. Therefore, γ embodies the effect on exports of hosting a Summer Olympic Games for each legal family (French, German and British legal origin countries); α_i and α_j are exporter and importer fixed effects while α_t identifies the time fixed effects, capturing common trend in global trade.

Z_{ijt} is a set of control variables usually employed in the gravity equation (Helpman et al., 2008, Rose and Spiegel, 2011, Bista, 2017, Méngova, 2012) that are not captured by the fixed effects. It includes: the log of real GDP per capita of importer and exporter country; the log of importer and exporter population; the log of the distance between country i and j; a dummy variable equal to one if i and j share the same currency at time t; a dummy variable equal to one if i and j have the same official language; a binary variable equal to one if a regional trade agreement is signed between i and j; a binary variable equal to one if the two countries share a border; the number (0/1/2) of island countries in the pair; the log of the product of the areas of the two countries; a binary variable equal to one if the two countries have a common colonizer; a binary variable equal to one if the two countries where in a colony-relationship at time t; a binary variable equal to one if the two countries were being in a colonial relationship; a binary variable equal to one if the two countries are part of the same country at time t and, differently from previous models (Helpman et al. 2008, Rose and Spiegel 2011, Bista 2017, Méngova 2012), a binary variable which value is unity if the two countries share the same legal origin system.

Our dataset corresponds to the data used by Rose and Spiegel (2011) and includes bilateral trade flows for 196 nations, recorded annually from 1950 to 2006; it is not balanced (as usual in international trade) and reports only strictly positive trade flows. Trade flows are measured in US $, taken form IFS Direction of Trade and deflated by US CPI for all Urban Consumer. The list of candidates and hosting countries for Summer Olympic Games, World Cups and Universal Exhibitions (Expos) are presented in Appendix 1.A.

[21] Finland (Scandinavian) and Russia (Socialist) are the only countries to host a Summer Olympic Games in 1952 and 1980 respectively while we have 3 British legal origin, 4 French and 3 German legal origin countries having host at least one Summer Olympic Games.

An additional dataset is used for robustness check. This dataset corresponds to the data employed by Head et al. (2010) and is supplied by CEPII[22]. The second dataset includes bilateral trade flows for 208 nations, from 1948 to 2006, recorded annually. It includes zero trade flows and missing trades and it allows to evaluate the effect of zero trades using the PPML and the Heckman sample selection model. In this dataset, GDPs (not deflated, in accordance to trade flows) and populations come from the World Bank's World Development Indicators (WDI).

1.3.2 Main result

In Table 1.1, we show the estimates of Equation 1.1, using the Rose and Spiegel (2011) dataset. Before discussing the variable of our interest, we check if our control variables are similar to previous researches: coefficients for distance, regional trade agreements, borders (neighboring nations), common language and many other are significant and similar to those estimated by other authors. Differently from the previous authors, we use tri-clustered standard errors to control for contemporaneous error correlation within the same importer, exporter and year. In such a way, we control for shocks affecting importer and exporter over time and for common shocks affecting all the countries in a given year.

[22] French research center in international economics: http://www.cepii.fr

Table 1.1 - The Olympic effect on trade in common and civil law countries.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation technique	OLS	OLS	OLS	OLS	OLS	OLS	OLS	PPML
Dependent Variable	$ln(X_{ijt})$	$ln(X_{ijt})$	$ln(X_{ijt})$	$ln(X_{ijt})$	$ln(X_{ijt})$	$ln(X_{ijt})$	$ln(X_{ijt})$	X_{ijt}
Summer Olympics hosting countries	0.295*** (0.03)	0.295+ (0.16)						
Summer Olympics in British l.o. countries			-0.092 (0.09)	-0.092 (0.07)	-0.097 (0.08)	-0.097 (0.08)	-0.28* (0.13)	-0.122* (0.06)
Summer Olympics in Civil law countries			0.56*** (0.11)		0.457*** (0.11)			
Summer Olympics in French l.o. countries				0.605*** (0.11)		0.478*** (0.11)	0.498*** (0.11)	0.328*** (0.06)
Summer Olympics in German l.o. countries				0.497** (0.16)		0.426*** (0.12)	0.538*** (0.15)	-0.0362 (0.099)
Year fixed effect	Y	Y	Y	Y	Y	Y	Y	Y
Exporter fixed effect	Y	Y	Y	Y				Y
Importer fixed effect	Y	Y	Y	Y			Y	Y
Exporter-Importer f.e.					Y	Y		
Exporter linear trend							Y	
Standard errors	Country-pair clustered	3-Way clustered	3-Way clustered	3-Way clustered	3-Way clustered	3-Way clustered	3-Way clustered	3-Way clustered
N	449,220	449,220	449,220	449,220	449,220	449,220	449,220	449,220
The Olympic effect is homogeneous between civil and common law countries?			0.00***		0.00***			
The Olympic effect is homogeneous between French and German law countries?				0.52		0.74		

*Standard errors in parentheses + p<0.10m *p<0.05, **p<0.01, ***p<0.001.*

Note: Table 1.1 shows estimates of the empirical gravity model specified in Equation 1.1. In the first specification (Model 1), we compute the Olympic effect as in Rose and Spiegel (2011). Correcting the standard errors for contemporaneous correlation among the same exporter, importer and year (three-way clustered standard errors, reported from Model 2 to 8) decreases the significance level found by Rose and Spiegel (2011). Control variables are log of real GDP per capita and population of importer and exporter countries, log of distance between importer and exporter, log of the product of the two areas of the countries, a set of binary variables equal to one if the two countries share the same currency, official language, border, regional trade agreement, colonizer, legal system or are in a current colony relationship or have been in a former colony relationship or in the same country. Our dataset included 184 countries, with ten countries who have hosted at least one Olympic Games.

From Table 1.1, we observe that clustering errors for importer, exporter and year (Model 2) increases the standard errors found by Rose and Spiegel by about 500%, from 0.03 to 0.16. The significance level decreases from 99.9% to 90% (p-value 0.06). From Model 3, we observe the Olympic effect conditioned to the legal origin system: these coefficients ($exp\gamma_l$ - 1) report the impact on exports of hosting a summer Olympic Games in the countries with the specified legal system, compared to the non-hosting countries. According to OLS estimates, we surprisingly observe that all the positive effect of the Summer Olympic Games on export found by Rose and Spiegel (2011) are due to the civil law countries (the French, the pure civil law countries, and the German, the hybrid civil law countries). The data confirm that the effect of hosting a Summer Olympic Games diverges considering the legal origin system of the hosting country. Civil law countries experienced a positive, persistent and robust effect on export (between +58% and +75%) after hosting the event while the common law countries experience a non-significative or slightly negative effect. For the French legal origin countries, we estimate a permanent increase between +61% and +83% while German legal origin countries are affected by an export increase between +53% and +71%. The difference in effect between the common law (British) and the civil law (French and German) hosting countries is statistically significative at 99.9% while we reject the hypothesis of different effect between German and French legal origin countries. Our results are robust even when we include individual exporter linear trend (model 7) and, for the French legal origin countries, when we consider different model specification (model 8) as PPML.

1.3.3 Structural estimates and legal families' pre-impact on trade

To give estimates consistent with the theoretically founded structural gravity model developed by Anderson and Wincoop (2003), we need to control for the inward multilateral resistance and total expenditure of importers terms and the outward multilateral resistance and countries' output shares of exporters terms. Time varying importer and time varying exporter fixed effects capture these elements.

Structural estimates of the Olympic effect are therefore computed using a two-steps method. In the first step, we regress the log of trading value on exporters and importers time varying fixed effects and on variable trade cost[23]. In the second step, we regress the Olympic effect on the predicted time-varying exporters fixed effects, computed using estimates obtained in the previous step. With this two-step estimation procedure, we are even able to test if British law countries exported a-priori more than

[23] Dyadic variables are used as proxies of variable trading cost.

civil law countries, to check our intuition that common law countries already have an open economy and pro-market attitude. The first equation is:

$$\ln(X_{ijt}) = \beta Z_{ijt} + \sum_{i=1}^{I}\sum_{t=1}^{T}\gamma_{it}Exp_{it} + \sum_{j=1}^{J}\sum_{t=1}^{T}\eta_{jt}Imp_{jt} + \varepsilon_{ijt} \quad (1.2)$$

where vector Z includes all the dyadic variables. From the fitted export-year fixed effects ($\widehat{Exp_{it}} = \gamma_{it}Exp_{it}$), we then compute our Olympic and legal families' effect controlling for the other monadic variables as specified by the following equation:

$$\widehat{Exp_{it}} = \sum_{l=1}^{l}\partial_l\, LegalOriginSystem_i + \sum_{l=1}^{L}\gamma_l Host_{it} * LegalOriginSystem_l + \beta X_{it} + \sum_{t=1}^{T}\alpha_t\, Year_t + \varepsilon_{it} \quad (1.3)$$

where X contains all the monadic attributes of the exporter country, as GDP per capita and population. The value of our $LegalOriginSystem_l$ dummies (∂_l) is therefore the average value of exports for countries belonging to the same legal family conditioned to not having hosted the Olympic game[24]. The Olympic effect conditioned to the legal family of the exporter (γ_l) is then computed adding country fixed effects and setting ∂_l equal to 0 for each *l*, to avoid collinearity.

[24] We recall that $Host_{it}$ is equal to 1 from the year *t* when country *i* has hosted an Olympic Games to the last year T of our dataset.

Table 1.2 - Structural estimate of Olympic effect and legal family impact on trade

Dependent Variable	(1) $\widehat{Exp_{it}}$	(2) $\widehat{Exp_{it}}$	(3) $\widehat{Exp_{it}}$	(4) $\widehat{Exp_{it}}$
Summer Olympic in British legal origin countries	0.13 (0.08)	0.13 (0.08)	-436.17* (182.64)	-452.62* (182.86)
Summer Olympic in Civil law countries	0.638*** (0.13)			365.96* (176.74)
Summer Olympic in French legal origin countries		0.648*** (0.13)	81.17 (72.83)	
Summer Olympic in German legal origin countries		0.624*** (0.20)	240.94+ (124.75)	
British legal origin system countries			335.513*** (85.95)	339.151*** (86.33)
Civil law countries				95.809 (70.63)
French Legal origin system countries			81.17 (72.83)	
German legal origin system countries			240.933+ (124.75)	
Exporter fixed effect	Y	Y	N	N
Year fixed effect	Y	Y	Y	Y
N	563,686	563,686	563,686	563,686
			(Prob > F)	(Prob > F)
Civil law countries = Common law countries				0.0021**
French legal = German legal			0.2	
French legal = British legal			0.0016**	
German legal = British legal			0.4841	

*Standard errors in parentheses + p<0.10m *p<0.05, **p<0.01, ***p<0.001.*

Note: This table displays estimates of the Olympic and legal families' effect specified in Equation 1.2. Control variables include the log of GDP per capita and the log of population. The dependent variable $\widehat{Exp_{it}}$ is computed from Equation 1.2, using dyadic control variables of Equation 1.1. Errors are clustered at the exporter level.

Results in Table 1.2 (Models 1 and 2) confirm our previous finding. The Olympic effect is positive for Civil law countries while for Common law countries the impact is equal to 0. Moreover, Models 3 and 4 give empirical confirmations to our intuition: common law countries export a priori more than civil law countries. The difference is statistically significant and seems to stress the importance of the political and adaptability channel. The role of this last channel is established when we look at the coefficient for the German legal origin countries (Model 3): they export more than French but less than British legal origin countries, reinforcing our basis idea regarding the heterogeneity of the Olympic effect.

1.4. Some robustness tests

1.4.1 The endogeneity problem

Referring to a possible endogeneity problem or reverse causality in the selection of the countries hosting a Summer Olympic Games, we recall Rose and Spiegel (2011). They state that: (i) the endogeneity critique is primarily cross-sectional while this analysis is in the time-series behavior of trade; (ii) the IOC chose the hosting country on a long list of criteria generally poorly related to trade; (iii) openness does not affect the probability to host the event, suggesting that reverse causality is not an issue. We can surely share theirs assumptions in this study. The insignificant coefficients of Exports to GDP in Table 1.3 confirm that having a more open economy does not affect the probability to host or bid for the event for all the different legal families.

Table 1.3 - Determinants of Bidding for and Winning the Olympic Games for each legal family

	(1)	(2)	(3)	(4)	(5)	(6)
Model	Probit	Probit	Probit	Probit	Probit	Probit
Dependent Variable	British host olympics	French host olympics	German host olympics	British Olympics bidders	French Olympics bidders	German Olympics bidders
ln(Exports/GDP)	-1.002 (0.96)	-0.514 (0.40)	0.256 (0.44)	-0.571 (0.38)	-0.180 (0.27)	0.298 (0.61)
Already host an Olympic				-1.064* (0.45)	-0.880+ (0.50)	0.438 (0.59)
Already bid for an Olympic		1.097+ (0.59)	0.648 (0.47)			
Already host a World CUP	-1.087 (0.84)	-0.402 (0.59)		-0.631 (0.43)	-0.202 (0.38)	0.560 (0.55)
ln(Population)	-0.063 (0.45)	0.065 (0.18)	0.408+ (0.22)	0.534** (0.18)	0.276* (0.12)	0.384 (0.29)
ln(Real GDP p/c)	5.525* (2.79)	0.382 (0.35)	0.540 (0.33)	1.625*** (0.36)	0.693*** (0.20)	0.820+ (0.47)
Year Fixed Effect	Y	Y	Y	Y	Y	Y
N	109	463	558	1212	966	448

*Robust standard errors in parentheses + p<0.10m *p<0.05, **p<0.01, ***p<0.001.*

Note: This table shows if openness (specified by Export on GDP) affects the probability to bid or host for Olympic Games.

Referring to our control variables, we observe that, in most of ours specifications, richer and bigger countries have a higher probability to bid for a Summer Olympic Games. Instead, having already hosted an Olympic reduces the probability to bid.

To control for potential endogeneity derived by the sample selection, we chose to consider as counterfactual only the countries having hosted at least one Summer Olympic. Therefore, we estimate Equation 1.1 on a reduced sample, where we include only the countries who have hosted, at least, one Summer Olympic. Results are in Table 1.4.

Table 1.4 - The Olympic effect for the countries who have hosted at least one Summer Olympic Games

	(1)	(2)	(3)
Estimation Technique	OLS	OLS	PPML
Dependent Variable	$\ln(X_{ijt})$	$\ln(X_{ijt})$	X_{ijt}
Summer Olympic Host in British legal or. countries	-0.371+	-0.430**	-0.278*
	(0.20)	(0.13)	(0.12)
Summer Olympic Host in French legal or. countries	0.325*	0.236	0.334***
	(0.15)	(0.16)	(0.06)
Summer Olympic Host in German legal or. countries	-0.099	-0.047	0.119
	(0.18)	(0.19)	(0.17)
Year Fixed Effect	Y	Y	Y
Importer Fixed Effect	Y		Y
Exporter Fixed Effect	Y		Y
Importer-exporter fixed effect (dyadic)		Y	
Standard Errors	Jackknife-Node	3-Way clustered	3-Way clustered
N	58500	58500	58500
R-sq	0.82	0.91	

*Standard errors in parentheses + p<0.10, * p<0.05, ** p<0.01, *** p<0.001*

Note: In this table we include only the countries who have hosted at least one Summer Olympic Games. Control variables are the log of real GDP per capita and population of importer and exporter countries, log of distance between importer and exporter, log of the product of the two areas of the countries, a set of binary variables equal to one if the two countries share the same currency, official language, border, regional trade agreement, colonizer, legal system or are in a current colony relationship or have been in a former colony relationship or in the same country.

Following Cameron and Miller (2014), we estimate standard errors through a Node-Jackknife variance estimator, in order to consider the small number of countries included in the sample (10 countries). This variance estimator, that has been shown to perform better when G (the number of countries) is small, is obtained by dropping country g and any pair with that country to acquire $\widehat{B_{(-g)}}$, evaluating then the variance of these beta estimates[25]. Moreover, this procedure permits to evaluate if the Olympic effect is driven by only a subset of countries inside each legal family.

Obviously, clustering for only 10 groups increases the standard errors and decreases the value of the t-statistics, lowering the significance levels. Nevertheless, we are able to confirm in all of our model specifications heterogeneous effect between the "pure" Civil law (French legal origin) countries and the common law countries. Most surprisingly, the effect for the common law countries seems to be more negative than the estimates with the whole sample, while for the German law countries the positive impact disappears.

1.4.2 The impact of zero trade flows

In order to estimate the impact of zero trade flows, another dataset is used. This new dataset corresponds to the data used by Head et al. (2010) and is supplied by CEPII[26]. Following the approach of Helpman et al. (2008) and Head and Mayer (2011), we use a sample selection model to correct for the selection bias. We employ as identification variable the log of the square value of the difference between the nominal gross domestic products (GDPs) of the two countries[27]. This variable affects positively the probability to trade without influencing the value of trade. Larger is the difference between the sizes of the two countries higher the probability to trade. Using the Head et al. (2010) dataset, we can confirm our previous results, as shown in Table 1.5.

[25] $\hat{V}[\hat{B}] = \frac{G-2}{2G} + \sum_{g=1}^{G}\left(\widehat{B_{(-g)}} - \bar{\hat{B}})(\widehat{B_{(-g)}} - \bar{\hat{B}}\right)'$

[26] French research center in international economics: http://www.cepii.fr

[27] $\ln gdp_{diff} = \ln((gdp_o - gdp_d)^2)$

Table 1.5 - The impact of zero trade flows on the Olympic effect

	(1)	(2)	(3)	(4)
Estimation Technique	OLS	Heckman	Heckman (selection eq.)	PPML
Dependent Variable	$\ln(X_{ijt})$	$\ln(X_{ijt})$	$\Pr(X_{ijt}) > 0$	X_{ijt}
Summer Olympic Host in British legal or. countries	0.02 (0.08)	0.025 (0.07)	0.761*** (0.12)	-0.088 (0.06)
Summer Olympic Host in French legal or. countries	0.338* (0.10)	0.333*** (0.09)	0.694*** (0.20)	0.18* (0.07)
Summer Olympic Host in German legal or. countries	0.592* (0.24)	0.579* (0.26)	1.310*** (0.17)	0.029 (0.18)
Year Fixed Effect	Y	Y		Y
Importer Fixed Effect	Y	Y		Y
Exporter Fixed Effect	Y	Y		Y
Standard Errors	3-Way clustered	Exporter clustered		3-Way clustered
N	486,927	547,766	547,776	547,768
R-sq	0.683			

*Standard errors in parentheses +p<0.10, *p<0.05, **p<0.01, ***p<0.001*

Note: In this table we report estimates of Equation 1.1 using the Head et al. (2010) dataset that include 0 trade flows. Control variables are the log of real GDP per capita and population of importer and exporter countries, log of distance between importer and exporter, log of the product of the two areas of the countries, a set of binary variables equal to one if the two countries share the same currency, official language, border, regional trade agreement, colonizer, legal system or are in a current colony relationship or have been in a former colony relationship or in the same country. In model 3 we use as identification variable the log of the square value of the difference between the nominal gross domestic products (GDPs) of the two countries.

The Olympic effect is confirmed for the French civil law countries, even though the value of the impact decreases with respect to the RS dataset, with the positive effect ranging between +18% and +40%. British civil law countries exhibit a null effect, confirming our previous results. As in the RS dataset, we reject the hypothesis of different effects between German and French legal origin countries, in Models 1 and 2. Referring to the impact of zero trades, we observe in the sample selection model that the bias induces by the zero trade flows is very small for each legal family (coefficients respectively decrease about -1% and -2% for French and German legal origin countries). The highest bias seems to derive from the presence of heteroskedasticity in the log-linearization of the gravity equation (PPML estimates).

Referring to the selection equation (Model 3), we observe that the effect of hosting a Summer Olympic Games on the probability to trade with another country is positive for the whole set of countries. We can therefore conclude that hosting a Summer Olympic Games increases the visibility of a country on the international market, extending the number of their trading relationships (the trading partners) and the overall value of trade (for the French legal origin countries).

1.5 Signalling is about bidding, not hosting

1.5.1 The Signalling effect of the Summer Olympic Games for civil and common-law countries

A main finding of Rose and Spiegel (2011) is that the Olympic effect is similar for hosting countries and unsuccessful bidders[28]; to explain this result, they developed a signalling model in which bidding, and not hosting, is used to signal to the investors the country's intention to pursue future liberalization policies. We want therefore to control if the legal system interaction effect lasts when we include the bidding countries[29]. We compute the Summer Olympics Games bidding variables as the previous one: a binary variable equal to one from the year in which the country bid (successfully or unsuccessfully) for the Summer Olympic Games. Results are in Table 1.6, and confirm that the legal system has still an impact on the Olympic effect.

[28] Rose and Spiegel (2011) show the Olympics effect affects both the unsuccessful bidders and the hosting countries (the effect is not statistically different).

[29] We continue to use the CEPII dataset because, including zero trade flows, it provide us a better information set respect to the RS dataset. Moreover, it gives better and faster convergence when maximum likelihood estimates are required and bilateral trade flows are more accurate.

Table 1.6 - The Olympic bidding effect on export for common and civil law countries

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation Technique	OLS	OLS	OLS	PPML	OLS	OLS
Dependent Variable	$\ln(X_{ijt})$	$\ln(X_{ijt})$	$\ln(X_{ijt})$	X_{ijt}	$\ln(X_{ijt})$	$\ln(X_{ijt})$
Summer Olympic Bidding effect in British legal or. countries	-0.157	-0.24	-0.210	-0.258	-0.286***	-0.286***
	(0.19)	(0.23)	(0.21)	(0.20)	(0.08)	(0.04)
Summer Olympic Bidding effect in French legal or. countries	0.731***	0.517**	0.671**	0.219	0.663***	0.663***
	(0.2)	(0.18)	(0.29)	(0.14)	(0.16)	(0.12)
Summer Olympic Bidding effect in German legal or. countries	0.676***	0.604***	0.660***	0.341***	0.699***	0.699***
	(0.16)	(0.13)	(0.15)	(0.04)	(0.18)	(0.13)
Year Fixed Effect	Y	Y	Y	Y	Y	Y
Importer Fixed Effect	Y		Y	Y	Y	Y
Exporter Fixed Effect	Y			Y	Y	Y
Importer-exporter fixed effect (dyadic)		Y				
Exporter linear trend			Y			
Reduced sample (only bidding countries)					Y	Y
S.E.	3-Way clustered	3-Way clustered	3-Way clustered	3-Way clustered	3-Way clustered	Node jackknife
N	486927	486927	486927	547766	113161	113161
R-sq	0.683	0.83	0.684	0.905	0.83	0.83

*Standard errors in parentheses + p<0.10, * p<0.05, ** p<0.01, *** p<0.001*

Note: This table shows estimates of the Olympic bidding effect. International trade data comes from Head et al. (2010) and includes 183 countries. Olympic bidding countries are 18 and standard errors are clustered at exporter, importer and year level. Control variables are the log of real GDP per capita and population of importer and exporter countries, log of distance between importer and exporter, log of the product of the two areas of the countries, a set of binary variables equal to one if the two countries share the same currency, official language, border, regional trade agreement, colonizer, legal system or are in a current colony relationship or have been in a former colony relationship or in the same country.

Inspecting the value of ours estimates, we find that the average effect for the French law bidding countries is almost double than for the French law hosting countries; the positive effect is included between +24% and +108%, depending on the model specification[30], comparing to a range between +20%

[30] The coefficient of PPML estimates for the French legal origin countries is different from zero with p < 12,5%. The higher s.e. derives from a strong error correlation at export level for a small bunch of countries.

and +40% for the hosting countries (results in Table 1.5). The effect for the German legal origin bidding countries is instead almost the same than the hosting countries' effect and, with the inclusion of a higher number of treated countries and a better timing identification[31], the heteroskedasticity bias becomes smaller giving consistent estimates even with the Pseudo-Poisson specification (PPML model).

In a separate regression, we further observe that countries bidding for a Summer Olympics continue to exhibit a higher probability to trade with another partner, confirming again the RS (2011) signalling theory.

1.5.2 The Signalling effects for the real unsuccessful bidders

As a further test, we assess the impact of legal system on the unsuccessful bidders (results in Table 1.7). Differently from Rose and Spiegel (2011), we consider only the "real unsuccessful" bidder, namely countries that bid for a Summer Olympic Games and never host it or other kind of mega-events[32]. Considering only the "real unsuccessful bidders", the number of treated countries profusely decreases. The bidding effect for the pure Civil law countries continue to be positive and significant (from +47% to +356%), even if the coefficients capturing the bidding effect for the German law countries change back to non-significant in Model 3[33]. Comparison with the previous table are difficult due to the small number of treated countries in the sample[34] .

[31] Countries hosting an Olympics are quite always bidder countries.
[32]Most of the countries unsuccessfully bidding for a Summer Olympic Games host some other kind of Mega-event. RS (2011) demonstrate positive effects for both World Cups and Expos; consequently, some identification problem arises considering unsuccessful SOG bidders that are in reality successful bidders of other Mega-events.
[33] The Olympic effect for the German legal origin countries unsuccessful bidder in model 3 is equal to 0 with $p < 15\%$.
[34] There is only one countries fulfilling the peculiarity to be a British law unsuccessful bidders (that is South Africa, bidding unsuccessfully for the 2004 Summer Olympic Games, but hosting it in 2012 out of our sample), two French legal origin countries (Netherland and Turkey) and two German legal origin countries (Austria and China).

Table 1.7 - The Olympic bidding effect on export for the real unsuccessful bidders

	(1)	(2)	(3)	(4)
Estimation Technique	OLS	OLS	OLS	PPML
Dependent Variable	$\ln(X_{ijt})$	$\ln(X_{ijt})$	$\ln(X_{ijt})$	X_{ijt}
Unsuccessful Summer Olympic Bidding effect in British legal or. countries	0.039 (0.08)	-0.024 (0.03)	0.029 (0.07)	-0.069 (0.10)
Unsuccessful Summer Olympic Bidding effect in French legal or. countries	1.519*** (0.17)	1.093*** (0.15)	1.490*** (0.16)	0.404*** (0.07)
Unsuccessful Summer Olympic Bidding effect in German legal or. countries	0.518+ (0.31)	0.484+ (0.27)	0.458 (0.31)	0.385*** (0.10)
Year Fixed Effect	Y	Y	Y	Y
Importer Fixed Effect	Y		Y	Y
Exporter Fixed Effect	Y			Y
Importer-exporter fixed effect (dyadic)		Y		
Exporter linear trend			Y	
Standard Errors	3-Way clustered	3-Way clustered	3-Way clustered	3-Way clustered
N	486,927	486,927	486,927	547,766
R-sq	0.683	0.838	0.683	

*Standard errors in parentheses + p<0.10, * p<0.05, ** p<0.01, *** p<0.001.*

Note: In this table, we have only 5 real unsuccessful bidding countries; standard errors are clustered at Exporter, Importer and Year level. Control variables are the log of real GDP per capita and population of importer and exporter countries, log of distance between importer and exporter, log of the product of the two areas of the countries, a set of binary variables equal to one if the two countries share the same currency, official language, border, regional trade agreement, colonizer, legal system or are in a current colony relationship or have been in a former colony relationship or in the same country.

1.6. Signalling effect and Mega-events

1.6.1 The Olympic effect is only a case of the (more general) Mega-events effect

Another essential finding of Rose and Spiegel (2011) is the similarity between the Olympic effect, the effect of hosting a World Cup and the Universal Exhibition (EXPO) hosting effect. We suppose that a country can signal to private investors its intention to liberalize hosting every kind of mega-event, not only Summer Olympic Games. World cups and Expos have almost the same features of Summer Olympic Games for media coverage, distinction and uniqueness. All of these events have a big impact on the international stage and a nation can spread the signal and gain reputation or visibility on international market through everyone of these events. Therefore, we test the assumption that legal families continue to influence the impact on export of countries bidding, successfully or unsuccessfully, for a Universal Exhibition (Expo), a World Cup or a Summer Olympic Games[35]. Another element supporting our idea to consider the mega-events jointly is the behaviors of nations bidding for or hosting a Summer Olympic. Nations strongly compete to host every kinds of mega-event, bidding for or hosting more mega-events; moreover, the correlation between hosting and bidding different kinds of mega-events is very high. Germany, for example, before to host the Summer Olympic Games in 1972 bids for the 1962 and 1966 World Cups; Belgium, after hosting a Universal Exhibition in 1958, unsuccessfully bids for the 1960 and 1964 Summer Olympic Games; Switzerland bids for the 1948 Summer Olympic Games, hosts a World Cup in 1954 and bids again for the 1960 Summer Olympic Games. More than 70% of the countries hosting a Summer Olympic Games have hosted at least one other kind of mega-event (World Cup or Expo) and among the countries that bid for a Summer Olympic Games more than 70% bid or host another kind of mega-event. Only 20% of nations bidding for a Summer Olympic Games were not able to host any kind of Mega-Event (but they host Winter Olympic Games or other secondary exhibitions). We run therefore into an identification problem if we try to evaluate separately Expo, Olympics and World Cup permanent effects on exports (see Appendixes 1.A and 1.B). We therefore compute a Mega-Event bidding binary variable for each legal family, which value is equal to one if the country i (the exporter) bid for the Summer Olympic, World Cup[36] or Expo[37] at or before the year t. Results of ours estimates are in Table 1.8: the permanent effect of bidding for a Mega-event is still positive for the civil law countries while is not significant for the common law countries.

[35] We jointly consider these events because we suppose there is no difference in sending a signal through an Expo, a Summer Olympic Games or a World Cup.

[36] For World Cup we consider only the real bidders; countries withdrawing before the FIFA vote are not expected to send a credible signals, because they will not pay the expected cost to host the World Cup (they sometimes bid for political reason).

[37] We consider only the countries hosting an Expo given that there is not a reliable list of countries bidding for the past Universal Exhibition.

Table 1.8 - The Mega-events bidding effect on export for common and civil law countries

	(1)	(2)	(3)	(4)	(5)
Estimation Technique	OLS	OLS	OLS	PPML	OLS
Dependent Variable	$\ln(X_{ijt})$	$\ln(X_{ijt})$	$\ln(X_{ijt})$	X_{ijt}	$\ln(X_{ijt})$
Mega-event Bidding effect in British legal or. countries	0.032	-0.2	0.001	-0.135	-0.136
	(0.11)	(0.13)	(0.12)	(0.13)	(0.10)
Mega-event Bidding effect in French legal or. countries	0.585**	0.502***	0.53**	0.229**	0.395*
	(0.17)	(0.13)	(0.18)	(0.11)	(0.18)
Mega-event Bidding effect in German legal or. Countries	0.678***	0.618***	0.663***	0.352***	0.696***
	(0.16)	(0.13)	(0.15)	(0.04)	(0.18)
Year Fixed Effect	Y	Y	Y	Y	Y
Importer Fixed Effect	Y		Y	Y	Y
Exporter Fixed Effect	Y			Y	Y
Importer-exporter fixed effect (dyadic)		Y			
Exporter linear trend			Y		
Reduced sample (only Mega Events bidding countries)					Y
Standard Errors	3-Way clustered	3-Way clustered	3-Way clustered	3-Way clustered	3-Way clustered
N	486,927	486,927	486,927	547,766	131,609
R-sq	0.683	0.83	0.684		0.81

*Standard errors in parentheses + p<0.10, * p<0.05, ** p<0.01, *** p<0.001*

Note: In this table, we have 26 countries bidding for a Mega Event. Standard errors are clustered at Exporter, Importer and Year level. Control variables are the log of real GDP per capita and population of importer and exporter countries, log of distance between importer and exporter, log of the product of the two areas of the countries, a set of binary variables equal to one if the two countries share the same currency, official language, border, regional trade agreement, colonizer, legal system or are in a current colony relationship or have been in a former colony relationship or in the same country.

Exports for the pure civil law countries (French legal origin countries) increase in a range from +26% to 79%, depending on the estimation technique, while for the German legal origin countries from +42% to +97%; the effect is not statistically different between these two legal families and the coefficients are very close to the Olympic effect estimated in Table 1.1 with the Rose and Spiegel (2011) dataset.

For the common law countries, our estimates continue to exhibit a null effect confirming our assumption about the impact of the legal origin. As in the previous analysis, we find that bidding for a mega-event increases the probability to have a positive trade flow with another country. Bidding for a mega-event improves the visibility of a nation on the international stage. Another confirm for the signalling theory. Testing separately the World Cup or Expo hosting or bidding effect show us the same results. Results are robust even considering as counterfactual only the mega-events bidding countries (reduced sample in Model 5).

1.6.2 The exogenous shock: the case of failed Colombia world cup and the reputational effect of Copa América in 2001

To ensure the effect we catch is not due to some particular trend in legal families – we have already tested that Olympics and MEs effects are robust to legal families trend – or to some endogenous selection – that we control using the reduced sample of hosting or bidding countries, but is the result of a signal of future liberalization policies and increase in international reputation, we chose to verify the effect on Colombia exports of the World Cup withdraw in 1982. Colombia, a French legal origin country, was selected to host the 1986 World Cup but suddenly, in 1982, withdrew due to financial problems. The 1986 Fifa World Cup was then assigned to Mexico and Colombia did not bid or host other mega-events until 2001. In 2001, Colombia host successfully, for the first time, the Copa America, assigned in 1999 by the Conmebol. Colombia government was able to plan and manage a safe event, even if the countries was deeply involved in a wide guerilla warfare.

Constructing two dummy variables, one for the years between 1982 and 2000 and one for 2001-2006, we are able to distinguish the World Cup withdraw effect (between 1982 and 2000) and the Copa América hosting effect (from 2001 to 2006). As shown in Table 1.9, Colombia has not experienced any trade increase until 2001, while from 2001 to 2006 its exports has grown in a range between +30% and +60%, a value comparable with our previous findings.

Table 1.9 - The Colombia 1982 withdrawal and the Copa América reputational effect in 2001

	(1)	(2)	(3)
Estimation Technique	OLS	OLS	PPML
Dependent Variable	$\ln(X_{ijt})$	$\ln(X_{ijt})$	X_{ijt}
Failed World Cup host, 1982-2000	0.160	0.134	0.098
	(0.12)	(0.08)	(0.08)
Copa America 2001 hosting effect	0.473***	0.425***	0.266*
	(0.13)	(0.10)	(0.10)
Year Fixed Effect	Y	Y	Y
Importer Fixed Effect	Y	Y	Y
Exporter Fixed Effect	Y		Y
Exporter linear trend		Y	
S.E.	3-Way clustered	3-Way clustered	3-Way clustered
N	486927	486927	547766
R-sq	0.683	0.682	

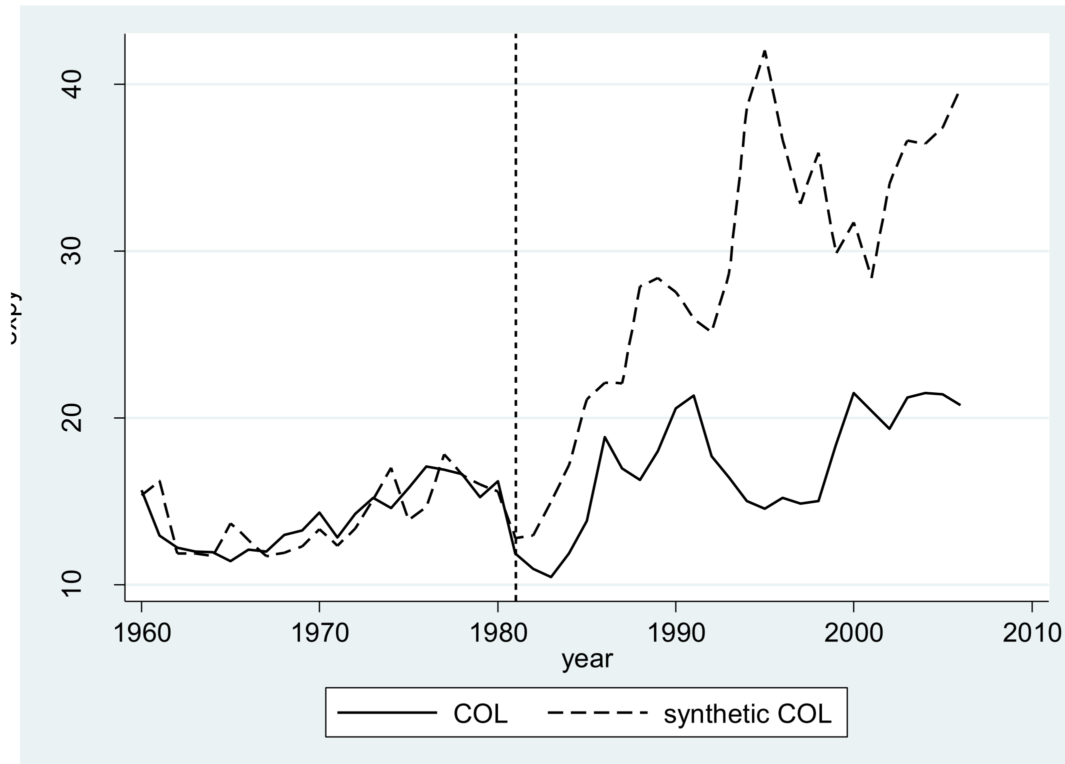
*Standard errors in parentheses + p<0.10, * p<0.05, ** p<0.01, *** p<0.001*

Note: This table shows the effect of Colombia withdrawal in 1982 and Copa America Hosting effect in 2001.Standard errors are clustered at Exporter, Importer and Year level. Control variables are the log of real GDP per capita and population of importer and exporter countries, log of distance between importer and exporter, log of the product of the two areas of the countries, a set of binary variables equal to one if the two countries share the same currency, official language, border, regional trade agreement, colonizer, legal system or are in a current colony relationship or have been in a former colony relationship or in the same country.

In order to give more robustness to these results, we decided to estimate the Failed World Cup effect and the Copa América effect with a non-parametric approach. We use the Synthetic Control method developed by Abadie and Gardeazabal (2003) to compare the impact on Colombia openness (exports on GDP) with the openness of a synthetic control country. To build the counterfactual, we use two groups; the first include a set of South American countries with French legal origins that host at least one Copa América or bid for other kinds of Mega-events (7 countries), the second a largest group of

South America French legal origins countries (13 countries). The first group offers better balance property[38] than the second group. Results are in Figure 1 and Figure 2.

Figure 1.1 - The Colombia World Cup withdraw effect in 1982 on the Export to GDP ratio

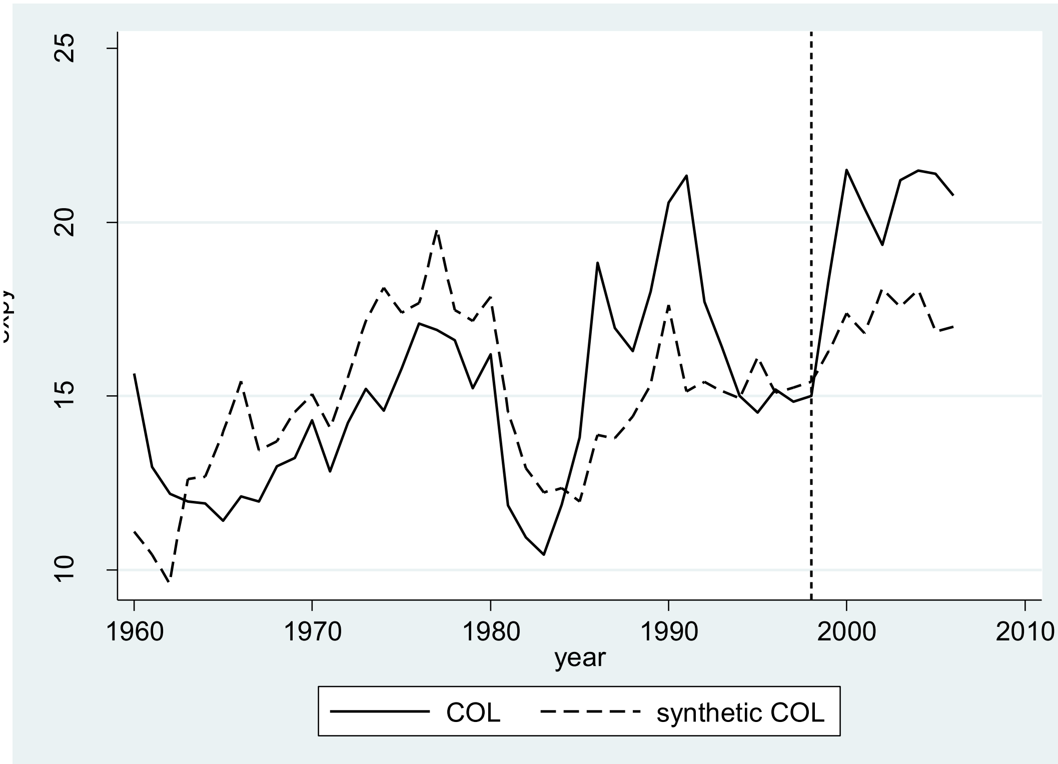


Note: Control group includes South American countries with French legal origin that host at least one Copa América or bid for a Mega-event.

In the first figure, we compare Colombia with the set of countries that host at least one Copa América or bid for a Mega-event. We observe a strong negative effect on Colombia trade openness (Export to GDP ratio) starting from the withdraw year, when compared to its synthetic counterfactual.

[38] We construct the synthetic counterfactual minimizing the Root Mean Squared Prediction Error including the population, real Gdp per capita and the past level of export on Gdp as control variable.

Figure 1.2 - Conmebol awards Copa América to Colombia in 1999: the effect on the Export to GDP ratio



Note: Control group includes South American countries with French legal origin.

In the second figure, we instead observe the positive effect of the Copa América hosting assignment in 1999, compared to all the South American countries with French legal origin system, even if the balancing property is worse.

1.6.3 Is the Mega-event bidding effect due solely to liberalization policies? The Wacziarg and Welch (2003) liberalization date

To assess if Mega-events effects are merely proxies for liberalizations, we add to Equation 1.1 the Wacziarg and Welch (2003) liberalization date, as a control variable. WW define the liberalization date based on the Sachs and Warner (1995) openness criteria[39]. They classify a country as closed if at least one of the following characteristics is displayed: (i) average tariff rates equal or greater than 40%; (ii) non-tariff barriers covering 40% or more of trade; (iii) a black market exchange rate depreciated at least 20% more than the official exchange rate; (iv) a state monopoly on major export; (v) a socialist

[39] Wacziarg and Welch (2003) extend the liberalization date previously calculated by Sachs and Warner (1995).

economic system. Every year, the Wacziarg-Welch variable assume a value equal to zero if the economy is coded as closed, 1 otherwise.

Merging the Head et al. (2010) dataset with the WW dataset, we are able to cover 146 countries, from 1950 to 2001. Aware of all the constraints of using a simple dummy to define if, and how much, a country is liberalized, we proceed to estimate the Mega-Events bidding effect, controlling for the WW liberalization date. Results are shown in Table 1.10.

Table 1.10 - Controlling the Mega-event bidding effect for the Wacziarg and Welch (2003) liberalization date

	ME effect, controlling or not for WW date			
	SOG hosting effect		ME bidding effect	
British legal Origin Countries	*0.023*	**-0.01**	*0.032*	**0.053**
French legal Origin Countries	*0.338***	**0.294****	*0.585***	**0.412****
German legal Origin Countries	*0.592**	**0.387***	*0.678****	**0.393****
Controlling for WW liberalization date	*N*	**Y**	*N*	**Y**

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Note: This table displays OLS estimate of the Mega Event Bidding effect controlling or not for the Wacziarg and Welch (2003) liberalization date. Estimates include importer, exporter and year fixed effects and standard errors are clustered at exporter, importer and year level. Control variables are the log of real GDP per capita and population of importer and exporter countries, log of distance between importer and exporters, log of the product of the two areas of the countries, a set of binary variables equal to one if the two countries share the same currency, official language, border, regional trade agreement, colonizer, legal system or are in a current colony relationship or have been in a former colony relationship or in the same country.

The positive effect on exports for the MEs bidding countries decreases from +79% to +51% for the French legal origin countries and from +97% to +48% for the German legal origin countries; no differences are found for Common law countries. The MEs bidding effect for civil law countries decreases but continue to be positive, large and significant. These results confirm that the Olympic and Mega-event effect are robust to some measure of liberalization policies, suggesting that some reputation theory could arise[40] or that the WW liberalization variable does not completely catch the liberalizing attitude of a country.

[40] We may think that bidding for a Mega-event increases the reputation of a country – to complete the bid for a ME implies some bargaining power and diplomatic capability – and spread over a signal of improved financial stability – not all of the countries are able to sustain the cost of a Mega-event. These two elements may be perceived by the investors as an improvement of the economic settings and bargaining power of the bidding country and the higher level of openness could

1.7 At the root of heterogeneity: the impact of trade tariffs and capital controls on trade

Using the Economic Freedom of the World report developed by the Frasier institute, we build a new dataset to test the impact of some regulatory variables on trade, trying to discover why different legal families exhibit heterogeneous effect on export after bidding for a Mega-event. The Economic Freedom of the World report includes some freedom and openness data for about 150 country, every five years from 1970 to 2005. We focus on the Tariffs and Capital controls variables. Theses variables are computed by the Frasier institute in a range from 0 to 10, where 10 is the best value in term of openness, meaning that tariffs or capital controls are completely missing. The tariffs variable includes revenue from trade taxes (% of traded value), mean tariff rate and standard deviation of tariff rates while the capital control variable is computed using several IMF data. The International Monetary Fund reports on up to 13 types of international capital controls: the zero-to-10 rating computed the Frasier Institute is the percentage of capital controls not levied as a share of the total number of capital controls listed, multiplied by 10. The within variation – timing variation – of the variables for all the countries is more than 50% of the overall standard deviation and is comparable among British, French and German legal origin countries. Values for the Tariffs and Capital Control variables are reported in Table 1.11.

be the result of an increased economic activity derived by a foreign and residential investment growth. Common law countries could exhibit some not significant impact since their economic setting is already close to the optima respect to the Civil law countries and they are not able to collect further investment compared to the new liberalized civil law countries.

Table 1.11 - Average values of Tariffs and Capital Controls for all the countries bidding for a Mega-event

	Tariffs		Capital Controls		Number of observation	
	Before ME bidding	After ME bidding	Before ME bidding	After ME bidding	Before ME bidding	After ME bidding
British legal origin countries	7.93 (1.2)	7.88 (1.31)	1.82 (0.47)	6.62 (2.84)	7	33
French legal origin countries	5.01 (2.50)	7.42 (2.07)	0.95 (1.03)	4.13 (3.27)	19	84
German legal origin	7.34 (0.93)	8.35 (0.88)	0.5 (1)	5.81 (3.31)	4	36
British=French (p-value)	0.007	0.167	0.024	0.00		
German=British (p-value)	0.403	0.091	0.047	0.279		
German=French (p-value)	0.051	0.002	0.477	0.015		

Average value and standard deviation in parenthesis

Note: This table reports Tariffs and Capital control indexes computed by the Frasier Institute (Economic Freedom of the World report). Variables range from 0 to 10, where 10 meaning that tariffs or capital controls are completely missing.

Referring only to the countries bidding for a Mega-event, we observe in Table 1.11 a general increase of the Tariffs variable[41] only for civil law countries and especially for French legal origin countries, whose score rises from 5 to 7.4. For common law countries, the Tariffs variable slightly decreases, from 7.93 to 7.88. This strengthens our idea that common law countries are a-priori more trade liberalized than civil law countries[42] (before bidding for a Mega-Event the Tariffs variable is equal to 7.93 for British and 5.01 for French). After the ME bidding, French and British legal origin countries reach a similar score of the Tariffs variable.

Higher openness for common law countries is still confirmed when we consider the capital control variable. Before to bid for a ME, common law countries exhibit the highest level of capital openness and, differently from the Tariffs variable, they maintain the highest level even after the bidding[43]. Moreover, the increase in capital openness is 50% bigger than for French legal origin countries and is comparable to the variation of German legal origin countries.

[41] In other word, tax revenue on trade, mean tariff rate and standard deviation of tariff rates drop.
[42] The German legal origin countries exhibit a score of the Tariffs variable between the French and British values, while after the bidding they display the lower tariffs of our sample, confirming their export oriented economic approach.
[43] Before the bidding, common law countries have a score for Capital control equal to 1.8 (0.95 for French civil law); after the bidding their score increases to 6.6 (4.1 for French civil law).

Tariffs obviously affect positively trade, decreasing fixed and variable cost of trade, while capital controls can have an ambiguous effect. Easing capital controls reduces the relative cost of FDI versus export; thus, firms may prefer FDIs over exports, conforming to the Helpman et al. (2004) model of trade. As a result, the impact of easing capital controls on the aggregates exports can be negative, especially for countries with an ex-ante high level of exporting firms. This seems to be confirmed by estimates of Table 1.12.

Table 1.12 - Tariffs and Capital Controls effects on trade

	(1)	(2)	(3)
Estimation Technique	OLS	OLS	OLS
Dependent Variable	$\ln(X_{ijt})$	$\ln(X_{ijt})$	$\ln(X_{ijt})$
Exporter capital control	-0.131*	-0.06	-0.125+
	(0.066)	(0.05)	(0.07)
Exporter Tariffs variable	0.211*	0.19**	0.207*
	(0.084)	(0.06)	(0.08)
Importer capital control	-0.171**	-0.11**	-0.171**
	(0.06)	(0.04)	(0.05)
Importer Tariffs variable	0.152*	0.151*	0.151**
	(0.07)	(0.07)	(0.06)
Year Fixed Effect	Y	Y	Y
Importer Fixed Effect	Y		Y
Exporter Fixed Effect	Y		
Importer-exporter fixed effect		Y	
Exporter linear trend			Y
S.E.	3-Way clustered	3-Way clustered	3-Way clustered
N	29,090	29,090	29,090
R-sq	0.78	0.90	0.78

*Standard errors in parentheses + p<0.10, * p<0.05, ** p<0.01, *** p<0.001*

Note: This table shows the impact of capital control and tariffs (computed by IMF every 5 year) on national trade flow. Standard errors are clustered at Exporter, Importer and Year level. Control variables are the log of real GDP per capita and population of importer and exporter countries, log of distance between importer and exporters, log of the product of the two areas of the countries, a set of binary variables equal to one if the two countries share the same currency, official language, border, regional trade agreement, colonizer, legal system or are in a current colony relationship or have been in a former colony relationship or in the same country.

Tariffs reductions are shown to boost the value of trade flow between two countries – 1-point reduction of the exporter Tariffs variable increases export of about 0.23% – while easing capital controls decreases the averages values of trade flows. If the importer removes one of the thirteen kinds of capital controls coded by IMF, trade flow shrinks on average by about -15% and slightly less considering the exporter, even if the effect is not robust to all the specification of the model. These results contribute to explain why legal families, influencing the countries' economic structure, influence the output of the ME bidding effect.

1.8 Conclusion

In this paper, we investigate several aspects of Olympics and Mega events on export. We prove that the Olympic effect is only a sub-element of the wider Mega-event effect and that an identification problem arises trying to separate the permanent effect among different kinds of Mega-events, because countries nearly always bid and host more than a single and unique event. We found robust evidence of an interaction effect between the legal families and the impact on exports of bidding, successfully or unsuccessfully, for a Summer Olympic or another Mega-event. Civil law countries exhibit a positive, strong and persistent effect after bidding for a Mega-event while for common law countries we report no significative effects. According to the model of Rose and Spiegel (2011), countries bidding for a Mega-event signal to private investors future liberalization policies that increase investments and exports. Nevertheless, common law countries seem not to take advantage from the liberalizations and the increased visibility following the bidding for a Mega-event. We propose a possible explanation for this heterogeneous effect introducing Trade tariff and Capital control variables. We show that common law countries have, ex-ante, lower trade tariffs that do not change after the bidding while capital controls decrease after the bid. On the other hand, civil law countries, especially French legal origin countries, reduce trade tariffs to a level close to the common law countries and increase capital openness but at a lower level than common law countries. Capital openness has an ambiguous effect on export because, in an export versus FDI model of trade with heterogeneous firms (Helpman et al., 2004), reducing the cost of FDI may push a greater number of firm toward FDI instead of export. This effect is proved in our empirical analysis: capital control liberalization affects negatively trade flows between two countries while the impact of lowering tariffs is positive. Legal family, influencing a-priori the countries' economic and regulatory structure, are therefore influencing the Mega-event effect on trade.

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Appendix 1

Table 1.A - Countries bidding for or hosting a Summer Olympics, World Cup or Expo

Country	1948	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	2006
British legal origin countries																																																											
AUS									HOST SOG																																				BID SOG				BID SOG				HOST SOG						
CAN																				HOST EXPO					BID SOG				HOST SOG										BID WC										BID SOG										
GBR																			HOST WC																								BID WC		BID SOG								BID SOG						BID WC
USA	BID SOG				BID SOG				BID SOG				BID SOG				BID SOG				BID SOG				BID SOG				BID SOG				BID SOG				HOST SOG		BID WC								HOST V		HOST SOG										
ZAF																																																									BID SO(		BID WC
French legal origin countries																																																											
ARG									BID SOG		BID WC				BID WC						BID SOG		BID WC								HOST WC																										BID SOG		
BEL											HOST EXPO		BID SOG				BID SOG																																										
BRA			HOST WC																																												BID WC												
CHL											BID WC				HOST WC																																BID WC												
COL																																							BID WC																				
ESP																			BID WC						BID SOG		BID WC								HOST WC										HOST SOG / HOST EXPO														
FRA																					BID SOG																								BID SOG						HOST WC								
GRC																																											BID WC						BID SOG								HOST SOG		
ITA													HOST SOG																														HOST WC														BID SOG		
MAR																																															BID WC				BID WC								BID WC
MEX									BID SOG		BID WC										HOST SOG		HOST WC								BID WC								HOST WC																BID WC				
NLD					BID SOG																																								BID SOG														
TUR																																																					BID SOG						
German legal origin countries																																																											
AUT																	BID SOG																																										
CHE	BID SOG						HOST WC						BID SOG																																						BID WC								
GER															BID WC				BID WC						HOST SO		HOST WC								BID WC																		BID SOG / HOST EXPO						HOST WC
HUN													BID SOG																																														
JPN													BID SOG				HOST SOG						HOST EXPO																		BID SOG																		
KOR																																									HOST SOG														HOST WC				
CHN																																																					BID SOG						

List of countries that have bid or host for a World Cup (WC), Summer Olympic Games (SOG) or Universal Exhibition (EXPO). Bidder countries are countries that have bid for the specific event of year t but were not award winner

Table 1.B: Summer Olympic Bidding countries tend to host or bid for other Mega-events

Country	Legal origin system	Host SOG	Bid SOG	Bid/host for others MEs before SOG bidding	Bid/host for others MEs after SOG bidding
AUS	British	Y	Y		
CAN	British	Y	Y	Y	Y
ESP	French	Y	Y	Y	Y
GER	German	Y	Y	Y	Y
CHE	German		Y		Y
GRC	French	Y	Y	Y	Y
ITA	French	Y	Y		Y
JPN	German	Y	Y		Y
KOR	German	Y	Y		Y
MEX	French	Y	Y		Y
USA	British	Y	Y		Y
NLD	French		Y		
ARG	French		Y		Y
BEL	French		Y	Y	Y
HUN	German		Y		Y
AUT	German		Y		
FRA	French		Y		Y
GBR	British		Y	Y	Y
CHN	German		Y		
TUR	French		Y		
ZAF	British		Y		Y

List of Summer Olympics (SOG) bidding countries that also bid or host for a World Cup or Universal Exhibition.

Chapter 2: Bargaining power and the currency denomination of trade[44].

Davide Arioldi, Mark David Witte[45] and Luigi Ventura[46]

ABSTRACT

The currency denomination of trade has been shown in many recent contributions to have far reaching effects on different macroeconomic phenomena, such as inflation and the transmission of shocks. In this work, we apply a novel index of bargaining power, which stresses the network dimension of trade, and brings fresh evidence as to the relevance of bargaining power and negotiation in the choice of invoicing currency, which has received relatively little attention in the empirical literature, so far. By using a highly disaggregated, almost transaction level, dataset of Italian imports and exports, we contribute to the existing empirical literature by documenting a very significant impact of bargaining power over the choice of invoicing currency.

Keywords: currency invoicing, bargaining power, network structure, market shares.

JEL Classification: C78, F12, F41.

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[44] This chapter is based on Arioldi et al. (2018), Bargaining power and the currency denomination of trade. *To be submitted to an international economic journal.*

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2.1 Introduction

In this study, we provide evidence of a bargaining process for the currency invoicing determination. We adopt a new index of sector importer and exporter bargaining power (in directed and weighted network) as a proxy for the outside options of the players involved in the currency negotiation. Our aim is to understand whether the exporter and importer's sector bargaining power (defined by the trade communication structure) have a role in the currency choice.

We add to the literature by showing that the currency determination is a complex process where both importer and exporter characteristics play a role. In doing so, we move well beyond the simple use of the sector market share as we consider the structure of trade with the other trading partners. We argue that controlling only for the global country sector market share (defined as the ratio between the country export/import of a commodity over the global export/import of that commodity), as is standard in the literature, previous works do not fully account for the asymmetries induced by the trade structure that restricts pairwise meetings. By resorting to this new index, we will account for the fact that countries do not always enjoy a free and costless access to every market in every country as well as for the separation of national markets due to different local rules and commercial agreements.

With highly disaggregated Italian export and import customs data for the year 2010, we document a significant impact on the invoice currency decision for our bargaining power index. Importers (exporters) with greater bargaining power tend to price their traded goods in the local (producer) currencies. This result is robust to the inclusion of geographical characteristics and many other control variables, as the global sector market shares. As discussed in the literature, the invoicing currency decision seems to depend not only on the characteristics of the exporter, but also on the importer's features (conditioned to their positions on the network) giving further support to the existence of some bargaining power for the currency denomination of trade[47].

2.2 Literature

The invoicing currency has been shown by many scholars to play a critical role in the new open economy macroeconomics literature. The exchange rate volatility (Devereux and Engel, 2002) and the

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[47] See for example Goldberg and Tille (2013) and Devereux, Dong and Tomlin (2017).

impact of the exchange rate on the economy are influenced by the currency denomination of trade (Engel, 1999, Chari et al. 2002, Devereux and Engel, 2003, Engel, 2003, and Obstfeld, 2002). Invoicing in the producer (PCP) or importer (LCP) currency influences the pass-through of exchange rate changes to the import price. As a result, see Corsetti and Pesenti (2005), the optimal monetary policy is different based on the degree of pass-through[48], and thus on the invoicing regime.

From a microeconomic perspective, many theoretical models have been proposed to explain the firm's currency invoicing decision and their implication at a macroeconomic level. Bacchetta and Van Wincoop (2005) are among the first to underline the role of strategic interactions among firms in the invoicing currency decision. They find that the level of competition faced by firms in the foreign market, as reflected by market share and product differentiation, has direct implications in the choice of invoicing currency. In the Bacchetta and Van Wincoop (2005) general equilibrium model, the producer sets univocally the invoicing currency in the producer (exporting) or local (importing) currency, based on its profit maximization[49]. The previous authors highlight the importance of strategic interactions among firms in the process of the currency denomination decision by finding that exporters with greater industry market shares and producing differentiated goods are more likely to price in their currency. In the Bacchetta and van Wincoop (2005) theoretical model, the choice of invoicing currency rests solely with the exporter, who consider the price-elasticity of the importer's demand in choosing the invoicing currency.

The assumption of a unilateral setting of the invoicing currency was criticized in the empirical work of Friberg and Wilander (2008) and Takatoshi et al. (2010). The formers survey a representative panel of Swedish firms to understand the determinants of the currency denomination of trade. One of the main findings is that both price and invoicing currency are determined by a process of negotiation between producer and customer. Transaction size, the exporting market dimension, product differentiation and firm's dimension all play a significant role in the invoicing currency choice while the competitors' currency denomination decision, the availability of financial instruments and exchange rate transaction costs are deemed unimportant[50]. Takatoshi et al. (2010), surveying Japanese firms, highlights

[48] If all the exporting firms use PCP then the Corsetti and Pesenti (2005) model simplifies into a dynamic version of Obstfeld and Rogoff (2000) model and the optimal monetary policy replicates the flexible-price equilibrium while if the price is set in the local (importer) currency, then the national welfare is maximized when exporters' revenues are stabilized in their own currencies and a fixed exchange rate is preferred.

[49] One of their main findings was that greater exporter market share and more differentiated goods increase the likelihood of PCP.

[50] Some of their results do not seem to be supported by current empirical evidences (Witte and Ventura, 2016).

the role of the structure of the firm's supply chain and the destination of the firm's final sales in the invoicing currency decision. According to the previous theoretical literature, they find that local currency invoicing is prevalent in exports to developed countries, where the importers face severe competition in the local markets. However, Japanese firms that produce highly differentiated products or have a dominant share in global markets tend to denominate in yen (producer currency pricing), even in exports to developed countries. Another finding is related to the use of the vehicle currency: Japanese firms that have shifted production to Asian countries invoice their products to these Asian countries in US dollars as long as the final destination market is United States.

Goldberg and Tille (2013) propose an exporter-importer bargaining model of trade, where importers and exporters negotiate over the allocation of exchange rate risk through the choice of both the price level and the invoicing currency, taking into account the outside option of the counterpart. The implications of this model are complex as there is no closed solution of the system. In this setting, the share of specific exporters and importers in each other's total profits has a substantial impact on effective bargaining weights, prices, and exchange rate exposure. This impact is not limited to specific exporter-importer pairs but also affects the aggregate values of prices and exposure. Goldberg and Tille (2016) confirm empirically that importer concentration and transaction size are important determinants of the currency denomination choice.

Devereux et al. (2017) give another contribution to this discussion on invoicing currency decisions. They developed a model of monopolistic competition with heterogeneous firms, finding that exchange rate pass-through and importer currency invoicing is non-monotonic, but possesses a U-shaped relationship with the export market share and monotonically increase in the importing firms' market share. These theoretical implications are supported by some empirical findings on a Canadian import dataset and confirm the role of importer characteristics on the currency invoicing decision.

Alternative explanations of invoicing currency decision are proposed by Engel (2006) and Gopinah et al. (2010). The former predicts that an exporting firm is more likely to invoice in its currency if the currency has a lower variance to price shock. If export price cannot be adjusted in response to shocks, it should be set in the local-currency price. The latter develop an endogenous currency choice model, where firms that adjust prices less frequently are more likely to price in the producer currency.

This work is also related to the findings of Auer and Schoenle (2016). Firms' reactions to changes in competitor prices are equally important than changes in their own cost for explaining the industry wide equilibrium pass-through rate. Variations of the competitor prices are intuitively captured by changes in the importer market share and should be probably related to the invoicing currency. Other empirical works underline the role of macroeconomic stability on the currency invoicing decision, as Devereux et al. (2004), or the impact of transaction costs in exchange rate market, as in Portes and Rey (1998) or Devereux and Shi (2013). More determinants of the invoicing currency are found at the micro-level, as the "coalescing effect" (Goldberg and Tille, 2008) or the firm "information effect" (Takatoshi et al., 2010, Friberg and Wilander, 2008).

2.3 Bargaining for the invoicing currency

2.3.1 A mixture strategy equilibrium for the currency choice

In a simple framework, as described by Viaene and De Vries (1992), where the home currencies are the preferred monetary habitats for both parties in the transaction and the traders hedge to cover their currency risks, the exporter and the importer have opposite preferences relative to the invoicing currency decision. Usually, invoicing in a foreign currency is partially suboptimal; firms and consumers try to set the invoicing currency in their own currencies and they can accept or reject the partner's proposal, even terminating the negotiation. In this classical bargaining process, if the partner stops the negotiation, the two players may propose another offer to another firm or consumer in the same trading country or to a different player located in a different country[51]; likewise, players can invite bids from other firms or consumers. The relative value of these outside options are captured (proxied) by our bargaining indices. These indices are a function of the ex-ante payoff that the players can achieve conditioned by their positions of the network[52]. They express the probability to be chosen or to be the chooser in a new negotiation, when the timing discount factor (that express the preference to delay the agreement) is equal

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[51] Given the lack of complete producer-consumer network microdata, we are forced to use national sector data; we therefore simplify this setting assuming to have only one monopolistic firm or consumer for each traded good in each country. Alternatively, we can ease this restriction considering that oligopolistic firms and consumers in the same sector coordinate their choices. Consequently, the players chose a respondent in another country.

[52] Theoretically, in a bargaining process, when two players have the possibility of opting out, the Rubinstein's equilibrium (Rubinstein, 1982) could be broken (Ponsatí and Sákovics, 1996) deviating from the Outside Option Principle (Binmore et al., 1989). Consequently, the bargaining outcome depends on the size of the outside options, as showed by Cunyat (1998), Li et al. (2004) or Manzini and Manotti (2004), and the relative bargaining power increases in the own outside option and decreases in the partner's outside option.

to 1, as we will show in the next chapter. Within this framework, firms and consumers contact different counterparts and bargain with them in order to obtain their best solutions. Another assumption of this model is that total firm production is limited in the short run. The invoicing currency emerges as the output of the bargaining process.

Transactions between each pair of importer-exporter can be priced in the producer, local or vehicle currency (usually USD). Exporter and importer bargain over the currency determination and can terminate the negotiation (opt out) at any moment. A feasible equilibrium solution to this class of bargaining problems is proposed by Kalai and Smorodinsky (1975) that substitute the condition of independence of irrelevant alternatives of the Nash (1950) bargaining equilibrium with a resource monotonicity assumption[53], holding constants all other axioms[54]. An obvious condition is that the utility of the disagreement must not be greater than the utility of the agreements, for both players[55].

The KS solution to the bargaining problem is the maximal utility point equalizing the relative gain of the players:

$$\frac{U_i - d_i}{U_i^{max} - d_i} = \frac{U_j - d_j}{U_j^{max} - d_j} \tag{2.1}$$

Where $U_{i,j}$ is the utility level of player i or j, $d_{i,j}$ is the disagreement utility, and $U_{i,j}^{max}$ is the maximum utility level that player i or j can achieve.

The two players maximize their utilities $(U_{i,j})$ with a mixture strategy, given that the transaction can be settled in producer, local or vehicle currency, solving the system described in Equation 2.2.

$$\max \frac{U_i - d_i}{U_i^{max} - d_i} = \frac{U_j - d_j}{U_j^{max} - d_j}$$

$$U_i = xU_i^{PCP} + yU_i^{LCP} + zU_i^{VCP}$$

$$U_j = xU_j^{PCP} + yU_j^{LCP} + zU_j^{VCP}$$

[53] As stated by Kalai and Smorodinsky (1975) "If, for every utility level that player 1 may demand, the maximum feasible utility level that player 2 can simultaneously reach is increased, then the utility level assigned to player 2 according to the solution should also be increased".
[54] Pareto optimality of the returned agreement, symmetry, invariant to affine transformation.
[55] This assumption is realistic in our framework, given that the cost to delay (the discount factor) is in a range between zero and one.

s.t. $x + y + z = 1$ and $x, y, z \geq 0$ (2.2)

Where $U_{i,j}^{PCP,LCP,VCP}$ is the utility of player *i* or *j* when the transaction is Producer Currency Priced (PCP), Local Currency Priced (LCP)[56] or Vehicle Currency Priced (VCP), $d_{i,j}$ is the utility of opting out (that is a function of our bargaining index, equivalent to the probability to be selected as a bargainer in the network) and *x, y, z* are the shares of time option PCP, LCP or VCP are chosen.

Supposing the utility of player *i* and *j* conditioned to choose PCP, LCP, VCP is distributed as in Table 2.1, panel *a* and *c*, we can derive how much of the time exporter and importer pair will choose to price the good in the producer, local or vehicle currency. Results are in Table 2.1, panel *b* and *d*. It is straightforward to note that, without imposing some particular structure to the payoff, it is possible to have multiple equilibria[57].

[56] Local Currency is the consumer's currency.

[57] For example, in Table 1, panel b, with $(d_i; d_j) = (30; 0), (15; 10), (10; 10)$ Eq. 2.14 is even solved for x,y,z=(50%,50%,0), (18%,82%,0%), (39%,33%,28%) respectively.

Table 2.1 - Equilibrium strategy of players i and j to price the traded good in the Producer (PCP), Consumer (LCP) or Vehicle (VCP) currency

a) Utility of Player i and j conditioned to choose PCP, LCP or VCP, sample a.

	$U_{i,j}^{PCP}$	$U_{i,j}^{VCP}$	$U_{i,j}^{LCP}$	$U(d_{i,j})$
Player i	50	40	30	d_i
Player j	40	50	60	d_j

b) Some optimal (non-unique) mixture strategy for different outside option, sample a.

$(d_i; d_j) =$	(30;0)	(15;10)	(10;10)	(10;15)	(0;30)
x=%pcp	75% (50%)	59% (42%)	11% (39%)	6% (42%)	37.5% (21%)
y=%vcp	0% (50%)	0% (33%)	89% (33%)	94% (21%)	0% (33%)
z=%lcp	25% (0%)	41% (25%)	0% (28%)	0% (36%)	62.5% (46%)
U_i	45	41.8	41.1	40.6	37.5
U_j	45	48.2	48.9	49.4	52.5

c) Utility of Player i and j conditioned to choose PCP, LCP or VCP, sample b.

	$U_{i,j}^{PCP}$	$U_{i,j}^{VCP}$	$U_{i,j}^{LCP}$	$U(d_{i,j})$
Player i	55	45	40	d_i
Player j	40	45	55	d_j

d) Optimal mixture strategy for different outside option, sample b.

$(d_i; d_j) =$	(30;0)	(15;10)	(10;10)	(10;15)	(0;30)
x=%pcp	69%	53%	50%	47%	31%
y=%vcp	0%	0%	0%	0%	0%
z=%lcp	31%	47%	50%	53%	69%
U_i	50.3	47.9	45	47.1	44.7
U_j	44.7	47.1	45	47.9	50.3

Note: Tables b and d show the optimal mixture strategy conditioned to different values of the outside options $U(d_i, d_j)$.

The existence of a unique solution is guaranteed if both players can not choose equivalent dominant strategies. Conversely, multiple solutions are possible if, for both players i and j, $U_{i,j}^a = U_{i,j}^b = U_{i,j}^c$ or $\frac{(U_{i,j}^a + U_{i,j}^c)}{2} = U_{i,j}^b$ with $U_i^a > U_i^b > U_i^c$ and $U_j^c > U_j^b > U_j^a$, $\forall\, a, b, c \in$ S, where S is the set of choices. Excluding these special cases[58], the share of time that the player's best choice is selected is monotone and positively correlated with her own outside option while decreases with the other player's outside option. We will test this hypothesis in the empirical specification, using our bargaining power index, which express the possibility to be selected in the trade network, as a proxy for the outside option[59].

[58] Without obviously considering the unique dominant strategy for both players.

[59] $d_{i,j} = E(U_{i,j}) = f(pr_{i,j}, U_{k \neq i,j})$, where $E(U_{i,j})$ is the expected utility of player i or j excluding the actual counterparty and $pr_{i,j}$ the probability to be selected in the network.

2.3.2 Bargaining power in trade network

Many authors (among all Kamps, 2006, Goldberg and Tille, 2008, Devereux et al., 2017, Goldberg et al., 2016, Fennstra et al., 1996) have proved that global sector market shares[60] are key elements in the rate of pass-through and invoicing currency literature. The currency of invoicing has been shown to be endogenously or exogenously determined based on some features of importer and exporter or on the relationship between the currency and the local cost. Far too little attention has been devoted to the role of asymmetries induced by the trade network that restricts pairwise meeting. As in cooperative game theory, communication restrictions affect choices and economic outputs. Calvò-Armengol and Jackson (2004) have proved how network connections shape the labour market outcomes and, in turn, are shaped by them; Chaney (2014) has offered a novel theory of trade frictions, where firms export only into market where they have a contact, searching new customers using their existing network of contacts.

In this work, we treat the communication network as given (exogenous determined) computing an index of bargaining power similarly to Calvò-Armengol (2001). Our communication linkages are defined by the trading structure, which is a weighted and directed network. We consider an adaption of the Rubinstein-Stähl alternating offers game as in Rubinstein (1982) and Stähl (1972). In this game, pairing members creates value, which must be divided between them. One partner (the proponent) randomly selects an individual among her set of connected partners (the respondent) and makes her a splitting offer. The respondent partner can accept or reject. In case of rejection, the respondent becomes the new proposer and her respondent is again randomly selected among her connected partners. The assumptions of the model are that only players that are in direct contact with each other can negotiate together, simultaneous offers to two different neighbors are not possible and the pairs of neighbors that bargain at every round are randomly[61] chosen within the network constraints. Trading network depicts therefore the set of bargaining possibilities. The unique stationary subgame perfect equilibrium is reached when the proposer concedes to the respondent the discounted expected payoff that can be achieved by the respondent if she rejects the proposal. At equilibrium, players are indifferent between accepting their share as respondent and acting as a delayed proposer. If the payout to split is equal to one and $(\alpha_{ij}; 1 - \alpha_{ji})$ is the one-cake proposal made by player i to player j, the equilibrium share is equal to the following:

[60] Defined as the ratio between the exported or imported good for a country or firms and the total world export or import for that good.
[61] Bargainer selection is not considered here as a strategic issue.

$$1 - \alpha_{ij} = \delta_j \sum_k \frac{w_{jk}}{W_j^{Out}} \alpha_{jk} \tag{2.3}$$

Where $1 - \alpha_{ij}$ is the payout assigned to the respondent j by the proposer i[62], δ_j is the time discount factor $\delta_i \,\epsilon(0,1)$, $\frac{w_{jk}}{W_j^{Out}}$ is the weight of the link from *j* to *k* over the sum of the outward link of *j* and α_{jk} is the payout that player *j* assigned to each k[63].

As shown by Calvò-Armengol (2001, 2002), when population is homogeneous in time preferences with a common discount factor and the payout to split add to 1 ($\alpha_{ij} + \alpha_{ji} = 1$), at equilibrium all players make the standard division proposal independently by their structure position, equal to $\left(\frac{1}{1+\delta}, \frac{\delta}{1+\delta}\right)$. When the discount factor is equal to 1 the standard Rubinstein-Stähl partition is recovered.

According to the framework of our play, proposers and associates are drawn randomly, with a uniform distribution. All players have the same probability to be chosen as proponent and respondent are treated equally. Given the communication network, it is easy to compute the expected payoff for each member of the network. These individual payoffs define an allocation rule Y_i describing the ex-ante distribution of payoffs equal to the unique (stationary) expected equilibrium. The allocation rule[64] for each member *i* is defined as in Arioldi (2018) by the following equations[65].

$$Y_i(outward) = \frac{1}{N_{outward}} \sum_j \frac{w_{ij}}{W_i^{out}} \alpha_{ij} + \frac{1}{N_{inward}} \sum_j \frac{w_{ij}}{W_j^{in}} (1 - \alpha_{ji}) \tag{2.4}$$

$$Y_i(inward) = \frac{1}{N_{inward}} \sum_j \frac{w_{ji}}{W_i^{in}} \alpha_{ij} + \frac{1}{N_{outward}} \sum_j \frac{w_{ji}}{W_j^{out}} (1 - \alpha_{ji}) \tag{2.5}$$

---

[62] α_{ij} is the payout of player *i*.

[63] The payout proposed by *i* to *j* is equal to the weighted average of the payoffs that *j* may obtain acting as a promoter after rejecting the proposal of *i*. In a trade network, $\frac{w_{jk}}{W_j^{out}}$ is equal to $\frac{x_{jk}}{Total\ Export_j}$, where x_{jk} is the trade flow from country *j* to country *k*.

[64] As in Calvo Armengol (2001), ex ante payoffs, given by the expected equilibrium partition of the bargaining game with random selection of the negotiators, define the allocation rule.

[65] More generally, assuming *i* selects *j* as co-bargainer with probability p, the allocation rule is $Y_i = \left[\sum_j q_i\, p_{ij} \alpha_{ij} + q_j\, p_{ji} (1 - \alpha_{ij})\right]$ where q is the probability to be selected as proposer.

Where w_{ij} is the link weight from i to j, $W^{in,out}$ the sum of inward or outward weights and N the total number of inwards or outwards players. The ratio $1/N_{inward,outward}$ captures the probability to be chosen as proposer or respondent. This allocation rule is efficient given that $\sum_i Y_i = 1$.

Supposing that the communication network corresponds to the trade network (all the players are in contact with their trading partners in the network) and assuming that, in the trade network, the outward player is the producer (or the exporter) and the inward player the consumer (or the importer) we can derive Equations 2.4 and 2.5 for the player i as

$$Y_i(producer) = \frac{1}{N_{producers}}\sum_j \frac{x_{ij}}{Total\ Export_i}\alpha_{ij} + \frac{1}{N_{consumers}}\sum_j \frac{x_{ij}}{Total\ Import_j}(1-\alpha_{ji}) \qquad (2.6)$$

$$Y_i(consumer) = \frac{1}{N_{consumers}}\sum_j \frac{x_{ji}}{Total\ Import_i}\alpha_{ij} + \frac{1}{N_{producers}}\sum_j \frac{x_{ji}}{Total\ Export_j}(1-\alpha_{ji}) \qquad (2.7)$$

Where N is the total number of producers or consumers (or exporters and importers) included in the trade network and x_{ij} is the trade flows from player (country) i to player (country) j. The first adding terms on the right of Equations 2.6 and 2.7 represent the remunerations of player i acting as a proposer and they are equal to the expected flow of payoffs that member i receives starting as a proposer, when is considered as producer or consumer respectively. The second right terms of Equations 2.4 and 2.5 are instead the expected flows member i obtains as respondent. They capture the expected remuneration that player i collects collaborating with the proposers.

Plugging the subgame perfect equilibrium shares when players are homogeneous in time preferences (the standard $\frac{1}{1+\delta}, \frac{\delta}{1+\delta}$ cake division) in Equations 2.6 and 2.7, we obtain a measure of the ex-ante payoff expected by player i depending on the player's network position. Setting the discount factor δ equal to 1[66], and assuming to have only one producer (monopolistic firm) and one consumer in each country-sector, we can derive the following allocation rules[67] corresponding to the asymmetric Nash bargaining solution:

$$\phi_i(exporter) = \frac{1}{2}\left(\frac{1}{N_{exporters}} + \frac{1}{N_{importers}}\sum_j \frac{x_{ij}}{Total\ Import_j}\right) \qquad (2.8)$$

[66] We focus on the special case where players are indifferent to postpone the agreement (δ is the cost to delay); in this case, the bargaining outcome is independent of the identity of the first proposer.

[67] $\sum_j \frac{x_{ji}}{Total\ Import_i}\frac{1}{1+\delta}$ and $\sum_j \frac{x_{ij}}{Total\ Export_i}\frac{1}{1+\delta}$ are equal to $\frac{1}{1+\delta}$, given that the payoff $\frac{1}{1+\delta}$ is identical for all j.

$$\phi_i(importer) = \frac{1}{2}\left(\frac{1}{N_{importers}} + \frac{1}{N_{exporters}}\sum_j \frac{x_{ji}}{Total\ Export_j}\right) \tag{2.9}$$

Where $N_{exporters,importers}$ is the number of countries exporting and importing the good and $\phi_i(exporter)$, $\phi_i(importer)$ is the bargaining power as exporter or importer of country *i* for the same good. These indexes capture the asymmetries induced by the geometry of trade network and are related to the number and weights of the link of each player. Moreover, these indexes, derived from the allocation rule in the special case of homogeneous preference with discounting factor equal to 1, are equivalent to the probability of the player *i* to be selected as proposer or respondent, given the communication network.

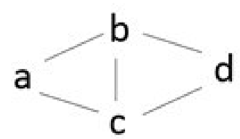
We illustrate in Figure 2.1 two examples of trade networks when the number of producing players (the exporters) equals the number of consumer players (the importers) and the two previous equations simplify into Equations 2.10 and 2.11:

$$\phi_i(exporter) = \frac{1}{2N}\left(1 + \sum_j \frac{x_{ij}}{Total\ Import_j}\right) \tag{2.10}$$

$$\phi_i(importer) = \frac{1}{2N}\left(1 + \sum_j \frac{x_{ji}}{Total\ Export_j}\right) \tag{2.11}$$

Figure 2.1 - Hypothetical Network Structure and Exporter-Importer Bargaining Power Index computation.

A) Trade network with high variable trading cost

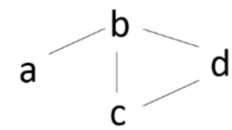


Trading matrix

		Country j a	b	c	d	$Total\ Export_i$
Country i	a	0	30	30	0	60
	b	20	0	20	20	60
	c	20	20	0	20	60
	d	0	30	30	0	60
$Total\ Import_j$		40	80	80	40	240

Country	ϕ_i (Exp)	Exporter MS	ϕ_i (Imp)	Importer MS
a	0.219	0.250	0.208	0.167
b	0.281	0.250	0.292	0.333
c	0.281	0.250	0.292	0.333
d	0.219	0.250	0.208	0.167

B) Trade network with high variable trading cost and high fixed cost to trade between a and c



Trading matrix

		Country j a	b	c	d	$Total\ Export_i$
Country i	a	0	100	0	0	100
	b	50	0	25	25	100
	c	0	50	0	50	100
	d	0	50	50	0	100
$Total\ Import_j$		50	200	75	75	400

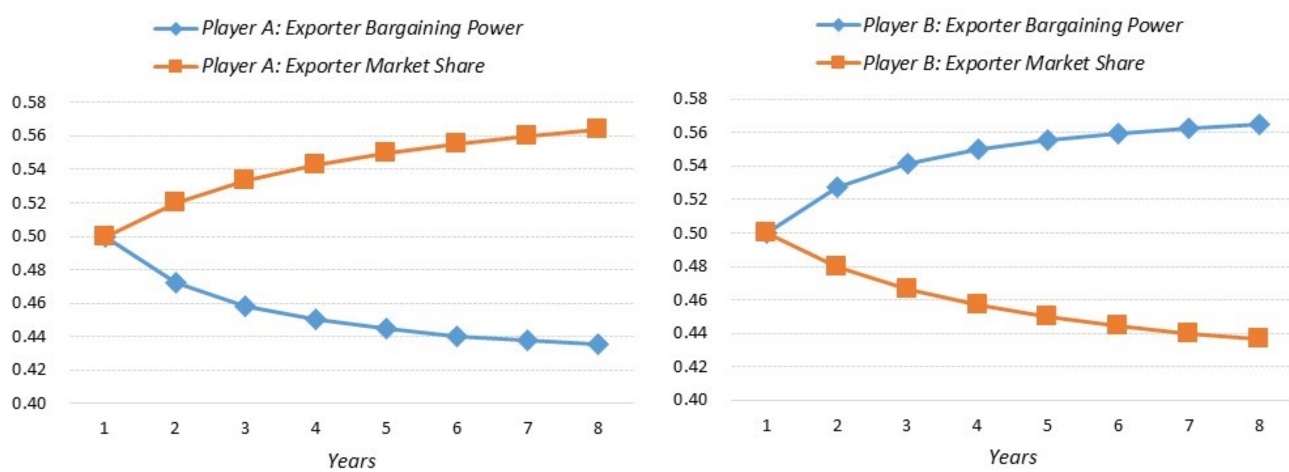
Country	ϕ_i (Exp)	Exporter MS	ϕ_i (Imp)	Importer MS
a	0.188	0.250	0.188	0.125
b	0.333	0.250	0.375	0.500
c	0.240	0.250	0.219	0.188
d	0.240	0.250	0.219	0.188

Note: This figure shows two examples of trading networks. The lines of the two graphs represent undirected links while trading flows between countries i and j are displayed in the trading matrix. Exporter and Importer MS are the total export and import market shares of country i computed using the trading matrix and $\phi_i(Exp)$, $\phi_i(Imp)$ *are our bargaining indices derived respectively from Equations 2.8 and 2.9, respectively.*

In panel *A* of Figure 2.1, high variable trading cost prevents countries *a* and *d* from trading. Total exporter market shares (Exporter MS) are equal for all the countries included in the trade network and do not capture the asymmetry of the trade structure. With our index, countries *b* and *c* are shown to have a high bargaining power, given that they are in contact with more trading partners. Similar considerations apply to the players in the trade network of Figure 2.1, panel B. Export market shares are not able to measure the impact of trade network asymmetry, which is captured by our index. Another informative example is when exporting countries have the same market shares in each importing country but the size of importers is different. With this particular specification, our index gets the same value for all the exporters while using the global exporter market share the smallest country[68] exhibits the highest value.

In order to stress the difference between our bargaining power index and the global market share, we provide a further example in a dynamic setting. We describe an extreme situation where the two indexes diverge. We assume to have 9 players in the trade network and, to simplify, only two exporters (or producers). In the first year, player *a* (*b*) exports to *b* (*a*) goods for a total value of 100. At each following steps, the two players pursue different strategies: player *a* increases export in its first market by 20 and exports 10 in a new market; player *b* does not increase previous exports but sell goods for an amount equal to 20 in the same new market of player *a*. In this specific setting, as shown in figure 2.2, player *a* increases its global market share while the bargaining power index decreases. The situation is reversed for player *b*.

Figure 2.2 - Exporter Sector Bargaining Power and Global Market Share in a dynamic setting.

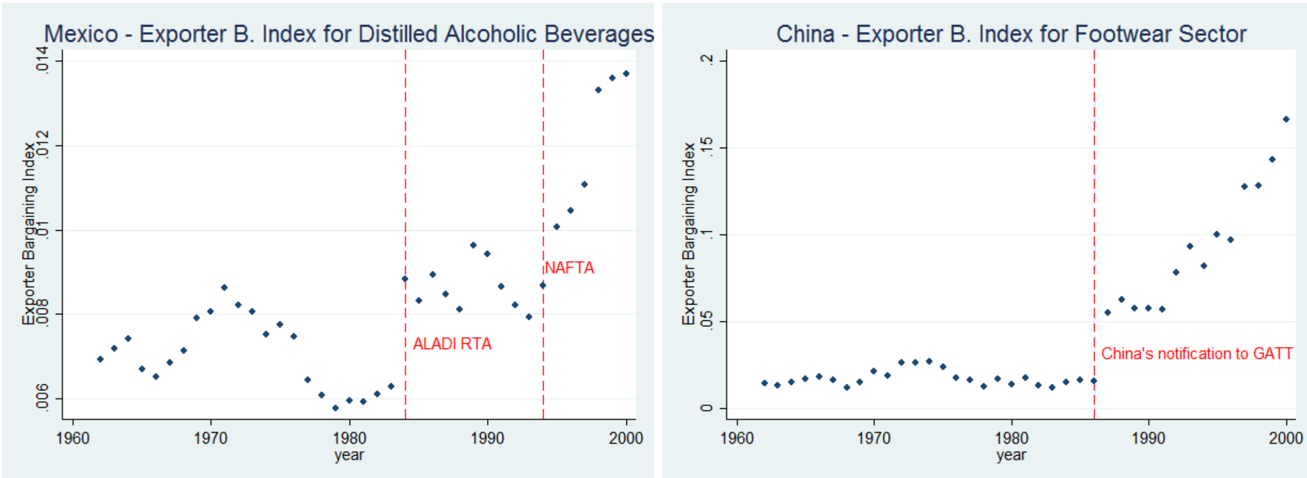


Note: Market share and bargaining power index in a dynamic setting. Every new year, player a increases export in its first market by 20 and exports 10 in a new market while player b does not increase previous exports but sell goods for an amount equal to 20 in the same new market of player a.

Some empirical examples of our index computation are shown in Figure 2.3. We observe the value of the index computed in Equation 2.8 for Mexico and China, for Alcoholic beverages and Footwear exports respectively. We clearly observe the positive relationship between trade liberalizations and our index, in sectors where the two countries are supposed to have comparative advantages.

[68] The country importing less than the others do.

Figure 2.3 - Exporter Sector Bargaining Power Index after trade liberalization



Note: We observe a positive relationship between trade liberalization in Mexico and China and our sector bargaining power index, computed in Equation 2.8, for two different sectors. Trade agreements reduce fixed and variable costs to export changing the trade structure.

Furthermore, we test the correlation and explained variance (R-Squared from OLS regression) between our bargaining network index and several measures of network centrality (Google PageRank or Eigenvector centrality) and connectivity (in and out-degree). Although some of the correlations between our index and centrality measures exhibit relatively high values (in a range between 0.2 and 0.7, as shown in Appendix 2.A), we do not observe a systematic relationship between the two measures. This suggests that the information included in our index is substantially different from other measures of centrality or connectivity.

2.3.3 Factors underpinning bargaining power, in a theoretical framework.

Following Melitz and Redding (2014), we can derive aggregate exporting market shares in the importing market as:

$$\Lambda_{ij} = \frac{x_{ij}}{Total\ Import_j} = \frac{\frac{L_i}{f_{E(i)}}\tau_{ij}^{-k} w_i^{\left(1-\frac{k\sigma}{1-\sigma}\right)} f_{ij}^{1-\frac{k}{1-\sigma}}}{\sum_v \frac{L_v}{f_{E(v)}}\tau_{vj}^{-k} w_v^{\left(1-\frac{k\sigma}{1-\sigma}\right)} f_{vj}^{1-\frac{k}{1-\sigma}}} \qquad (2.12)$$

where L_i is the labour input supply for the exporting country *i*, $f_{E(i)}$ is the sunk entry cost that a firm pays before to produce in country *i* with a productivity φ drawn from a Pareto distribution $g(\varphi) = k\varphi_{min}^{k}\varphi^{-(k+1)}$, $\tau_{ij}$is the variable trading cost (iceberg cost, greater than one) paid to send a specific good from country *i* to country *j*, w_i the wage level in country *i*, f_{ij} the fixed cost to export the good from *i* to *j*, σ the elasticity of substitution among the goods and *V* are all the countries exporting to *j*.

Plugging the market share derived in Equation 2.12 in our Exporter bargaining index of Equation 2.8 we have:

$$\phi_i(exporter) = \frac{1}{2}\left(\frac{1}{N_{exp}} + \frac{1}{N_{imp}}\sum_j \frac{\frac{L_i}{f_{E(i)}}\tau_{ij}^{-k} w_i^{\left(1-\frac{k\sigma}{1-\sigma}\right)} f_{ij}^{1-\frac{k}{1-\sigma}}}{\sum_v \frac{L_v}{f_{E(v)}}\tau_{vj}^{-k} w_v^{\left(1-\frac{k\sigma}{1-\sigma}\right)} f_{vj}^{1-\frac{k}{1-\sigma}}}\right) \quad (2.13)$$

The number of exporting countries, N_{exp}, is the summation of all countries where at least one firm has a productivity greater than the minimum productivity cutoff[69] among all importing markets in the network, $max\varphi_i \geq min_j(\varphi_{ij}^*),\ \forall\, i,j \in N$. The number of importers, N_{imp}, is equal to the number of countries in the network minus the number of countries j where the productivity cutoff level φ_{ij}^* is higher than the most productive firm in all the countries of the network[70], $\varphi_{ij}^* > max_i(\varphi), \forall\, i,j \in N$. Holding the number of importing and exporting countries fixed[71], the bargaining power of exporting country *i* is higher if variable trading cost and fixed cost to export are smaller respect to the competitors in each exporting market, given that $k > 1-\sigma$ for construction[72]. Moreover, ceteris paribus, a larger labour supply (L_i) and low wages increase the bargaining power of the exporter.

With regard to the importer bargaining power, we can rewrite Equation 2.9 using market shares defined in Equation 2.12.

$$\phi_i(importer) = \frac{1}{2}\left(\frac{1}{N_{imp}} + \frac{1}{N_{exp}}\sum_j \frac{\frac{L_j}{f_{E(j)}}\tau_{ji}^{-k} w_j^{\left(1-\frac{k\sigma}{1-\sigma}\right)} f_{ji}^{1-\frac{k}{1-\sigma}}}{\sum_v \frac{L_j}{f_{E(j)}}\tau_{jv}^{-k} w_j^{\left(1-\frac{k\sigma}{1-\sigma}\right)} f_{jv}^{1-\frac{k}{1-\sigma}}}\right) \quad (2.14)$$

Intuitively, countries with relative lower fixed and variable costs to import (better accessibility) exhibit a higher importing bargaining power.

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69 In a symmetric country open economy $\left(\varphi_{ij}^*\right)^k = \frac{\sigma-1}{k-(\sigma-1)}\left[\frac{f_{ii}+(N-1)\tau_{ij}^{-k}\left(\frac{f_{ij}}{f_{ii}}\right)^{\frac{-k}{\sigma-1}} f_{ij}}{f_{Ei}}\right]\varphi_{min}^k$, see Melitz and Redding (2014) for a detailed explanation.

70 For example, the probability to have N_{exp} equal to 1 is $Pr(N_{exp} = 1) = \sum_{i,l} Pr(\varphi_i \geq min_j(\varphi_{ij}^*)) * Pr(\varphi_l < min_j(\varphi_{ij}^*))$, $Pr(N_{exp} = 2) = \sum_{i,s,l} Pr(\varphi_i \geq min_j(\varphi_{ij}^*)) * Pr(\varphi_s \geq min_j(\varphi_{ij}^*)) * Pr(\varphi_l < min_j(\varphi_{ij}^*))$ and so on.

71 This is equivalent to consider a small variation of fixed and variable trading costs not affecting the selection of exporting and importing countries.

72 In the theoretical model, this assumption is needed to assure a finite average firm size.

2.4 Data, empirical model and results

2.4.1 Data and preliminary evidence

We compute the bargaining power index specified in Equations 2.8 and 2.9 using the UN-Comtrade data for the year 2010 at the 5 digit SITC Rev. 4 industry level, for all available countries and sectors. The index is added to a dataset representing the universe of Italian imports and exports – external to EU – recorded by the Agenzia delle Dogane e dei Monopoli in Italy in 2010, almost at transaction level, augmented with a set of control variables[73]. Each observation contains informations on the country of origin or destination, value, weight, invoicing currency, reference exchange rate and date[74]. Transactions having the same trading partners, industry code (at the 10-digit-Harmonized Service level), currency, time period and reference exchange rate are aggregated by the data provider into one observation. Each observation includes an average of 8 transactions for Italian imports and 7.7 for Italian exports while the median is equal to 2 in both datasets.

In merging the bargaining power index computed from the UN-Comtrade data with this dataset, we lose some observations due to the lack of some reported trade in the UN-Comtrade data and, to a minor extent, to conversion from HS10 to 5 digit SITC rev. 4 classification. Nevertheless, we have been able to maintain more than 71% of the observations for the export data – 76% in terms of value – while for the import data we are able to maintain more than 81% of the observations – 60% in term of value.

The large difference between the number of observations and the total value of trade matched in the import dataset comes from the lack of recorded data in the UN-Comtrade about large transactions of oil coming mostly from a few countries in Asia and Africa. These missing oil transactions account for roughly 67% of the difference. For the same reason, the average total value of trade transaction in the full sample of Italian import is higher than our reduced sample, as shown in Table 2.3. This is rather irrelevant given that our study is about the determination of the currency denomination of trade and oil is predominantly invoiced in U.S. Dollars (USD) and not particularly susceptible to firm-level concerns. Checking for the consistency of our data, we do not find other relevant differences between the original transaction dataset and our reduced sample, as reported in Table 2.2 and Table 2.3.

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[73] This dataset was already used by Witte and Ventura (2016) and is explained in detail there.
[74] Date includes only the year and a two-month reference period.

Table 2.2 - Descriptive statistics for some variables in the Italian exports dataset, differences between full sample and reduced sample data.

	Full sample data			Reduced sample		
Variable	***Mean***	***S.D.***	***Median***	***Mean***	***S.D.***	***Median***
Producer Currency Pricing	0.727	0.446	1	0.718	0.450	1
Local Currency Pricing	0.077	0.266	0	0.088	0.284	0
Vehicle Currency Pricing	0.196	0.397	0	0.194	0.395	0
Total value of Trade transaction	135,660	2,118,925	9,187	135,989	2,293,913	9,709
Exporter's sector bargaining power index				0.039	0.028	0.076
Importer's sector bargaining power index				0.011	0.012	0.032
Exporter’s market share of world exports of good	0.077	0.072	0.058	0.077	0.071	0.057
Exporter’s market share of world imports of good	0.039	0.024	0.034	0.039	0.025	0.033
Importer’s market share of world exports of good	0.017	0.048	0.001	0.02	0.052	0.002
Importer’s market share of world imports of good	0.02	0.043	0.005	0.023	0.045	0.006
US market share of world exports of good	0.076	0.057	0.07	0.077	0.057	0.071
US market share of world imports of good	0.133	0.072	0.123	0.129	0.071	0.116
EMU’s market share of world exports of good	0.231	0.061	0.236	0.228	0.062	0.23
EMU’s market share of world imports of good	0.258	0.107	0.258	0.257	0.107	0.253
% of competition’s import value of good using PCP	0.781	0.144	0.815	0.782	0.144	0.814
% of competition’s import value of good using LCP	0.112	0.096	0.081	0.107	0.092	0.081
Modified Herfindahl Index of exports of good	0.106	0.056	0.09	0.105	0.055	0.092
Modified Herfindahl Index of imports of good	0.055	0.033	0.046	0.054	0.033	0.046
Value of trade is in lowest quartile	0.251	0.433	0	0.245	0.43	0
Value of trade is in highest quartile	0.249	0.432	0	0.249	0.433	0
Rauch classification – homogeneous	0.021	0.143	0	0.021	0.143	0
Rauch classification – differentiated	0.831	0.375	1	0.814	0.389	1
Importer weekly exch. rate volatility relative to EUR (last 3 years)	0.009	0.003	0.009	0.009	0.003	0.009
Importer weekly exch. rate volatility relative to USD (last 3 years)	0.016	0.005	0.017	0.016	0.005	0.018

Note: Merging the bargaining power index with the full sample data provided by the Agenzia delle Dogane e dei Monopoli in Italy in 2010 we lose some observations (28.6%) due mainly to missing reported trade and, to a minor extent, to conversion from HS10 to 5 digit SITC rev. 4.

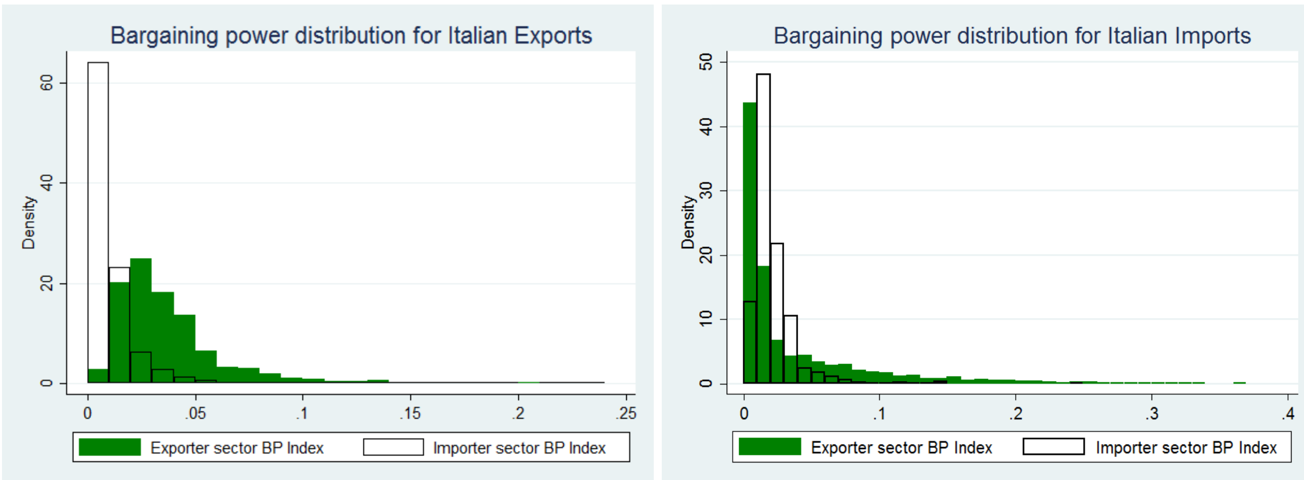
Table 2.3 - Descriptive statistics for some variables in the Italian imports dataset, differences between full sample and reduced sample data.

	Full sample data			Reduced sample		
Variable	***Mean***	***S.D.***	***Median***	***Mean***	***S.D.***	***Median***
Producer Currency Pricing	0.199	0.399	0	0.210	0.408	0
Local Currency Pricing	0.367	0.482	0	0.368	0.482	0
Vehicle Currency Pricing	0.434	0.496	0	0.421	0.494	0
Total value of Trade transaction	283,049	6,734,675	6,075	187,419	2,984,809	5,986
Exporter's sector bargaining power index				0.035	0.049	0.012
Importer's sector bargaining power index				0.021	0.016	0.016
Exporter’s market share of world exports of good	0.057	0.093	0.017	0.059	0.093	0.018
Exporter’s market share of world imports of good	0.038	0.059	0.013	0.038	0.059	0.014
Importer’s market share of world exports of good	0.062	0.058	0.049	0.063	0.059	0.048
Importer’s market share of world imports of good	0.04	0.03	0.034	0.04	0.029	0.033
US market share of world exports of good	0.077	0.064	0.068	0.078	0.062	0.07
US market share of world imports of good	0.143	0.077	0.134	0.137	0.074	0.125
EMU’s market share of world exports of good	0.227	0.062	0.232	0.225	0.062	0.229
EMU’s market share of world imports of good	0.231	0.101	0.21	0.231	0.1	0.217
% of competition’s import value of good using PCP	0.121	0.142	0.069	0.123	0.143	0.072
% of competition’s import value of good using LCP	0.455	0.184	0.429	0.455	0.185	0.429
Modified Herfindahl Index of exports of good	0.111	0.062	0.094	0.11	0.061	0.094
Modified Herfindahl Index of imports of good	0.062	0.042	0.052	0.061	0.041	0.051
Value of trade is in lowest quartile	0.253	0.435	0	0.254	0.435	0
Value of trade is in highest quartile	0.251	0.434	0	0.249	0.433	0
Rauch classification – homogeneous	0.025	0.156	0	0.023	0.15	0
Rauch classification – differentiated	0.838	0.368	1	0.83	0.376	1
Exporter weekly exch. rate volatility relative to EUR (last 3 years)	0.009	0.002	0.009	0.009	0.002	0.009
Exporter weekly exch. rate volatility relative to USD (last 3 years)	0.015	0.005	0.016	0.015	0.005	0.016

Note: Merging the bargaining power index with the full sample data provided by the Agenzia delle Dogane e dei Monopoli in Italy in 2010 we lose some observations (18.9%) due mainly to missing reported trade and, to a minor extent, to conversion from HS10 to 5 digit SITC rev. 4.

The distribution of the bargaining power index computed in Equations 2.8 and 2.9, reported in the previous tables, is very close to a lognormal distribution, as shown in Figure 2.4. The importer (exporter) sector bargaining index is higher than the exporter (importer) bargaining index in the Italian import (export) dataset. This suggests that Italian firms tend to trade with foreign firms in countries and industries with less bargaining power.

Figure 2.4 - Overall Importer and Exporter Bargaining Power distribution



Note: Exporter and Importer's bargaining power index distribution for Italian exports and Imports. Italian consumers and firms tend to trade with foreign industries with a lower bargaining power.

Our bargaining power index increases the more a sector is important for their partners and the more partners it has. Taking the ratio of the Exporter and Importer Bargaining Power Index, we therefore define what kind of players predominate in the network. An average index ratio greater than 1 is typical of exporter driven networks, while an index ratio smaller than 1 typifies importer driven networks, and we conjecture that in a bargaining process the most likely invoicing currency to be adopted is that of the country with the higher bargaining index. Therefore, if the index ratio is greater than 1, we expect to observe more transactions invoiced in the exporter (producer) currency while if the index is smaller than 1, it should be most likely to report transactions invoiced in the importer (local) currency. By taking the log of ratios (which makes the mean a consistent statistic for the first moment of the index, given its approximate lognormal distribution) all our previous considerations hold, the only proviso being that the cut-off value becomes 0 instead of 1. What we find in our data – as shown in Table 2.4 – broadly confirms our expectations. The average of the log of our index ratio for the Italian export dataset is equal to 1.41; Italian exports disclose an exporter driven network structure and most of the value traded (73%) is settled using the producer currency, as expected. On the other hand, Italian imports exhibit an importer driven network structure (the average of the log of the ratio is equal to -0.62) with most of the trading value denominated in the local – importer – currency (37%) rather than in the producer currency (21%).

Table 2.4 - Percentage of transactions value in Producer (PCP) or Local (LCP) currency and average of the log of ratio between the exporter and importer sector bargaining power index.

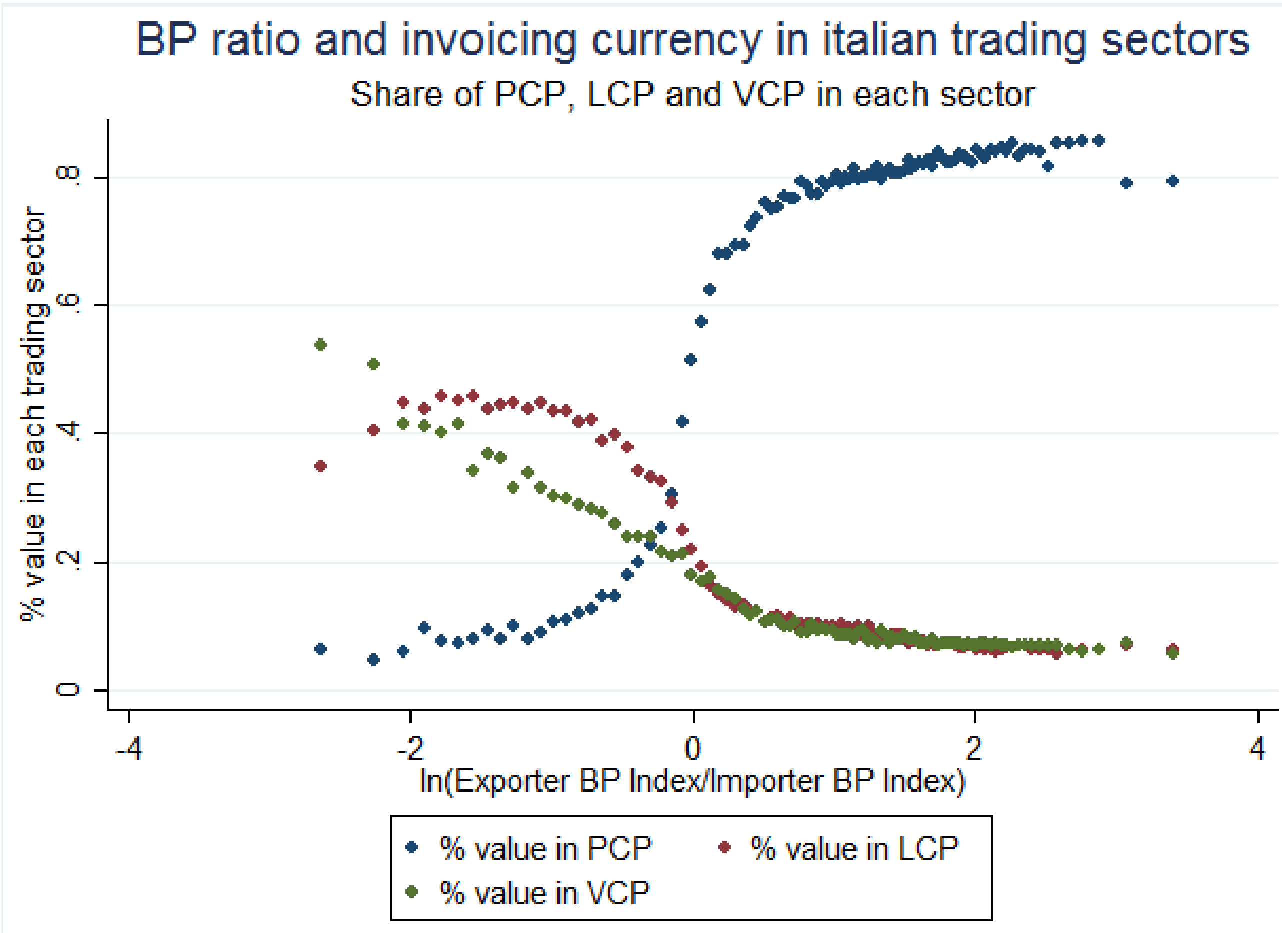
	LN(Exporter/Importer BP Index)		% of transaction in the dataset with producer or local currency		
	Mean	Std Dev	% PCP	% LCP	%PCP/%LCP
Italian Export	1.41	0.86	73%	8%	9.59
Italian Import	-0.62	1.20	21%	37%	0.57

Note: Italian exports disclose an exporter driven network structure with mostly of the transaction settled in the producer currency while Italian imports exhibit an importer driven network structure with a larger share of trade invoiced in the local currency rather than in the producer currency.

These findings are illustrated graphically in Figure 2.5. With a higher value of the index ratio, the invoicing currency is most likely to be settled in the producer currency (PCP) while with a lower value of the index ratio we are most likely to observe transactions denominated in the importer currency (LCP).

It is also interesting to look at the pattern emerging for transactions recorded in a vehicle currency (usually USD). The use of the vehicle currency is strictly correlated with the use of the local currency and tend to be higher at the lowest values of the index ratio.

Figure 2.5 - Importer and Exporter Sector Bargaining Power distribution in the joint export and import dataset



Note: Percentages of sector transactions in Producer (PCP), Local (LCP) or Vehicle (VCP) currency conditioned to the log of the ratio between the exporter's sector bargaining power index and the importer's sector bargaining power index. With higher values of the ratio, transactions are more likely to be invoiced in the producer's currency while with lower values we observe a higher percentage of transactions invoiced in the local or vehicle currency. At the lowest values of the ratio, we observe more transactions invoiced in a vehicle currency. For illustration purpose, data are grouped in 100 equal-sized bins.

With a simple OLS regression (results in Appendix, Table 2.A.3) we confirm our visual findings. The Exporter's sector Bargaining Power is positively related to producer currency pricing and negatively correlated with local and vehicle currency pricing, in terms of both observations and value. Conversely, a higher Importer's sector Bargaining Power is negatively related to producer currency pricing while exhibiting a positive relationship with the share of the local and vehicle currency used in the transaction. Our bargaining index is able to explain from about 14% to about 24% of the variance of the share of the invoicing currency[75], while the global sector market share explains the variance in a range from 12% to

[75] With a log specification of the bargaining index, R squared approaches 40% for almost all the invoicing currency shares.

19%. Using data only for differentiated goods, as shown in Appendix, Table 2.A.4, further increases the R-squared differences between our bargaining power index and the global sector market share.

The network dimension of our index seems to much better shape the currency invoicing decision, as opposed to simple global market shares.

2.4.2 Empirical model and results

Following Witte and Ventura (2016), we estimate our model using a multinomial probit model instead of multinomial logit to exclude the assumption of the independence of irrelevant alternatives.

The currency denomination decision is expressed by three options: producer (PCP), local (LCP) or vehicle (VCP) currency pricing. Weighting the regression by value, we give more weight to observations associated with larger trade transactions, providing a more accurate picture of the aggregate behavior of the Italian imports and exports through the following model specification:

$$\begin{aligned}\Pr(InvCurr_{i,j,z} | Y = PCP, LCP, VCP) \\ = \Phi\left(\beta_0 + \beta_1 ExpSectorBP_{i,k} + \beta_2 ImpSectorBP_{j,k} + \beta_3 X_{i,j,k} \right. \\ \left. + \beta_4 I_{i,j,k}\right)\end{aligned} \tag{2.15}$$

Where $InvCurr_{i,j,z}$ is the invoicing currency of the Italian imports from the trading partner *i,* or the Italian exports to the trading partner *j,* for the good traded in transaction *z*. $ExpSectorBP_{i,k}$ is our exporter sector bargaining power index computed in Equation 2.6 for country *i* in the sector k of the traded good while $ImpSectorBP_{j,k}$ is the importer sector bargaining power index computed in Equation 2.7 of country *j* in sector *k*. $X_{i,j,k}$ is a vector of control variables including standard controls (Modified Herfindahl Index of exports/imports of good, binary variable if the value of trade is in the lowest or highest quartile, binary variable if a good is classified by the Rauch classification as homogeneous or differentiated, exporter/importer weekly exchange rate volatility relative to EUR over last 3 years, exporter/importer weekly exchange rate volatility relative to the USD over last 3 years) and geographical controls (the log of distance between the two trading partners, binary variables accounting for the presence of a bilateral investment treaty or of a bilateral tax treaty) which are supposed to affect the relative utility to invoice in the own currency[76]. $I_{i,j,k}$ is a vector of binary variables controlling for the

[76] Because the frequency a strategy is played increases with the associated utility, we need to control for factors influencing player's utilities.

most often observed trading partners (the first 8 importers and exporters[77]) and sector fixed effects (at the one-digit SITC industries[78]).

If the currency determination is the result of a bargaining process between the importer and exporter countries and is affected by their outside options, we should observe a significant contribution of our empirical bargaining power index in Equation 2.15. The exporter bargaining power index should be positively correlated with the producer currency pricing (PCP) – countries with high level of bargaining power are more likely to invoice in their own currency. Likewise, the importing bargaining power index should increase the likelihood of local currency pricing (LCP) – importers with a high bargaining power are more likely to invoice in their own currencies. The ratio between the two measures should show an opposite contribution for PCP and LCP, assuming there is a threshold above (below) which a country is more (less) likely to invoice in its own (in the partner's) currency. Lastly, to avoid multiple equilibria due by equivalent dominant strategies, we exclude transactions where exporters or importers have a currency peg to the Euro or US Dollar currency. Results are shown in Table 2.5.

[77] The other importer/exporter dummies are excluded for multicollinearity and to have feasible results.
[78] In order to have feasible estimates we have to limit the industry fixed effect at the one-digit level.

Table 2.5 – Multinomial probit of invoicing currency, general results

Model	(1)	(1)	(2)	(2)	(3)	(3)	(4)	(4)	(5)	(5)	(6)	(6)
	PCP	LCP	PCP	LCP	PCP	LCP	PCP	LCP	PCP	LCP	PCP	LCP
Exporter Sector Bargaining Power			9.287***	-2.829***					9.156***	-3.092***		
			(0.665)	(0.752)					(0.692)	(0.820)		
Importer Sector Bargaining Power			-6.950**	5.303***					-6.942**	4.984***		
			(2.557)	(1.291)					(2.543)	(1.332)		
ln(Exp. Sect. BP/Imp. Sect. BP)					0.243***	-0.228***					0.236***	-0.219***
					(0.0168)	(0.0214)					(0.0166)	(0.0218)
Exporter's market share of world exports of good	6.894***	-1.657*			2.797***	2.361*	6.804***	-1.103			2.787***	2.432**
	(0.632)	(0.738)			(0.715)	(0.921)	(0.667)	(0.749)			(0.733)	(0.935)
Exporter's market share of world exports of good, squared	-9.877***	5.041**			-2.939+	-1.754	-9.545***	4.629**			-2.709+	-1.462
	(1.632)	(1.626)			(1.593)	(1.849)	(1.707)	(1.624)			(1.645)	(1.855)
Importer's market share of world exports of good	-2.125*	7.058***			0.535	4.699***	-2.507**	7.276***			0.0910	4.719***
	(0.825)	(0.701)			(0.831)	(0.694)	(0.874)	(0.739)			(0.873)	(0.743)
Standard control	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Geographical Control							Y	Y	Y	Y	Y	Y
Exporter, Importer and Sector F.E.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	1221586	1221586	1221586	1221586	1221586	1221586	1214381	1214381	1214381	1214381	1214381	1214381

Robust standard errors in parentheses + p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Note: Base outcome is VCP. Countries with a high bargaining power tend to invoice in own currency. Standard controls include: modified Herfindahl Index of exports/imports of good, binary variable if the value of trade is in the lowest or highest quartile, binary variable if a good is classified by the Rauch classification as homogeneous or differentiated, exporter/importer weekly exchange rate volatility relative to EUR over last 3 years, exporter/importer weekly exchange rate volatility relative to the USD over last 3 years. Geographical controls include: the log of distance between the two countries, binary variable equal to 1 if there is a tax treaty and if there is a bilateral investment treaty.

The coefficients of our Bargaining Power Index exhibit the expected results. Transactions in sectors with greater bargaining power are more likely to be invoiced in the own currencies rather than in a vehicle currency while the bargaining power of the trading partner has an opposite effect (Models 2 and 5 of Table 2.5). In other words, players with higher relative bargaining powers are more likely to invoice in their own currencies. This assertion is confirmed in Models 3 and 6, where we compute the log of the ratio between the exporter and importer bargaining power indices. With a value greater than zero, we are more likely to observe transactions in the producer currencies while negative values increase the likelihood that transactions are priced in the consumer (local) currencies. This effect is robust to the inclusion of sectoral market shares[79] as in Devereux et al. (2017).

These findings strongly support the idea of a bargaining process for the currency determination of trade, where the cost/risk to price in a foreign currency is assigned or shared based on the relative negotiating power of the two partners, and confirm our index is a good proxy for the players' bargaining power, independently from the sectoral market shares.

To provide some robustness to our results, we include in Table 2.6 a further set of control variables[80] and we compute our bargaining power index excluding market shares in the partner country, to prevent possible endogeneity due to shocks contemporaneously affecting the bilateral value of trade and the invoicing currency. Results remain significant and consistent with our previous estimates.

[79] Exporter, exporter squared and importer sectoral market shares, as shown in Model 1 and 4 of Table 2.5.

[80] EMU's market share of world exports and imports of good, % of Italian exports (import) with destination (from other) EMU for that industry, % of EMU exports/imports (all but Italy) to/from world for that industry, % of Italian exports/imports that go to/come from US in that industry

Table 2.6 – Multinomial probit of invoicing currency with additional control variables

Model	(1)	(1)	(2)	(2)	(3)	(3)	(4)[a]	(4)[a]	(5)[a]	(5)[a]
	PCP	LCP	PCP	LCP	PCP	LCP	PCP	LCP	PCP	LCP
Exporter Sector Bargaining Power[a]			9.144***	-2.478**			9.266***	-2.402**		
			(0.704)	(0.760)			(0.724)	(0.774)		
Importer Sector Bargaining Power[a]			-5.451*	7.901***			-5.317*	8.492***		
			(2.478)	(1.469)			(2.550)	(1.536)		
ln(Exp. Sect. BP/Imp. Sect. BP) [a]					0.279***	-0.193***			0.272***	-0.201***
					(0.0270)	(0.0362)			(0.0276)	(0.0364)
Exporter's market share of world exports of good	7.518***	0.234			3.465***	2.603**			3.522***	2.669**
	(0.713)	(0.731)			(0.830)	(0.996)			(0.833)	(0.999)
Exporter's market share of world exports of good, squared	-10.68***	2.067			-5.055**	-1.178			-5.122**	-1.243
	(1.750)	(1.533)			(1.764)	(1.804)			(1.765)	(1.805)
Importer's market share of world exports of good	-1.492+	8.419***			0.793	6.555***			0.721	6.485***
	(0.808)	(0.756)			(0.831)	(0.786)			(0.833)	(0.788)
Standard control	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Geographical control	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Currency control	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Exporter, Importer and Sector F.E.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	1214376	1214376	1214376	1214376	1214376	1214376	1214376	1214376	1214376	1214376

[a] Sector bargaining power in Models 4 and 5 are computed excluding market shares in the partner country.
Robust standard errors in parentheses + $p<0.10$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Note: Base outcome is VCP. Bargaining power index computed in Models 4 and 5 excludes direct market shares in the partner country. Standard controls include: modified Herfindahl Index of exports/imports of good, binary variable if the value of trade is in the lowest or highest quartile, binary variable if a good is classified by the Rauch classification as homogeneous or differentiated, exporter/importer weekly exchange rate volatility relative to EUR over last 3 years, exporter/importer weekly exchange rate volatility relative to the USD over last 3 years. Geographical controls include: the log of distance between the two countries, binary variable equal to 1 if there is a tax treaty and if there is a bilateral investment treaty. Currency controls include: EMU's market share of world exports and imports of good, % of Italian exports (import) with destination (from) EMU for that industry, % of EMU exports/imports (all but Italy) to/from world for that industry, % of Italian exports/imports that go to/come from US in that industry.

The positive and robust contribution of our bargaining power index is particularly interesting for both theoretical and empirical reasons. From a theoretical point of view, new models should recognize that firms and customers choose their invoicing currency based on a bilateral bargaining process (as in Friberg and Wilander, 2008) and that the choice is affected by the trade network structure (endogenously or exogenously determined), as measured by our index. From an empirical point of view, our measure seems to work as a better approximation of bargaining power than the global market shares, exhibiting an impact independent and robust to the inclusion of the sectoral market shares.

2.5 Conclusion

In this analysis, we have applied a new methodology to measure the relative bargaining power of a player in the trade network respect to the more standard procedure of global market shares that does not account for communication restrictions and asymmetries between players. Our Exporter and Importer Bargaining Power indices are constructed herein to examine whether there is any bargaining in the determination of the currency denomination of trade. Our results suggest a robust and large effect of the trading network position on the currency denomination of trade, which is independent from sectoral market shares. The communication structure, defined by the trade network, influencing the bargaining possibility of each player, modifies the mixture strategy played by each competitor for the determination of the invoicing currency. Transactions in sectors exporting to more trading partners and with high bilateral market shares are more likely to be priced in the producer currency if the partner imports from few market with lower market shares. As such we add to the literature on the currency denomination of trade by the implication of a bargaining process which should be included in future theoretical models and used as a control in future empirical researches. While we have looked solely at the role of the bargaining power indices to determine the currency denomination of trade, it’s also possible that other features of trade transactions (price, exchange-rate pass-through, quantity and timing) may be susceptible to the role of bargaining. We would then suggest that our results not only aid our understanding of the currency denomination of trade but also could shed light on a variety of other international trade researches.

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Appendix 2

2.A.1 – Correlation coefficients between Sector Bargaining Index and centrality measures

Correlation coefficients between our Bargaining Index and some centrality measures

	Exporter's sector B. Index	Importer's sector B. Index
Importer's sector B. Index	0.54	1.00
Google Pagerank (undirected network)	0.68	0.53
Weighted Google Pagerank (undirected network)	0.86	0.58
Google Pagerank (directed network)	0.22	0.48
Weighted Google Pagerank (directed network)	0.36	0.63
Weigthed Eigenvector centrality (directed network)	0.38	0.51
Eigenvector centrality (directed network)	0.27	0.40
Eigenvector centrality (undirected network)	0.58	0.54
Weighted Eigenvector centrality (undirected network)	0.70	0.52
IN-Degree (importer)	0.22	0.48
OUT-Degree (exporter)	0.69	0.52
Degree IN & OUT (AllDegree)	0.61	0.58

2.A.2 – R-Squared from an OLS regression of some centrality measures on our Bargaining power indexes

	Importer's sector B. Index	Exporter's sector B. Index
Degree IN & OUT (AllDegree)	0.35	0.36
OUT-Degree (exporter)	0.29	0.47
IN-Degree (importer)	0.25	0.08
Eigenvalue centrality (undirected network)	0.30	0.31
Weighted Eigenvector centrality (undirected network)	0.28	0.44
Eigenvector centrality (directed network)	0.18	0.09
Weigthed Eigenvector centrality (directed network)	0.27	0.15
Google Pagerank (undirected network)	0.30	0.45
Weighted Google Pagerank (undirected network)	0.34	0.72
Google Pagerank (directed network)	0.24	0.05
Weighted Google Pagerank (directed network)	0.41	0.14

Traditional directional Network Centrality measures do not systematically explain the variation of our bargaining index.

2.A.3 - OLS regression of the share of Producer (PCP), Local (LCP) and Vehicle (VCP) currency pricing on the Sector Bargaining Power Index and Global Sector Market Share, sectoral data.

a) Sector Bargaining Power Index and Invoicing Currency

	Full sample, % observation in each industry			**Full sample, % value in each industry**		
	% PCP	% LCP	% VCP	% PCP	% LCP	% VCP
Exporter's Sector Bargaining Power	1.774***	-1.077***	-0.697***	2.287***	-1.474***	-0.813***
	(0.110)	(0.0550)	(0.0713)	(0.141)	(0.0988)	(0.0853)
Importer's Sector Bargaining Power	-8.391***	4.522***	3.869***	-9.835***	4.950***	4.886***
	(0.502)	(0.333)	(0.226)	(0.667)	(0.458)	(0.336)
Constant	0.647***	0.134***	0.219***	0.657***	0.192***	0.151***
	(0.00749)	(0.00452)	(0.00425)	(0.00967)	(0.00658)	(0.00531)
R-Squared	0.235	0.226	0.158	0.219	0.146	0.14
N	112993	112993	112993	112993	112993	112993

Standard errors in parentheses *+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001*

b) Global Sector Market Share and Invoicing Currency

	Full sample, % observation in each industry			**Full sample, % value in each industry**		
	% PCP	% LCP	% VCP	% PCP	% LCP	% VCP
Exporter's global sector market share	0.827***	-0.493***	-0.334***	1.149***	-0.637***	-0.512***
	(0.0656)	(0.0299)	(0.0402)	(0.0937)	(0.0609)	(0.0470)
Importer's global sector market share	-2.904***	1.528***	1.377***	-3.462***	1.836***	1.625***
	(0.0975)	(0.0708)	(0.0496)	(0.151)	(0.111)	(0.0806)
Constant	0.606***	0.155***	0.238***	0.607***	0.208***	0.185***
	(0.00447)	(0.00230)	(0.00307)	(0.00613)	(0.00423)	(0.00362)
R-Squared	0.190	0.177	0.132	0.191	0.127	0.120
N	112993	112993	112993	112993	112993	112993

Standard errors in parentheses *+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001*

OLS regressions of the percentage of transactions priced in producer (PCP), local (LCP) and Vehicle (VCP) currency, for sectoral data, on Bargaining Power indexes (table A) or Global Sector Market shares (table B). Standard errors are clustered at the 5 digit SITC Rev. 4 Industry level.

2.A.4 - OLS regression of the share of Producer (PCP), Local (LCP) and Vehicle (VCP) currency pricing on the Sector Bargaining Power Index and Global Sector Market Share only for differentiated goods, sectoral data.

a) Sector Bargaining Power Index and Invoicing Currency

	Full sample, % observation in each industry			**Full sample, % value in each industry**		
	% PCP	% LCP	% VCP	% PCP	% LCP	% VCP
Exporter's Sector Bargaining Power	2.084*** (0.129)	-1.199*** (0.0571)	-0.885*** (0.0862)	2.626*** (0.151)	-1.594*** (0.0945)	-1.032*** (0.0959)
Importer's Sector Bargaining Power	-8.110*** (0.630)	4.452*** (0.434)	3.657*** (0.273)	-9.733*** (0.854)	4.717*** (0.572)	5.017*** (0.432)
Constant	0.636*** (0.00918)	0.141*** (0.00571)	0.223*** (0.00505)	0.659*** (0.0119)	0.195*** (0.00778)	0.146*** (0.00651)
R-Squared	0.254	0.253	0.175	0.241	0.169	0.168
N	83286	83286	83286	83286	83286	83286

Standard errors in parentheses *+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001*

b) Global Sector Market Share and Invoicing Currency

	Full sample, % observation in each industry			**Full sample, % value in each industry**		
	% PCP	% LCP	% VCP	% PCP	% LCP	% VCP
Exporter's global sector market share	0.948*** (0.0843)	-0.559*** (0.0388)	-0.389*** (0.0496)	1.240*** (0.116)	-0.692*** (0.0723)	-0.548*** (0.0567)
Importer's global sector market share	-2.670*** (0.109)	1.385*** (0.0829)	1.285*** (0.0587)	-3.260*** (0.183)	1.528*** (0.123)	1.732*** (0.103)
Constant	0.593*** (0.00570)	0.166*** (0.00288)	0.241*** (0.00382)	0.606*** (0.00774)	0.217*** (0.00509)	0.177*** (0.00444)
R-Squared	0.200	0.192	0.145	0.201	0.132	0.149
N	83286	83286	83286	83286	83286	83286

Standard errors in parentheses *+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001*

OLS regressions of the percentage of transactions priced in producer (PCP), local (LCP) and Vehicle (VCP) currency, sectoral data for differentiated good, on Bargaining Power indexes (table A) or Global Sector Market shares (table B). Standard errors are clustered at the 5 digit SITC Rev. 4 Industry level.

Chapter 3: Spatially correlated preferences in international trade[81].

Davide Arioldi

ABSTRACT

Empirical evidences of extended gravity, spatial or sequential exporters and remote search of new trading partners have been theoretically justified by trade frictions and ad hoc dynamic models. We internalize these empirical findings in the gravity model of trade developed by Chaney (2008), introducing spatially correlated country-pairs preferences in the consumers' utility. Using the ratio of exports in a custom union, we are able to identify the spatial correlation parameter of our structural model, through Monte Carlo Markov chain (HMC) methods. Consumers' preferences follow a spatially dependent structure, confirming the results of our reduced form and strengthening search and learning model developed by previous authors. With this paper, we hope to encourage a process of integration of preferences modelling into the international trading literature.

JEL classification: C11, C21, F11, F14, F20, F40, F61

Keywords: spatially correlated preferences, trade network, extended gravity, spatial exporters.

[81] This chapter is based on Arioldi (2018), Spatially correlated preferences in international trade. *To be submitted to an international journal.*

3.1 Introduction

In recent years, the dynamic of firms' exports has received a great deal of attention. Das et al. (2007), modelling firms' exporting decision with sunk entry costs and plant level heterogeneity in export profits on a set of Colombian industries, find that entry costs are substantial and producers do not begin to export unless the present value of their expected future export profit stream is large. Furthermore, they state that history and expectation of producers are important determinants for the decision of being in a foreign market, even more than the value of the export profit that firms expect to earn in the current year[82]. Eaton et al. (2008), using transaction level data, observe that many Colombian firms enter foreign markets every year, selling small quantities to a single neighbor country, and almost half of them cease to export in the following year. The firms who survive expand their presence in the current destination and a sizeable fraction of them expands to other markets, depending on the initial foreign market. The empirical findings of Eaton et al. (2008), where many firms are jumping into and out of foreign markets, seem to be incompatible with large sunk costs, unless to suppose a two-tiered entry cost structure or serial correlated productivity of firm and product quality shocks. Moreover, Das et al. (2007) model does not explain the empirical sequential exporting findings described above. Nguyen (2012) and Albornoz et al. (2012) propose two new models to rationalize why firms wait to export and why many exporters fail. In the former model, demand is uncertain and imperfectly correlated among markets and firms choose to sequentially export in order to slowly learn about the possibility to succeed in new markets. The latter assumes that firms are uncertain about their export profitability but success factors are highly persistent over time and across destinations: therefore, entry in a foreign market allows firms to learn about their profit potentials in future and different markets. These new expectations are taken into account in firms' exporting decision and lead to a process of sequential exporting. Similar to the previous authors, Eaton et al. (2015) develop a search and learning model, where buyers reveal the appeal of the firms' product in a market, affecting the firms' propensity and cost to search for new clients. Chaney (2014), by modelling trade patterns as an international network, provides a further explanation for sequential entering. More specifically, firms export into markets where they have a contact, similar to social interactions (Jackson and Rogers, 2007). New contacts (trading partners) are searched both directly and indirectly; the formers using the existing network of contacts in the native market, the latter searching

[82] Firms prefer to continue to export in the foreign market even if their net profits are negative, because of the value they give to the possibility to export the next year without to pay entry costs.

remotely from the exporting markets. The predictions of Chaney's model are confirmed on a sample of French exporters, whose exports are geographically distributed conformed to the model.

More generally, standard gravity models do not completely capture the spatial correlation of trade, because predict trading patterns less spatially correlated than reality. Defever et al. (2015) provide robust causal evidence of extended gravity effects: using exports of a sample of Chinese firms after import liberalizations in US, EU and Canada, they prove that the probability of a firm to export in a country increases by about two percentage points for each additional prior export destination having a common border with the new country. Morales et al. (2017) quantify the impact of the extended gravity variables (common border, continent, language or similar income between new and previous foreign markets) on export entry costs, using a sample of Chilean firms. They find the sunk cost of entry in foreign markets is lower, from -19% to -38%, for markets having similarities with prior export destinations.

With this paper, we provide a framework to reconcile the extended gravity and sequential exporting findings with the traditional gravity model of trade. We extend the Chaney (2008) model of trade with heterogeneous firms by adding an unobserved country pairs and good specific preference parameter in the consumer's utility. As a result, we can shape trade flows as a function of the ratio between the consumers' preference parameter and fixed cost. Modelling the preference parameter or fixed cost as spatial dependent, the equation of trade internalizes the reinforced spatial pattern correlation. Sequential entering consequently emerges simply adding a time propagation effect to the fixed cost of entry or to the preference parameter, which are related to the geographical distribution of previous exports[83].

Differently from previous authors and supported by findings in empirical economics and marketing (Yang and Allenby, 2003; Rossi et al., 2005; Bradlow et al., 2005) we choose to spatially model the preference parameter. Spatial correlated preferences can explain many phenomena discovered by international trade scholars, such as the residual spatial correlation of traditional gravity model, the correlation over time and across destinations of export profitability and the "social network" effect discovered by Combes et al. (2005). Using a measure of social and business linkages inferred using migrations, Combes et al. (2005) find a positive impact of network linkages on inter-regional trade in France. Informational and social networks facilitate trade, overcoming informational barriers. Therefore,

[83] Sequential entering should emerges even only considering preferences correlated over time.

they posit that social interactions reduce fixed and variable costs to enter a foreign market. Garmendia et al. (2012), using Spanish data, confirm their results proving that the home bias disappears considering social and business networks. In our theoretical model with spatial correlated preferences, the network effect on firms' exports emerges formally, without assuming network lowers variable cost to export[84]. The preference parameter influences both the export value of each firm, the intensive margin, and the quantity of firms able to export, the extensive margin. According to our framework, network affects both the fixed cost to export, reducing informational barriers, and the preference parameter, boosting demand for imported and exported goods. Migrants, maintaining a network with their origin countries and with emigrants to other countries, can shape preferences, not only at idiosyncratic and bilateral country level but also on a world basis, promoting more homogenous preferences among all countries. In this paper, we do not assert that network does not affect exporting costs or that fixed costs to export are not spatially correlated[85], but we say that the geography of trade is widely affected by the spatial correlation of preferences. Including spatially correlated preferences in empirical studies and theoretical model, can advance the understanding of international phenomena and improve the evaluation of economic policies.

To the best of our knowledge, we are the first to provide general evidence of correlated preferences in the international trade structure and to propose a formal explanation of the extended gravity equation of trade. This paper is also related to the country of origin (COO) literature, started by Ditcher (1962) and widely explored by consumer's behaviours and marketing scholars in the last 40 years. Alternative recent research directions are proposed by Bertoletti et al. (2018), who develop a general equilibrium model of trade with non-homotetic indirectly additive preferences. Within their framework, both the extensive margin and intensive margin of trade depend positively on the per capita income of the destination country. Spatially enhanced effects can subsequently emerge because of spatially correlated income.

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[84] In the classical model of trade with heterogeneous firm à la Melitz (2003), fixed cost of entry has no impact on the firm's export value but only on the extensive margin. It is therefore impossible to explain any increase of the intensive margin with a reduction of fixed costs (such as informational costs). Previous scholars have consequently assumed that networks of immigrants reduce variable exporting cost.

[85] The findings of Cavusgil and Zou (1994) and Artopoulus et al. (2011), documenting how product adaption and marketing strategy are key factors for firms export success, support this hypothesis. Product adaption, distribution chains, customers search and customer services can be model as fixed cost that increase with the distance to the target market. Moreover, knowledge of institutions and business practices are other fixed costs increasing with distance. Consequently, firms already exporting in foreign markets close to the target market could benefit from distribution chains, customer service supports and knowledge they have already developed in the previous markets. The fixed cost of entry in a new market is therefore increasing with the distance to the already reached markets.

The remainder of the paper is organized as follows: Chapter 3.2 presents reduced-form evidences that the spatial structure of export affects the probability to export to a new market (sequential entering) and the value exported. Chapter 3.3 provides a theoretical model with spatial correlated preferences able to explain the findings of Chapter 3.2. Chapter 3.4 proposes an identification strategy to estimate the idiosyncratic and correlation preference parameter on a subset of countries and goods, controlling for observable and unobserved fixed cost to export. Chapter 3.5 concludes.

3.2 Reduced form evidence

In this section, we provide reduced-form evidence that aggregate national export in a specific sector[86] and, more specifically, the spatial structure of the industry's trade network, affects both the probability to export to a market and the total traded value. The probability to sell goods to a foreign country is higher for sectors already exporting to markets close to the foreign destination and it increases with the value exported to those markets; moreover, this probability is higher if the foreign destination and the prior markets have a trading relationship in the same sector. Similar results emerge for the national value of exports: the more a sector exports to countries close to the target market, the higher is the value exported to the target market. These effects are robust, even after controlling for the extended gravity variables, which should be a proxy for correlated fixed costs to export, according to Morales et al. (2017).

Data source – We use product level data aggregate at the 2 digit-level of the Standard International Trade Classification, Revision 2, over the period 1980-2000. The data comes from the same source of Feenstra et al. (2005) and includes trade from 155 exporters to 154 importers, accounting for about 98% of the world trade. We add zero trade flows to this data for every combination of exporter, importer and sector that is not reported. Our final dataset includes about 33 million observations. Every product is exported on average to 12 different countries, with a minimum average of 0.4 exporting markets for the SITC 35 class (fish, dried, salted or in brine; smoked fish) and a maximum average of 24 exporting markets for the SITC 65 Class (Textile yarn, fabrics, made-up articles and related products). About 30% of the national industries[87] in our sample have never exported to any country and only 3 classes of products (specialized industrial machinery, road vehicles, medicinal and pharmaceutical

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[86] We assume that each product h is produced by sector h.

[87] We assume that for each country-SITC product class corresponds a set of firms belonging to the same nation and producing the specific good.

products) have been exported to at least 150 countries. In addition to the data on trade flows, we add geographical variables (such as the population weighted distance, contiguity and binary variables for regional trade agreement, common or former colony, same language), economic variables (such as gross domestic product) and extended gravity variables[88]. This final dataset includes about 12 million observations, with 2,147,868 positive flows.

Regression specifications – We estimate probit and linear regressions (OLS) with different specifications of the remote distance variable. Our dependent variables are the exporting status in the target market j for good h produced in country i in year $t + 1$ and the trade value from country i to country j for product h in year t. Using two set of countries K (K_0 and K_1) we compute two variables for the distance between the other exporting destinations K and the target market j, modelling them as the log of averaged distances (population weighted) from j to K, and two variables for the total exports of product h from country i to countries K_0 and K_1. Countries belonging to K_0 are all the countries, different from j, where country i sell the good h while countries included in K_1 are a subset of K_0, whenever the countries are already exporting the good h to the consumers located in the country j (that are countries jointly belonging to the set of importers of j and to the set of exporters of i, for sector h).

With the probit specification, we also test if belonging to different trade networks (as above, at the product level h) affects the probability to directly export to the target market using the minimum distance path between sector h of country i and the target market j. The minimum distance path is defined as the minimum number of exporting markets the producing sector h has to pass through to reach the target market j[89]. We include in our model a set of two binary variable for the path distance: the first ($1[\min(pathdist^h_{i,j,t}) = \infty]$) is equal to one if countries i and j do not belong to the same trade network (the path distance is equal to infinite) while the second ($1[\min(pathdist^h_{i,j,t}) = 1]$) is set to 1 if country i and j belong to the same trade network and country i exports to at least one country k belonging to the set of importer of j. The base category for this variable is therefore the path distance different to infinite and one.

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[88] We compute extended gravity variables (extended contiguity, common language, common colony, common currency, common religion and common legal system) as in Morales et al. (2017), Albornoz et al. (2012) or Defever et al. (2015) to control for potential different fixed costs to export. Geographical variables are from CEPII while economic variables from Penn World table.

[89] If sector h in country i exports directly to country j, the minimum distance path between i and j for sector h is zero; if sector h does not export directly to j, but it exports in k and industry h in k exports directly to j, the minimum distance path is equal to 1.

As control variables, we add the difference between the per capita GDP of the two countries, to control for cost that firms face to adapt the production chain to the quality requested in the new market[90], and the number of exporting markets of sector *h*, in order to control for the experience and propensity to export to foreign markets. We even control for all the set of traditional gravity variables, as the log of the population weighted distance between the two countries, the log of the GDP of countries *i* and *j* and a set of binary variables controlling for Regional Trade Agreement, contiguity, common language, common colonizer, common currency, GATT/WTO membership for exporter and importer and the share of population with common religion. For the probit model we add the exporting status of country *i* in market *j* for the product *h* at time *t*, that controls for the resilience of the exporting status, and the import growth of country *j* for product *h*, as in Chaney (2014). As a robustness test, we include a set of extended gravity variables (as in Albornoz et al., 2012, or Defever et al., 2015) for contiguity, common language, common colony/colonizer, common currency, common religion and common legal system. These variables are equal to 1 if product h produced by country i is exported to at least one country k sharing some characteristics with country *j*[91]. These variables can control for fixed (even sunk) costs to export which are correlated among destinations, as in Morales at al. (2017).

We estimate different specifications of the probit model in Equation 3.1 and OLS in Equation 3.2. In Equation 3.1, we chose to use, as dependent variable, the lead exporting status (at *t+1*) instead of the exporting status at time *t*, in order to give results comparable to the previous literature[92].

$$\Pr\left(export_{i,j,t+1}^{h} > 0 \middle| observables\right) = \Phi\Big(\delta 1\left[export_{i,j,t}^{h} > 0\right] + \gamma_1 \ln(avg\_dist_{K,j,t}^{h}) + \gamma_2 ln\left(\sum_k export_{i,k,t}^{h}\right) + \beta Controls_{i,j,t} + Exporter_i + Importer_j + Year_t + Extended\ Gravity\ Variables_{i,j,t}^{h}\Big) \tag{3.1}$$

$$\ln(export_{i,j,t}^{h}) = \gamma_3 \ln\left(avg\_dist_{K,j,t}^{h}\right) + \gamma_4 ln\left(\sum_k export_{i,k,t}^{h}\right) + \beta Controls_{i,j,t} + Exporter_i + Importer_j + Year_t + Extended\ Gravity\ Variables_{i,j,t}^{h} + \varepsilon_{i,j,t}^{h} \tag{3.2}$$

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[90] Murphy and Shleifer (1997) have shown that countries tend to trade with partners with similar level of development, producing similar quality products.

[91] For the sake of clarification, extended contiguity is equal to one if country *i* exports good *h* to at least one country *k* with a common border with *j*; equally, extended common currency is equal to 1 if country *i* exports good *h* to at least one country *k* having the same currency of country *j* and so on.

[92] Performing our analysis with export status at time *t* doesn't significantly change the results and all the conclusions remain meaningful. The same occurs when estimating Equation 3.2 with the lag of the averaged remote distances and lagged total exports.

Given that we are assuming spatially correlated preferences, we expect to find negative values for the coefficients of remote distance (parameters γ_1 and γ_3), because industries exporting product h to countries close to *j* are expected to be more likely to export and to sell more goods to market j. γ_2 and γ_4 are instead supposed to be positive, given that the more the product *h* is exported to the other markets *K*, the more likely it will be exported to the market *j,* with larger quantities.

Results – Estimates of Equation 3.1 and Equation 3.2 are reported in Table 3.1 and 3.2, respectively.

Table 3.1 – Export Network Effect on the probability to export to market j

Dependent variable $export^h_{i,j,t+1} > 0$	Par	(1)	(2)	(3)	(4)	(5)	(6)
$1[export^h_{i,j,t} > 0]$	$\delta 1$	2.102*** (0.0453)	1.995*** (0.0435)	1.842*** (0.0490)	1.816*** (0.0471)	1.899*** (0.0430)	1.841*** (0.0471)
$\sum_k 1[export^h_{i,k,t} > 0]$	β_1	0.0171*** (0.00046)	0.0151*** (0.00044)	0.01*** (0.00037)	0.0096*** (0.00038)	0.0099*** (0.00037)	0.0085*** (0.00036)
$ln(GDPpc_{i,t} - GDPpc_{j,t})^2$	β_1	-0.00505* (0.00210)	-0.006** (0.00199)	-0.0055** (0.00209)	-0.0062** (0.00202)	-0.0062** (0.00208)	-0.0059** (0.00212)
$lnDist_{i,j}$	β_1	-0.394*** (0.0116)	-0.376*** (0.0113)	-0.356*** (0.0111)	-0.348*** (0.0109)	-0.387*** (0.0113)	-0.358*** (0.0111)
$1[\min(pathdist^h_{i,j,t}) = 1]$	δ_1	0.258*** (0.0234)	0.188*** (0.0240)	0.0358 (0.0301)	0.0260 (0.0296)	0.109*** (0.0243)	0.0423 (0.0278)
$1[\min(pathdist^h_{i,j,t}) = \infty]$	δ_2	-0.105+ (0.0541)	-0.140* (0.0573)	-0.219** (0.0669)	-0.222*** (0.0666)	-0.176** (0.0650)	-0.214** (0.0681)
$\ln \sum_k 1[\text{export}^h_{k,j,t} > 0]\text{export}^h_{i,k,t}$	γ_1^*			0.312*** (0.00967)	0.269*** (0.00947)		0.179*** (0.00912)
$\ln \frac{\sum_k 1[\text{export}^h_{i,k,t} > 0 \,\&\, \text{export}^h_{k,j,t} > 0](\text{Dist}^h_{k,j,t})}{\sum_k 1[\text{export}^h_{i,k,t} > 0 \,\&\, \text{export}^h_{k,j,t} > 0]}$	γ_2^*			-0.568*** (0.0150)	-0.482*** (0.0138)		-0.440*** (0.0140)
$\ln \sum_k \text{export}^h_{i,k,t}$	γ_1					0.111*** (0.00423)	0.0873*** (0.00395)
$\ln \frac{\sum_k 1[\text{export}^h_{i,k,t} > 0](\text{Dist}^h_{k,j,t})}{\sum_k 1[\text{export}^h_{i,k,t} > 0]}$	γ_2					-0.0159** (0.00536)	
Extended Contiguity			0.231*** (0.00556)		0.193*** (0.00484)	0.223*** (0.00563)	
Extended Common Language			0.105*** (0.00457)		0.0525*** (0.00404)	0.0758*** (0.00407)	
Extended Common Colony/Colonizer			0.130*** (0.00590)		0.0895*** (0.00534)	0.120*** (0.00576)	
Extended Common Currency			-0.00187 (0.00440)		-0.00439 (0.00435)	-0.000271 (0.00437)	
Extended Common Religion			-0.0657 (0.0556)		-0.102+ (0.0532)	-0.0993* (0.0481)	
Extended Common Legal System			0.165*** (0.00702)		0.0644*** (0.00546)	0.0959*** (0.00643)	
Control variables		Y	Y	Y	Y	Y	Y
Exporter Fixed Effect		Y	Y	Y	Y	Y	Y
Importer Fixed Effect		Y	Y	Y	Y	Y	Y
Year Fixed Effect		Y	Y	Y	Y	Y	Y
N		11564608	11564608	11564608	11564608	11564608	11564608

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Notes: This table shows the coefficients of the Probit estimation of Equation 3.1 for 62 products (SITC rev. 2 at 2 digit) traded between 155 countries from 1980 to 2000. The dependent variable is equal to 1 if the product h produced by industry h in country i is exported to country j at time t + 1. Control variables include import growth of country j, the log of GDP of the two countries and a set of binary variables for regional trade agreement (as reported by WTO), contiguity, common language, common colonizer, common currency, importer GATT membership, exporter GATT membership and the share of population with same religion. Standard errors, clustered at the product level, are in parenthesis.

Table 3.1 shows the results of the Probit estimation for different specifications of Equation 3.1. The coefficients γ_1 (the level of export to other countries) and γ_2 (the remote distance) have the expected signs and are significative at the 0.1 percent level. These results confirm that we are more likely to observe exports of product h from country i to country j if country i already exports the same good h to countries close to j and that the probability to export to market j is positively correlated with the total value of good h exported to the other countries close to j. Furthermore, as shown by the coefficient of the path distance variable δ_2, the probability to export to j is higher if the product h is exported to at least one country k belonging to the trade network of j. This effect is robust even considering the full set of extended gravity variables that should control for differences in fixed costs to export and potentially capturing, at least partially, preferences' similarities. Having exported in the previous year to countries sharing a border or having a common language, legal system or the same colonizer of the target market increases the probability to export to the target market. Extended common currency and common religion seem however having a null or a negative impact[93]. With reference to the other control variables, all the signs and significance levels are as expected. The probability to export to the target market is positively correlated with the number of previous foreign destinations while decreases with geographic and GDP distances.

We posit that even the value of trade is influenced by the structure of the trade network, specifically by the total exporting value to the other countries K and by their distances to market j. We assume a complex ("*satellite"*) gravitational effect, where distance exhibits both direct (from the local market) and indirect (from the remote markets) effect. We estimate Equation 3.2 as a standard empirical gravity equation, with exporter, importer, year and sector fixed effects, using the same group of control variables from Equation 3.1, except for the import growth variable, the path distance variables and the exporting status variable. As standard in all gravity equations, our dependent variable is the log of the aggregated trading value of product h from country i to country j in year t. The impact of the export structure on the value of trade is reported on Table 3.2, parameters γ_1 and γ_2.

[93] The negative impact of the extended common legal system variable in Models 6 seems to be related to the correlation with the value of export to countries K. Extended results are available upon request.

Table 3.2 – Export Network Effect on the value of trade (intensive margin)

Dependent variable $\ln export_{i,j,t}^{h}$		(1)	(2)	(3)	(4)	(5)	(6)
$\sum_{k} 1[export_{i,k,t}^{h} > 0]$	β_1	0.0408*** (0.00106)	0.0397*** (0.00104)	0.0311*** (0.00140)	0.0312*** (0.00141)	0.015*** (0.00093)	0.015*** (0.00095)
$ln(GDPpc_{i,t} - GDPpc_{j,t})^2$	β_2	-0.04*** (0.00540)	-0.041*** (0.00534)	-0.038*** (0.00530)	-0.038*** (0.00528)	-0.042*** (0.00521)	-0.042*** (0.00517)
$lnDist_{i,j}$	β_3	-0.806*** (0.0334)	-0.791*** (0.0333)	-0.787*** (0.0341)	-0.781*** (0.0342)	-0.822*** (0.0313)	-0.814*** (0.0314)
$\ln \sum_{k} 1[\text{export}_{k,j,t}^{h} > 0]\text{export}_{i,k,t}^{h}$	γ_3^*			0.557*** (0.0659)	0.513*** (0.0640)		
$\ln \frac{\sum_k 1[\text{export}_{i,k,t}^{h} > 0 \ \& \ \text{export}_{k,j,t}^{h} > 0](\text{Dist}_{k,j,t}^{h})}{\sum_k 1[\text{export}_{i,k,t}^{h} > 0 \ \& \ \text{export}_{k,j,t}^{h} > 0]}$	γ_4^*			-0.864*** (0.103)	-0.779*** (0.0996)		
$\ln \sum_{k} \text{export}_{i,k,t}^{h}$	γ_3					0.632*** (0.0217)	0.628*** (0.0219)
$\ln \frac{\sum_k 1[\text{export}_{i,k,t}^{h} > 0](\text{Dist}_{k,j,t}^{h})}{\sum_k 1[\text{export}_{i,k,t}^{h} > 0]}$	γ_4					-0.199*** (0.0126)	-0.202*** (0.0125)
Extended Contiguity			0.200*** (0.0156)		0.141*** (0.0115)		0.124*** (0.0128)
Extended Common Language			0.216*** (0.0232)		0.134*** (0.0163)		0.0879*** (0.0181)
Extended Common Colony/Colonizer			0.0209 (0.0171)		-0.0248 (0.0162)		-0.0181 (0.0161)
Extended Common Currency			0.0176* (0.00842)		0.0123 (0.00848)		0.00815 (0.00859)
Extended Common Religion			-0.657** (0.207)		-0.676** (0.202)		-0.707*** (0.154)
Extended Common Legal System			0.0623** (0.0182)		0.000091 (0.0180)		-0.066*** (0.0172)
Control variables		Y	Y	Y	Y	Y	Y
Exporter Fixed Effect		Y	Y	Y	Y	Y	Y
Importer Fixed Effect		Y	Y	Y	Y	Y	Y
Year Fixed Effect		Y	Y	Y	Y	Y	Y
N		2147868	2147868	2147868	2147868	2147868	2147868

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Notes: This table shows the coefficients for the OLS estimation of a gravity equation of trade, for 62 products (SITC rev. 2- 2 digit, level) between 155 countries from 1980 to 2000. The dependent variable is the log of trade value for the product h produced in country i and exported to j at time t. Control variables include the log of GDP of the two countries and a set of binary variables for regional trade agreement (as reported by WTO), contiguity, common language, common colonizer, common currency, importer GATT membership, exporter GATT membership and the share of population with same religion. Standard errors clustered at the product level are in parenthesis.

The closer is market *j* to the other exporting destinations *K* and the more country *i* sells good *h* to these countries *K*, the higher market *j* imports the good *h* produced by country *i*. As shown in Table 3.1 and 3.2, industries not only are more likely to export in countries close to their other destinations, but also they export more.

3.3 Theoretical model

Our previous empirical findings support the idea of enhanced spatial effects and path dependence structure of trade. As shown by other scholars, these spatial effects are not completely caught by traditional gravity models. With our reduced form function, we are not able to identify if these evidences originate from spatially (or network) correlated preferences of consumers (demand side) or from spatially correlated fixed costs to access foreign markets (supply side). To define formally our framework, we extend the Chaney (2008) model of trade with heterogeneous firms by adding an exogenous preference parameter in the consumer's utility. Supported by empirical findings in the Country of Origin (COO) and marketing literature, we assume consumers' preferences are country pairs, goods specific and correlated among consumers[94]. As in Chaney (2008), we consider *N* countries with population L_n. Each firm produces one differentiated good using only labor, with a given productivity ϕ. Consumers in each country *n* consume $q_h(\omega)$ units of each variety ω of good *h* and q_0 units of good 0, the homogeneous good. Sectors *H* produce a continuum of differentiated goods. The utility of consumer is:

$$U = q_0^{\mu_0} \left[\prod_{h=1}^{H} \int_{\Omega_h} (\alpha_{ij}^h)^{\frac{1}{\sigma_h}} q_h(\omega)^{\frac{\sigma_h - 1}{\sigma_h}} d\omega \right]^{\frac{\sigma_h}{\sigma_h - 1}\mu_h} \tag{3.3}$$

where $\mu_0 + \sum_1^H \mu_h = 1$. α_{ij}^h is the exogenous preference shifter of consumers in country *j* for the goods of sector *h* produced in country *i,* as in Feenstra et al. (2018)[95], while $\sigma_h > 1$ is the elasticity of substitution between two varieties of good *h*. The homogeneous good 0 is used as numeraire and is produced with unitary constant returns to scale[96]. It is freely traded with price equal to 1, so that if country *n* produces the good, the wage in the country is w_n. As standard in literature, we assume that each country produces the numeraire, to simplify the analysis[97]. For a firm in country *i*, the cost of producing and selling *q* unit of good *h* to country *j* is:

$$c_{ij}^h(q) = \frac{w_i \tau_{ij}^h}{\varphi} q + f_{ij}^h \tag{3.4}$$

[94] The willingness to pay for Italian or Spanish hams is higher in Europe but not in middle-east Muslim countries. German or Japan cars are worldwide perceived as high quality products, or European consumers prefer Swiss watches to Japan watches.
[95] $\sum_{i \neq j} \alpha_{ij}^h = 1$
[96] One unit of labor in country n produces w_n units of good 0.
[97] As Chaney (2008) specifies, the assumption hold as long as μ_0 or trade barriers are large enough.

where $\tau_{ij}^{h} > 1$ is the variable trade cost in the form of an "iceberg" transportation cost and f_{ij}^{h} is the fixed cost to export from country i to country j. All countries have access to the same technology and, given the presence of fixed cost, firms produce under increasing returns to scale. The unit labor productivity φ is drawn by each firm from a Pareto distribution function, as in Helpman, Melitz and Yeaple (2004) with shape parameter $\gamma_h > \sigma_h - 1$. The distribution of productivity is

$$P(\tilde{\varphi}_h < \varphi) = G_h(\varphi) = 1 - \varphi^{-\gamma_h} \tag{3.5}$$

distributed over $[1, \infty)$. Higher value of γ_h implies that firms' productivities are more homogeneous and concentrated among the lower part of the distribution. The condition $\gamma_h > \sigma_h - 1$ ensures that the size distribution of firms has a finite mean in equilibrium. Similarly to Chaney (2008), we assume the total mass of potential entrants in country n proportional to $w_n L_n$ in order to simplify the analysis. Hence, bigger and wealthier countries have more potential entrants. Furthermore, each worker owns own shares of a global fund collecting profits from all the firms and redistributing them in units of the numeraire good to the shareholders. Total expenditure Y_j of workers in country j is therefore the total income, $(1+\pi)w_j L_j$, where π is the dividend per share of the global mutual fund.

Firms are price setters and given that the demand function is isoelastic, the optimal price is a constant mark-up over the unit cost, including the iceberg transportation cost. The demand for exports from country i to country j in sector h, faced by a firm with productivity φ, is

$$x_{ij}^{h}(\varphi) = p_{ij}^{h}(\varphi) q_{ij}^{h}(\varphi) = \mu_h Y_j \, \alpha_{ij}^{h} \left(\frac{p_{ij}^{h}(\varphi)}{P_j^{h}} \right)^{1-\sigma_h} \tag{3.6}$$

where $P_j^h = \left[\sum_k^N \alpha_{kj}^h {p_{kj}^h}^{1-\sigma_h} \right]^{\frac{1}{1-\sigma_h}}$ is the price index for good h in country j. Because firms face a fixed cost to export, f_{kj}^{h}, only the firms with productivity φ above the threshold $\tilde{\varphi}_{kj}^{h}$ can export to country j. Given the assumption of exogenous entry (proportional to $w_k L_k$), the price index P_j^h is defined as

$$P_j^h = \left[\sum_{k=1}^{N} w_k L_k \int_{\tilde{\varphi}_{kj}^h}^{\infty} \alpha_{kj}^h \left(\frac{\sigma_h}{\sigma_h - 1} \, \frac{w_k \tau_{kj}^h}{\varphi} \right)^{1-\sigma_h} dG_h(\varphi) \right]^{\frac{1}{1-\sigma_h}} \tag{3.7}$$

and the net profit that a firm with productivity φ, producing good h in country k, earns exporting to country l is

$$\pi_{kl}^{h}(\varphi) = [p_{kl}^{h}(\varphi) - c_{kl}^{h}(\varphi)]q_{kl}^{h}(\varphi) - f_{kl}^{h} \quad (3.8)$$

Aggregate profit are therefore as in Chaney (2008)

$$\pi = \frac{\sum_{h=1}^{H}\sum_{k,l=1}^{N} w_k L_k \left(\int_{\tilde{\varphi}_{kl}^{h}}^{\infty} \pi_{kl}^{h}(\varphi) dG_h(\varphi)\right)}{\sum_{n=1}^{N} w_n L_n} \quad (3.9)$$

To compute the general equilibrium solution of this system we have to specify the cut-off productivity level $\tilde{\varphi}_{kj}^{h}$ above which firms export to country j. Plugging the demand of consumers and the price settled by firms in the profit equation we have the following equation for net profit $\pi_{ij}(\varphi)$

$$\pi_{ij}(\varphi) = \frac{\mu_h}{\sigma_h} Y_j\, \alpha_{ij}^{h} \left(\frac{\sigma_h}{\sigma_h - 1}\, \frac{w_i \tau_{ij}^{h}}{\varphi P_j^{h}}\right)^{1-\sigma_h} - f_{ij}^{h} \quad (3.10)$$

Defining the threshold $\tilde{\varphi}_{ij}^{h}$ as the level of productivity where the profit of the firm with productivity φ producing good h in country i and exporting in country j is null ($\pi_{ij}(\varphi) = 0$), we can rearrange the previous equation as

$$\tilde{\varphi}_{ij}^{h} = \left(\frac{\sigma_h}{\mu_h}\right)^{1/(\sigma_h - 1)} \frac{\sigma_h}{\sigma_h - 1} \left(\frac{f_{ij}^{h}}{Y_j \alpha_{ij}^{h}}\right)^{1/(\sigma_h - 1)} \frac{w_i \tau_{ij}^{h}}{P_j^{h}} \quad (3.11)$$

$\tilde{\varphi}_{ij}^{h}$ is therefore the productivity level below which any firms does not export to country j.

We observe that the preference parameter, α_{ij}^{h}, has a balancing effect with respect to the fixed cost, f_{ij}^{h}. A proportional increase of preferences for good h produced in country i is equivalent to a proportional reduction in the fixed cost of export f_{ij}^{h}. Formally, $\frac{\partial\, ln\, \tilde{\varphi}_{ij}^{h}}{\partial\, ln\, \alpha_{ij}^{h}} = -\frac{\partial\, ln\, \tilde{\varphi}_{ij}^{h}}{\partial\, ln\, f_{ij}^{h}} = 1/(\sigma_h - 1)$.

Thanks to the assumptions that wages are exogenously pinned down in the homogeneous sector 0 and entrants are exogenously determined, the equilibrium price index is given by the solution of the following system of equations:

$$\begin{cases} P_j^h = \left[\sum_{k=1}^{N} w_k L_k \int_{\tilde{\varphi}_{kj}^h}^{\infty} \alpha_{kj}^h \left(\frac{\sigma_h}{\sigma_h - 1} \frac{w_k \tau_{kj}^h}{\varphi}\right)^{1-\sigma_h} dG_h(\varphi)\right]^{\frac{1}{1-\sigma_h}} \\ \tilde{\varphi}_{kj}^h = \left(\frac{\sigma_h}{\mu_h}\right)^{1/(\sigma_h-1)} \frac{\sigma_h}{\sigma_h - 1}\left(\frac{f_{kj}^h}{Y_j \alpha_{kj}^h}\right)^{1/(\sigma_h-1)} \frac{w_k \tau_{kj}^h}{P_j^h} \end{cases} \quad (3.12)$$

Considering that the distribution of $G_h(\varphi)$ is a Pareto with shape parameter γ_h, we can solve for the integral and rearranging the equation expressing P_j^h as

$$P_j^h = \Phi_1 Y_j^{\frac{1}{\gamma_h} - \frac{1}{\sigma_h - 1}} \theta_j^h \quad (3.13)$$

where $\theta_j^h = \left(\frac{Y^*}{Y_k}\right)^{\frac{1}{\gamma_h}} \sum_{k=1}^{N} (w_k \tau_{kj}^h) f_{kj}^{h\;-\frac{1}{\gamma_h}} \left(\frac{f_{kj}^h}{\alpha_{kj}^h}\right)^{\frac{1}{\sigma_h - 1}}$ and $\Phi_1 = \frac{\sigma_h}{\sigma_h - 1}\left(\frac{\gamma_h - (\sigma_h - 1)}{\gamma_h}\right)^{\frac{1}{\gamma_h}} \left(\frac{\sigma_h}{\mu_h}\right)^{\left(\frac{1}{\sigma_h - 1} - \frac{1}{\gamma_h}\right)} \left(\frac{1+\pi^*}{Y^*}\right)^{\frac{1}{\gamma_h}}$ with Y* and π^* being, respectively, world output and profit computed in equilibrium.

By plugging the price index P_j^h into the demand function and the productivity threshold we can now compute the value of exports of an individual firm with labour productivity φ. As in Chaney (2008), we can simultaneously solve the system for firm level export, productivity threshold and total world profit.

The solution is given by plugging P_j^h into the following system of equations:

$$
\begin{cases}
x_{ij}(\varphi) = \begin{cases} \mu_h \left(\dfrac{\sigma_h}{\sigma_h - 1}\right)^{1-\sigma_h} Y_j \, \alpha_{ij}^h \left(\dfrac{w_i \tau_{ij}^h}{P_j^h}\right)^{1-\sigma_h} \varphi^{\sigma_h - 1} & if\ \varphi \geq \tilde{\varphi}_{ij}^h \\ 0 & if\ \varphi < \tilde{\varphi}_{ij}^h \end{cases} \\
\tilde{\varphi}_{ij}^h = \left(\dfrac{\sigma_h}{\mu_h}\right)^{1/(\sigma_h - 1)} \dfrac{\sigma_h}{\sigma_h - 1} \left(\dfrac{f_{ij}^h}{Y_j \alpha_{ij}^h}\right)^{1/(\sigma_h - 1)} \dfrac{w_i \tau_{ij}^h}{P_j^h} \\
Y_i = (1 + \pi) w_i L_i \\
\pi = \displaystyle\sum_{h=1}^{H} \pi_h
\end{cases}
\tag{3.14}
$$

As a result, we can define the export of product h to country j for a firm producing in country i as:

$$
x_{ij}(\varphi) = \begin{cases} \Phi_2 \left(\dfrac{Y_j}{Y}\right)^{\frac{\sigma_h - 1}{\gamma_h}} \alpha_{ij}^h \left(\dfrac{w_i \tau_{ij}^h}{\theta_j^h}\right)^{1-\sigma_h} \varphi^{\sigma_h - 1} & if\ \varphi \geq \tilde{\varphi}_{ij}^h \\ 0 & if\ \varphi < \tilde{\varphi}_{ij}^h \end{cases} \tag{3.15}
$$

With threshold $\tilde{\varphi}_{ij}^h = \Phi_3 \left(\frac{Y}{Y_j}\right)^{\frac{1}{\gamma_h}} \frac{w_i \tau_{ij}^h}{\theta_j^h} \left(\frac{f_{ij}^h}{\alpha_{ij}^h}\right)^{1/(\sigma_h - 1)}$, $\Phi_2 = \sigma_h \Phi_3^{1-\sigma_h}$, $\Phi_3 = \left[\frac{\sigma_h}{\mu_h} \frac{\gamma_h}{\gamma_h - (\sigma_h - 1)} \frac{1}{1+\pi}\right]^{\frac{1}{\gamma_h}}$ and π computed as in Chaney (2008).

The preference parameter of the country of origin has therefore an effect on the intensive and extensive margins of trade, lowering the productivity cutoff in the latter case[98].

In order to compute the value of aggregate trade from country i to country j for good h (X_{ij}^h) ,we have to sum the exporting value to country j of all firms in country i producing the good h, having a productivity at least equal to the productivity threshold $\tilde{\varphi}_{ij}^h$. With the assumption of exogenous potential entry, we define total exports as $X_{ij}^h = w_i L_i \int_{\tilde{\varphi}_{ij}^h}^{\infty} x_{ij}^h(\varphi) dG_h(\varphi)$

[98] A lower cutoff implies that a higher number of firms can access the foreign market j.

Plugging Equation 3.15 and the corresponding threshold $\tilde{\varphi}_{ij}^h$ into X_{ij}^h and considering $Y_i = (1 + \pi)w_i L_i$ we can derive total exports[99] as:

$$X_{ij}^h = \mu_h \frac{Y_i\, Y_j}{Y} \left(\frac{w_i \tau_{ij}^h}{\theta_j^h}\right)^{-\gamma_h} \alpha_{ij}^h \left(\frac{\alpha_{ij}^h}{f_{ij}^h}\right)^{\frac{\gamma_h}{(\sigma_h - 1)} - 1} \tag{3.16}$$

Given that $\gamma_h > \sigma_h - 1$, a proportional decrease of fixed cost f_{ij}^h increases the total value of exports, X_{ij}^h, less than a proportional increase of the consumers' preference parameter α_{ij}^h. Because both α_{ij}^h and some elements of fixed cost f_{ij}^h are unobservable, we are not able to identify if the sequential and spatial exporting effect discovered in our empirical analysis is due to spatial correlated structure of fixed cost f_{ij}^h or to the spatial correlated preferences (the α_{ij}^h parameter). One of the two variables, or probably both, are the source of the defined *extended gravity* (Morales et al., 2017). In appendix 3.A, we test if the impact of the ratio $\alpha_{ij}^h \left(\frac{\alpha_{ij}^h}{f_{ij}^h}\right)^{\frac{\gamma_h}{(\sigma_h - 1)} - 1}$ of Equation 3.16 can be negligible. We conclude that by omitting preference and cost parameters, it is impossible to correctly explain the structure of trade, especially for zero trade and large values of X_{ij}^h.

3.3.1 Introducing spatially correlated preferences

Several scholars in marketing and empirical economics have found that spatial interdependence among individual consumers plays a critical role in consumers' preferences. Frenkel et al. (2002) apply a cross-border structure to identify the segmentation of international markets. They introduce a spatial association and a spatial contiguity model in the segmentation literature, departing from the classical spatial independence or countries-as-segment assumption. Using survey data on a store image measurement instrument, they find superior performance of the spatial contiguity and association models and a relative preference of the spatial independence model over the countries-as-segment model, showing that preferences are correlated and cut across national borders.

Yang and Allenby (2003), using a Bayesian spatial autoregressive discrete choice model, show how preferences for Japanese-made cars are related to geographically and demographically defined networks. The authors display as the autoregressive specification reflects patterns of heterogeneity where

[99] Total export are equal to: $X_{ij}^h = w_i L_i * \Pr(\varphi > \tilde{\varphi}_h) * E(x_{ij}^h | \varphi > \tilde{\varphi}_h)$

influence propagates within and across networks. They demonstrate that preferences and choice behavior are influenced by consumer's own tastes and the tastes of others. People who identify themselves with a particular group often adopt the preferences of the group, resulting in choices that are interdependent. Examples include the preference for particular brands (e.g. Abercrombie and Fitch) or even entire product categories, as minivans. Yang and Allenby (2003), computing a measure of physical proximity[100] and a demographic neighbors variable[101], prove that geographically defined networks are more important to explain individual consumer behaviors than demographic networks.

Rossi et al. (2005), studying rating data, find that the latent preference variable is subject to respondent-specific location and scale shifts. Their latent rating provides superior information on purchases than the traditional centering method. Bell and Song (2007) show that consumers' decisions to adopt a new Internet service is affected by interactions with other consumers who live in the same postal code area, confirming the previous findings that consumers' preferences are spatially dependent.

Using Google trend data at national and local levels, we provide some intuitive graphical evidences about spatial correlation of preferences. Google trend data reports the relative frequency of search of a random sample of users in a selected area and time range. Data are scaled on a range from 0 to 100 based on a topic's proportion to all searches on all selected topics[102]. Topic's content is based on searched words, or set of words, that are then categorized by Google.

In Figure 3.1 and Figure 3.2, we observe the relative frequency of search for a subset of leading motor vehicle manufacturers. On a national basis, consumers in closer countries seem to search more for the same car producer, following a spatial pattern. This phenomenon is more evident when we move to a local level (Panels b of Figures 3.1 and 3.2). Switzerland is a multicultural country in the middle of Europe strongly influenced by habits, languages, culture and migration from their neighbours where preferences seem to be shaped along the border, as shown in panel b of Figure 3.1. Consumers in regions close to France search more for the French automaker Peugeot, consumers close to Italy for the Italian automaker FIAT and consumers close to Germany and Austria for the German automaker OPEL. Zurich

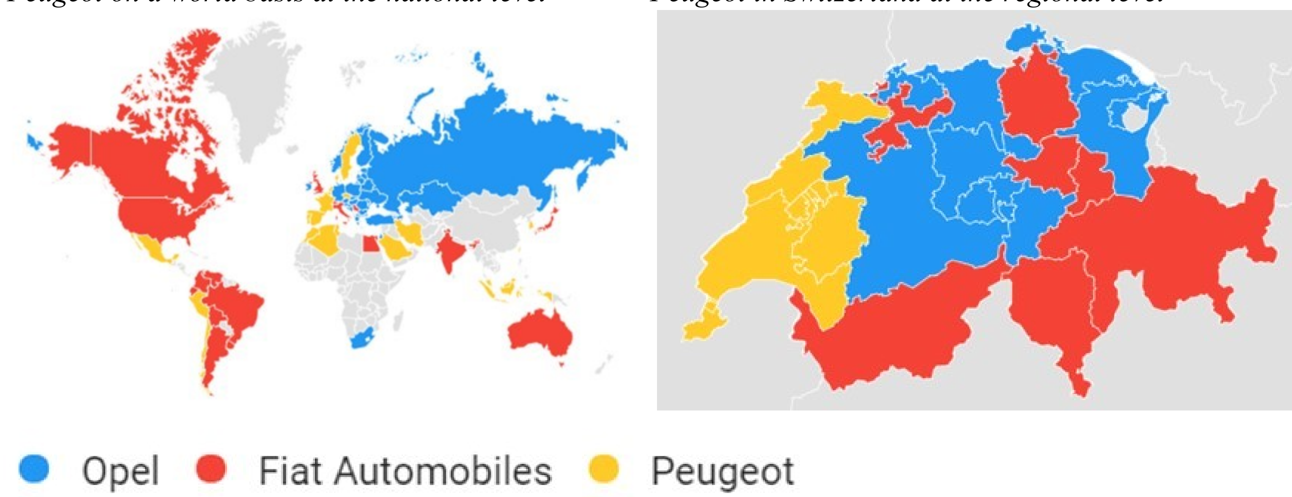
[100] Measured in terms of geographic distance among individuals' places of residence.
[101] Defined by membership in the same cluster with similar individuals.
[102] Google popularity of i in j = 100* $\frac{(\text{Google searches including the world or topic i/total Google searches})_j}{(\text{Google searches including the world or topic i/total Google searches})_{max}}$, where i is the searched word or topic and j is the local area.

and some others cantons (local entity at NUTS 2 levels) exhibit a more differentiated pattern of relative search, with a small preference for FIAT.

Figure 3.1 – Popularity (google relative trend data) for Opel, Fiat and Peugeot at a national and regional (Switzerland) level, for the year 2014-2015.

a) Relative frequency of search for Opel, Fiat and Peugeot on a world basis at the national level

b) Relative frequency of search for Opel, Fiat and Peugeot in Switzerland at the regional level

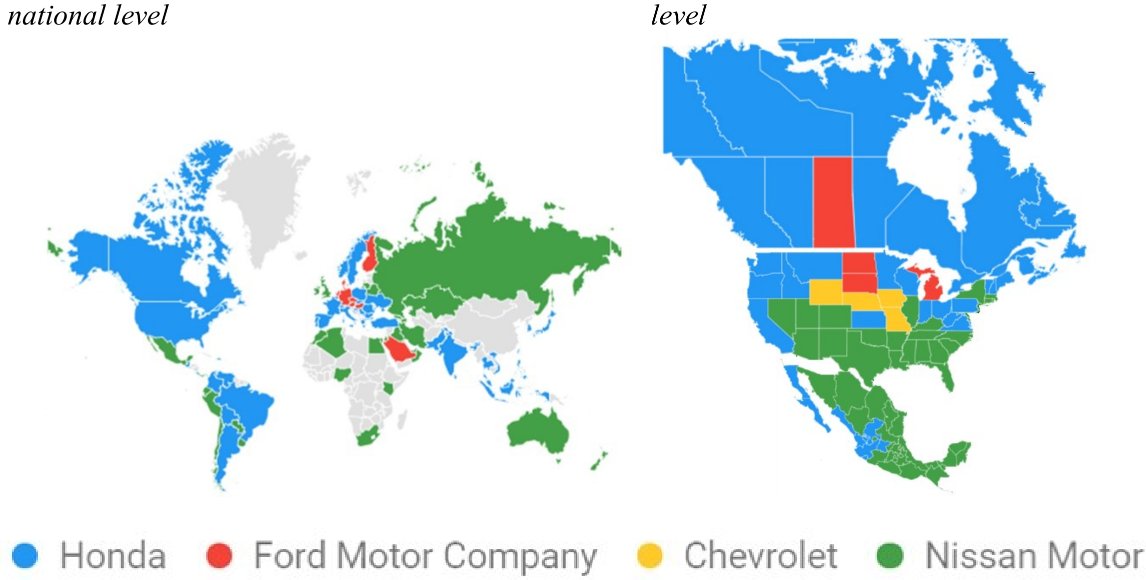


Note: Colour of regions or nations indicates the relative most searched carmaker in the years 2014-2015.

Figure 3.2 – Popularity (google relative trend data) for Honda, Ford, Chevrolet and Nissan at a national and regional (North America) level, for the year 2014-2015

a) Relative frequency of search for Honda, Ford, Chevrolet and Nissan on a world basis at the national level

b) Relative frequency of search for Honda, Ford, Chevrolet and Nissan in North America at the regional level



Note: Colour of regions or nations indicates the relative most searched carmaker in the years 2014-2015.

Similar considerations emerge from Figure 3.2, panel b. Relative searches popularity in North America clearly cross national borders and seem to be spatially correlated. Local consumers are more likely to look for the same car producer searched by their regional neighbors.

With the Moran's I test, we verify the presence of spatial correlation in the national data of Figure 3.1. As shown in Table 3.3, modelling preferences as spatially correlated seem to be justified, given that the test reject at 95% the null hypothesis of zero spatial autocorrelation. Z-score greater than zero points us that high or low values are more spatially clustered than expected[103].

Table 3.3 - Moran's I measure of spatial autocorrelation of the Google popularity index for FIAT, Peugeot and Opel carmakers in 2014, at a national level.

Variables	*I*	*E(I)*	*sd(I)*	*z*	*p-value*
GPI_{FIAT}	*0.050*	*-0.019*	*0.032*	*2.163*	*0.015*
GPI_{OPEL}	*0.339*	*-0.019*	*0.033*	*10.968*	*0.000*
$GPI_{PEUGEOT}$	*0.132*	*-0.019*	*0.032*	*4.642*	*0.000*

Note: This table shows the result of the Moran's I test of spatial autocorrelation. Based on these results, we can reject the null hypothesis that there is zero spatial autocorrelation in the variables at alpha = .05. I is the Moran I statistic, E(I) the expected value of the statistic under the null hypothesis of global spatial independence, sd(I) the standard deviation of the statistic, z the z-value of the statistic and p-value the corresponding 1-tail value.

Including spatial demand in a theoretical model is not straightforward. From a microeconomic point of view, we define the preference parameter α of consumer *e* for good *h* produced by *i* as $\alpha_{ie}^{h} = z_{ie}\phi + \sum_{f\neq e}^{E} \frac{1}{f(d_{ef})} \beta_{ef}\alpha_{if}^{h}$ where $z_{ie} = (g_i, r_e)$, is a vector of parameters including features of good *h* produced in country *i* (g_i) and characteristics of the consumer *e* (r_e), *f* is a consumers different from *e*, $\frac{1}{f(d_{ef})}$ is a function of distance expressing the probability that the two consumers get in touch (it can be a physical distance or a network linked matrix), β_{ef} is the individual weight that *e* gives to the preferences of *f*, capturing the imitation behavior of *e* and the social proximity between *e* and *f*[104].

---

[103] These seem compatible with the findings of Appendix 3.A. Omitting the unobserved preference and fixed cost parameters when trade is predicted by a gravity equation produces large bias especially for low and high value of the distribution.

[104] A more formal micro approach is used by Yang and Allenby (2003), where the binary choice of a good captures the potential social dependency of preferences among consumers. The latent preference of *i* for good 2 over 1, defined as z_i is captured by $z_i = x_i'\beta + \varepsilon_i + \theta_i$, with $\theta = \rho W\theta + u$, $\varepsilon \sim N(0, I), u \sim N(0, \sigma^2 I)$, where θ is a vector of autoregressive parameter with ρW capturing the interdependence of preferences across consumers, and W is a matrix of finite mixture of coefficient, $W = \sum_{k=1}^{K} \phi_k W_k$, with $\sum_{k=1}^{K} \phi_k = 1$ where k are factors capturing the theoretical proximity of consumer (k_1 could be the physical distance, k_2 the wealth distance, k_3 ethnicity and so on).

National average preferences are therefore equal to the mean of α_{ie}^{h} over all consumers *e* belonging to country *j*. Formally, we simplify the model defining the average preference of consumers in country *j* for the good *h* with country-of-origin *i*, α_{ij}^{h}, as

$$\alpha_{ij}^{h} = z_{ij}^{h}\phi + \sum_{k\neq j}^{K} \frac{\beta_{jk}^{h}}{d_{jk}^{h}} \alpha_{ik}^{h} \qquad (3.17)$$

where z_{ij}^{h} is a vector including the average characteristics of consumers in *j* and the features of product *h* produced in *i*, β_{jk} is the average influence parameter of consumer in country *k* over consumers in country *j* and d_{jk}^{h} is a function of the distance between consumer in country *j* and *k* (e.g. population weighted distance or a border binary variable) controlling for the probability that consumers in countries *j* and *k* are in contact or they observe each other[105].

Considering the spatial dependence of the preference parameter α_{ij}^{h}, we can therefore rewrite Eq. 3.16 as:

$$X_{ij}^{h} = \mu_h \frac{Y_i\, Y_j}{Y} \left(\frac{w_i \tau_{ij}^{h}}{\theta_j^{h}}\right)^{-\gamma_h} \left(z_{ij}^{h}\phi + \sum_{k\neq j}^{K} \frac{\beta_{jk}^{h}}{d_{jk}^{h}} \alpha_{ik}^{h}\right)^{\frac{\gamma_h}{(\sigma_h - 1)}} \left(f_{ij}^{h}\right)^{1-\frac{\gamma_h}{(\sigma_h - 1)}} \qquad (3.18)$$

and plugging α_{ik}^{h} derived from Eq. 3.16[106] as a function of the observable parameter X_{ik}^{h} in Equation 3.18:

$$X_{ij}^{h} = \mu_h \frac{Y_i\, Y_j}{Y} \left(\frac{w_i \tau_{ij}^{h}}{\theta_j^{h}}\right)^{-\gamma_h} \left(z_{ij}^{h}\phi + \left(\frac{Y {w_i}^{\gamma}}{\mu_h Y_i}\right)^{\frac{\sigma_h - 1}{\gamma}} \sum_{k\neq j}^{K} \frac{\beta_{jk}^{h}}{d_{jk}^{h}} \left[\left(\frac{X_{ik}^{h}}{Y_k}\right)^{\frac{1}{\gamma_h}} \left(\frac{\tau_{ik}^{h}}{\theta_k^{h}}\right) \left(f_{ik}^{h}\right)^{\left(\frac{1}{\gamma_h} - \frac{1}{\sigma_h - 1}\right)}\right]^{\sigma_h - 1}\right)^{\frac{\gamma_h}{(\sigma_h - 1)}} \left(f_{ij}^{h}\right)^{1-\frac{\gamma_h}{(\sigma_h - 1)}}$$

(3.19)

[105] Consequently, large area countries with sparse population and low accessibility will exhibits less homogenous preferences.

[106] Using Eq. 3.16, $\alpha_{ij}^{h} = \left(\frac{Y X_{ij}^{h}}{\mu_h Y_i Y_j}\right)^{\frac{\sigma_h - 1}{\gamma_h}} \left(\frac{w_i \tau_{ij}^{h}}{\theta_j^{h}}\right)^{\sigma_h - 1} \left(f_{ij}^{h}\right)^{\frac{\sigma_h - 1}{\gamma_h} - 1}$

Ceteris paribus, exports from country i to countries different from j are positively correlated with export from i to j, if the influence parameter (β_{jk}) is greater than 0. This correlation is higher for countries close to country j (because of d_{jl}^h), as we have shown in our empirical analysis (reduced from).

This *spatially demand gravity equation*, which includes in the traditional gravity framework a spatially correlated preference parameter, explains some of the empirical findings of previous scholars, such as Chaney (2014), Morales et al. (2017) or Blum and Goldfarb (2006) [107] and provides a useful framework to explore the migration-trade link effect[108]. Indeed, plugging Equation 3.17 into the equation of firm's exports (Equation 3.15) we can write

$$x_{ij}(\varphi) = \begin{cases} \Phi_2 \left(\frac{Y_j}{Y}\right)^{\frac{\sigma_h - 1}{\gamma_h}} \left(z_{ij}^h \phi + \sum_{k \neq j}^{K} \frac{\beta_{jk}^h}{d_{jk}^h} \alpha_{ik}^h\right) \left(\frac{w_i \tau_{ij}^h}{\theta_j^h}\right)^{1-\sigma_h} \varphi^{\sigma_h - 1} & if\ \varphi \geq \tilde{\varphi}_{ij}^h \\ 0 & if\ \varphi < \tilde{\varphi}_{ij}^h \end{cases} \tag{3.20}$$

with threshold

$$\tilde{\varphi}_{ij}^h = \Phi_3 \left(\frac{Y}{Y_j}\right)^{\frac{1}{\gamma_h}} \frac{w_i \tau_{ij}^h}{\theta_j^h} \left(\frac{f_{ij}^h}{z_{ij}^h \phi + \sum_{k \neq j}^{K} \frac{\beta_{jk}^h}{d_{jk}^h} \alpha_{ik}^h}\right)^{1/(\sigma_h - 1)} \tag{3.21}$$

[107] Blum and Goldfarb (2006) find distance impact lasts in the case of digital goods consumed over the Internet that have no trading costs. They show that the effect of distance only holds for taste-dependent digital products, such as music, games, and pornography, while disappears for non-taste-dependent products.

[108] Two main channels have been described in the literature to explain how immigrants can enhance trade: the information/search cost channel (fixed cost) and the transaction cost channel (variable cost). Migrants can serve as information providers and trade intermediaries because they have a deep knowledge of their home country's opportunities and potential markets, access to distribution channels, contacts and familiarity to local customs, law and business practices. In our framework, we overtake the fixed or variable cost migration effect, introducing a realistic impact on national consumers' preferences. We can therefore overhaul the traditional debate on the migration trade link defining a theoretical framework where immigrant can influence both the fixed cost to export (reducing information cost) and the preference parameter of consumers in the importing country, without resort to shape variable trade cost as a function of workers or consumers' characteristics. The idea that migrants reduce the variable cost of trade has been proposed in order to explain why immigration increaes the intensive margin of trade.

Deriving α_{ik}^h in Equation 3.20 as a function of the observable parameter, X_{ik}^h we have:

$x_{ij}(\varphi) =$

$$= \begin{cases} \Phi_2 \left(\frac{Y_j}{Y}\right)^{\frac{\sigma_h - 1}{\gamma_h}} \left(z_{ij}^h \phi + \left(\frac{Y w_i^{\gamma}}{\mu_h Y_i}\right)^{\frac{\sigma_h - 1}{\gamma}} \sum_{k \neq j}^{K} \frac{\beta_{jk}^h}{d_{jk}^h} \left[\left(\frac{X_{ik}^h}{Y_k}\right)^{\frac{1}{\gamma_h}} \left(\frac{\tau_{ik}^h}{\theta_k^h}\right) (f_{ik}^h)^{\left(\frac{1}{\gamma_h} - \frac{1}{\sigma_h - 1}\right)} \right]^{\sigma_h - 1} \right) \left(\frac{w_i \tau_{ij}^h}{\theta_j^h}\right)^{1-\sigma_h} \varphi^{\sigma_h - 1} & if\ \varphi \geq \tilde{\varphi}_{ij}^h \\ 0 & if\ \varphi < \tilde{\varphi}_{ij}^h \end{cases}$$

(3.22)

with threshold

$$\tilde{\varphi}_{ij}^h = \Phi_3 \left(\frac{Y}{Y_j}\right)^{\frac{1}{\gamma_h}} \frac{w_i \tau_{ij}^h}{\theta_j^h} \left(\frac{f_{ij}^h}{z_{ij}^h \phi + \left(\frac{Y w_i^{\gamma}}{\mu_h Y_i}\right)^{\frac{\sigma_h - 1}{\gamma}} \sum_{k \neq j}^{K} \frac{\beta_{jk}^h}{d_{jk}^h} \left[\left(\frac{X_{ik}^h}{Y_k}\right)^{\frac{1}{\gamma_h}} \left(\frac{\tau_{ik}^h}{\theta_k^h}\right) (f_{ik}^h)^{\left(\frac{1}{\gamma_h} - -\frac{1}{\sigma_h - 1}\right)} \right]^{\sigma_h - 1}} \right)^{1/(\sigma_h - 1)}$$

(3.23)

$\tilde{\varphi}_{ij}^h$ is lower for countries *j* that are closer in term of distance (lower d_{jk}^h) or in term of similarity (higher influence parameter β_{jk}) to countries where *i* already exports. An increase of β_{jk}^h or $z_{ij}^h \phi$[109], due for instance to migration or to increasing proximity with other consumers in *k*, reduces the minimum level of productivity to access market *j* and boosts the value of trade for each firm. We will therefore observe an increase in the extensive margin of trade, that is defined by $pr(\varphi > \tilde{\varphi}_{ij}^h)$ and in the intensive margin of trade (x_{ij}). So far, we are able to explain the trade-migration effect on the intensive margin of trade without imposing a particular structure to variable trade costs.

With spatial correlated preferences, consumers prefer to buy goods used by their geographical or social neighbours and this effect is independent from logistic or supply chain costs included in the fixed cost. This effect is stronger and explicit along the border, because connections and social interactions decrease rapidly with distance.

[109] $z_{ij}^h \phi$ is the average idiosyncratic preference parameter of consumers in country *j* for product *h* made by *i*, that is influenced by the features of customers in country *i*.

As found at a micro level by Chaney (2014) and at a macro level in our empirical analysis, the probability to observe trade flows between i and j increases with the total exports of i to countries k different from j ($\sum_{k\neq j}^{K} X_{ik}^{h}$) and decreases with the distance of country j from these other countries k (d_{jk}^{h}). According to the results of our reduced form, this effect is stronger for countries sharing some characteristics (the extended gravity variable), because of different β_{jk}^{h}.

3.4 Estimation of the correlation parameter

3.4.1 Identification strategy

In order to identify the preference parameter in the preference-fixed cost ratio, we need to cancel out the fixed cost variable. Exports from countries i and k to country j, for good h, are equals to $X_{ij}^{h} = \mu_h \frac{Y_i Y_j}{Y} \left(\frac{w_i \tau_{ij}^{h}}{\theta_j^{h}}\right)^{-\gamma_h} (\alpha_{ij}^{h})^{\frac{\gamma_h}{(\sigma_h-1)}} (f_{ij}^{h})^{1-\frac{\gamma_h}{(\sigma_h-1)}}$ and $X_{kj}^{h} = \mu_h \frac{Y_k Y_j}{Y} \left(\frac{w_k \tau_{kj}^{h}}{\theta_j^{h}}\right)^{-\gamma_h} (\alpha_{kj}^{h})^{\frac{\gamma_h}{(\sigma_h-1)}} (f_{kj}^{h})^{1-\frac{\gamma_h}{(\sigma_h-1)}}$

Taking the ratio of X_{ij}^{h} over X_{kj}^{h} we can write:

$$\frac{X_{ij}^{h}}{X_{kj}^{h}} = \frac{Y_i}{Y_k}\left(\frac{w_i \tau_{ij}^{h}}{w_k \tau_{kj}^{h}}\right)^{-\gamma_h} \left(\frac{f_{ij}^{h}}{f_{kj}^{h}}\right)^{1-\frac{\gamma_h}{(\sigma_h-1)}} \left(\frac{\alpha_{ij}^{h}}{\alpha_{kj}^{h}}\right)^{\frac{\gamma_h}{(\sigma_h-1)}} \qquad (3.24)$$

Our identification strategy relies on the fact that if *i, k* and *j* belong to the same custom union or common market *S*, $\frac{f_{ij}^{h}}{f_{kj}^{h}} = 1$. Fixed costs to export of the two countries, f_{ij}^{h} and f_{kj}^{h}, must be equals, given that country *j* has to guarantee the same importing conditions for products of countries *i* and *k*. Therefore, firms in countries *k* and *i* face the same fixed costs to export to market *j*. This assumption holds as long as networking, marketing, logistic, procedural fixed costs and sunk cost are the same for the exporting firms producing in countries *i* and *k*. This is a reasonable condition until we consider countries close to each other, in custom or market union, where firms shall have access to the same set of market information for the same price.

In a custom union *S*, where *i, j* and $k \in S$, the ratio between the exports of countries *i* and *k* to country *j* can be written as:

$$\frac{X_{ij}^h}{X_{kj}^h} = \frac{Y_i}{Y_k}\left(\frac{w_i\tau_{ij}^h}{w_k\tau_{kj}^h}\right)^{-\gamma_h}\left(\frac{\alpha_{ij}^h}{\alpha_{kj}^h}\right)^{\frac{\gamma_h}{(\sigma_h-1)}} \tag{3.25}$$

Recalling that

$$\alpha_{ij}^h = z_{ij}^h\phi + \sum_{l\neq j}^{L}\frac{\beta_{jl}^h}{d_{jl}^h}\alpha_{il}^h \text{ and } \alpha_{kj}^h = z_{kj}^h\phi + \sum_{l\neq j}^{L}\frac{\beta_{jl}^h}{d_{jl}^h}\alpha_{kl}^h \tag{3.26}$$

and, using Equation 3.25 to define α_{il}^h and α_{kl}^h as a function of the ratio between the observable exports from the same country *s* to country *l*, X_{sl}^h, over the export from country *i* to *l*, X_{il}^h, and *k* to *l*, X_{kl}^h (with *i,k,l,s* ∈ *S*)[110], we can write

$$\alpha_{il}^h = \left[\frac{X_{il}^h}{X_{sl}^h}\frac{Y_s}{Y_i}\left(\frac{w_s\tau_{sl}^h}{w_i\tau_{il}^h}\right)^{-\gamma_h}\right]^{\frac{\sigma_h-1}{\gamma_h}}\alpha_{sl}^h \text{ and } \alpha_{kl}^h = \left[\frac{X_{kl}^h}{X_{sl}^h}\frac{Y_s}{Y_k}\left(\frac{w_s\tau_{sl}^h}{w_k\tau_{kl}^h}\right)^{-\gamma_h}\right]^{\frac{\sigma_h-1}{\gamma_h}}\alpha_{sl}^h \tag{3.27}$$

Plugging Equation 3.27 into Equations 3.26 and substituting α_{ij}^h and α_{kj}^h in Equation 3.25 we have:

$$\frac{X_{ij}^h}{X_{kj}^h} = \frac{Y_i}{Y_k}\left(\frac{w_i\tau_{ij}^h}{w_k\tau_{kj}^h}\right)^{-\gamma_h}\left(\frac{z_{ij}^h\phi + \left(\frac{Y_s}{Y_i}\left(\frac{w_s}{w_i}\right)^{-\gamma_h}\right)^{\frac{\sigma_h-1}{\gamma_h}}\sum_{l\neq j}^{L}\frac{\beta_{jl}^h}{d_{jl}^h}\left[\frac{X_{il}^h}{X_{sl}^h}\left(\frac{\tau_{sl}^h}{\tau_{il}^h}\right)^{-\gamma_h}\right]^{\frac{\sigma_h-1}{\gamma_h}}\alpha_{sl}^h}{z_{kj}^h\phi + \left(\frac{Y_s}{Y_k}\left(\frac{w_s}{w_k}\right)^{-\gamma_h}\right)^{\frac{\sigma_h-1}{\gamma_h}}\sum_{l\neq j}^{L}\frac{\beta_{jl}^h}{d_{jl}^h}\left[\frac{X_{kl}^h}{X_{sl}^h}\left(\frac{\tau_{sl}^h}{\tau_{kl}^h}\right)^{-\gamma_h}\right]^{\frac{\sigma_h-1}{\gamma_h}}\alpha_{sl}^h}\right)^{\frac{\gamma_h}{(\sigma_h-1)}} \tag{3.28}$$

It is straightforward to note that for $\beta_{jl}^h > 0$, $\frac{dX_{ij}^h}{dX_{il}^h}$ is always greater than 0. Because of spatial correlated demand, exports from country *i* to countries different from *j* are positively correlated with imports of country *j* from country *i*. This effect is independent from the supply effects of *i* and *k* and from variations in the fixed costs f_{ij}^h and f_{kj}^h, as we are controlling for wage cost and considering *i, k, l* and *s* belonging to the same custom union *S*[111].

[110] This approach holds even in absence of custom union, until countries in the group *S* have to guarantee the same importing conditions at each member of the group.

If $\beta_{jl}^{h} > 0$, the value of the ratio $\frac{X_{ij}^{h}}{X_{kj}^{h}}$ is positively correlated with the ratio between $\sum_{l\neq j}^{L} \frac{X_{il}^{h}}{X_{sl}^{h}}$ over $\sum_{l\neq j}^{L} \frac{X_{kl}^{h}}{X_{sl}^{h}}$, holding constant all the other parameters.

In order to identify the spatial correlation parameter, we rewrite Equation 3.28 introducing the time dimension. Recalling that the idiosyncratic preference parameter $z_{ij}^{h}\phi$ is a vector of features of good *h* produced by country *i* and characteristics of consumers in *j*, we can decompose z_{ij}^{h} in the vector component r_{jt}, capturing all the time varying characteristics of consumers in *j*, and g_i^h controlling for the time invariant features of good *h* produced by *i*. We set the idiosyncratic preference parameter $z_{ij}^{h}\phi$ and $z_{kj}^{h}\phi$ equal to $g_i^h\phi_j^h + r_{jt}\phi_0^h$ and $g_k^h\phi_j^h + r_{jt}\phi_0^h$ respectively. We can express these terms as fixed effects, with ψ_{ij}^{h} and ψ_{kj}^{h} capturing the time-invariant preferences of consumers in *j* for the goods produced by *i* and *k*, and ψ_{jt}^{h} controlling for the time varying preferences of *j* for good *h*. Considering $\beta_{jl}^{h} = \beta^{h}\ \forall j, l \in S$ we have:

$$\frac{X_{ijt}^{h}}{X_{kjt}^{h}} = \frac{Y_{it}}{Y_{kt}}\left(\frac{w_{it}\tau_{ijt}^{h}}{w_{kt}\tau_{kjt}^{h}}\right)^{-\gamma_h}\left(\frac{\psi_{ij}^{h} + \psi_{jt}^{h} + \left(\frac{Y_{st}}{Y_{it}}\left(\frac{w_{st}}{w_{it}}\right)^{-\gamma_h}\right)^{\frac{\sigma_h-1}{\gamma_h}}\beta^{h}\sum_{l\neq j}^{L}\frac{\alpha_{slt}^{h}}{d_{jl}^{h}}\left[\frac{X_{ilt}^{h}}{X_{slt}^{h}}\left(\frac{\tau_{slt}^{h}}{\tau_{ilt}^{h}}\right)^{-\gamma_h}\right]^{\frac{\sigma_h-1}{\gamma_h}}}{\psi_{kj}^{h} + \psi_{jt}^{h} + \left(\frac{Y_{st}}{Y_{kt}}\left(\frac{w_{st}}{w_{kt}}\right)^{-\gamma_h}\right)^{\frac{\sigma_h-1}{\gamma_h}}\beta^{h}\sum_{l\neq j}^{L}\frac{\alpha_{slt}^{h}}{d_{jl}^{h}}\left[\frac{X_{klt}^{h}}{X_{slt}^{h}}\left(\frac{\tau_{slt}^{h}}{\tau_{klt}^{h}}\right)^{-\gamma_h}\right]^{\frac{\sigma_h-1}{\gamma_h}}}\right)^{\frac{\gamma_h}{\sigma_h-1}} \tag{3.29}$$

The idiosyncratic preferences are therefore a function of bilateral static preferences of consumers in *j* for product *h* produced by *i* or *j* and a time varying preference of consumers in *j* for the product *h*. The assumption of static idiosyncratic bilateral preference is needed to better identify our parameters and holds considering not too long length of time. In Appendix 3.B some concerns about possible endogeneity and error structure is examined in greater depth.

3.4.2 Model estimation

In order to estimate constrained and nested parameters and to avoid incidental parameter problem, we employ MCMC methods. The number of parameters to estimate and the number of observations are a function of timespan and number of countries in the custom union we consider. The higher the number of countries in the custom union, the better the probabilities to correctly identify the parameter β^h of our equation. To evaluate the performance of our MCMC estimator, we run some simulations considering ten years of trade in a custom union with ten members. Results are in Appendix 3.C.

To estimate the parameters of our model, we resort to some simplifying assumptions. We log linearized Equation 3.29 and we assume the log of exports' ratio (our dependent variable) being distributed as a normal with mean μ and independent error ε_{ijkt}^h with variance δ_h. Formally:

$$\ln\left(\frac{X_{ijt}^h}{X_{kjt}^h}\right) \sim N(\mu, \delta_h)$$

$$\mu = ln\left(\frac{Y_{it}}{Y_{kt}}\right) - \gamma_h ln\left(\frac{w_{it}\tau_{ijt}^h}{w_{kt}\tau_{kjt}^h}\right) +$$

$$+\left(\frac{\gamma_h}{\sigma_h - 1}\right) ln\left(\frac{\psi_{ij}^h + \psi_{jt}^h + \left(\frac{Y_{st}}{Y_{it}}\left(\frac{w_{st}}{w_{it}}\right)^{-\gamma_h}\right)^{\frac{\sigma_h-1}{\gamma_h}} \beta^h \sum_{l\neq j}^{L} \frac{\alpha_{slt}^h}{d_{jl}^h}\left[\frac{X_{ilt}^h}{X_{slt}^h}\left(\frac{\tau_{slt}^h}{\tau_{ilt}^h}\right)^{-\gamma_h}\right]^{\frac{\sigma_h-1}{\gamma_h}}}{\psi_{kj}^h + \psi_{jt}^h + \left(\frac{Y_{st}}{Y_{kt}}\left(\frac{w_{st}}{w_{kt}}\right)^{-\gamma_h}\right)^{\frac{\sigma_h-1}{\gamma_h}} \beta^h \sum_{l\neq j}^{L} \frac{\alpha_{slt}^h}{d_{jl}^h}\left[\frac{X_{klt}^h}{X_{slt}^h}\left(\frac{\tau_{slt}^h}{\tau_{klt}^h}\right)^{-\gamma_h}\right]^{\frac{\sigma_h-1}{\gamma_h}}}\right) \tag{3.30}$$

with $\gamma_h > \sigma_h > 1$ and $\psi_{ij}^h, \psi_{jt}^h, \alpha_{slt}^h > 0$, as specified in the theoretical setting[112].

Log linearization is a standard approach in international trade literature and allows us to efficiently deal with the numeric optimization of the sampler, reducing the scale. To implement the estimator, we specify prior density functions for the unknown parameters; combining these with the likelihood function of our equation and dividing them by the marginal distribution of the data we obtain the posterior distribution of our parameters[113]. We then sample from this distribution using a No-U-Turn sampler algorithm (Hoffman et al., 2014).

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[112] Because we are considering only positive trade, the constrain $\alpha_{ij}^h \geq 0$ becomes $\alpha_{ij}^h > 0$. Consequently ψ_{ij}^h, ψ_{jt}^h are set greater than zero because $\alpha_{ijt}^h = \psi_{ij}^h + \psi_{jt}^h$

[113] Formally $\frac{p(y|\theta)p(\theta)}{\int_\theta p(y|\theta)p(\theta)d\theta}$ where $y = ln\left(\frac{X_{ijt}^h}{X_{kjt}^h}\right)$, $p(y|\theta) = (2\pi\sigma^2)\exp\left(-\frac{1}{2\sigma^2}\sum_{i=1}^{N}(y_i - \mu)^2\right)$ and θ is our set of parameters.

In order to avoid discontinuity or infeasible value of μ in the estimation process, we constrain parameter β^h to be equal or greater than zero. All the priors are therefore modeled as exponential or function of exponential (Appendix 3.D). Trade flows data comes from UN-Comtrade, for the period 2002-2012, and are collected at 2 digit HS reported level (97 sectors) with annual frequency. For our identification purpose, we chose to consider the biggest available set of nations included in a custom union: the European countries. To avoid issued related to different currencies, which could bias our estimates (because of potential different fixed costs to export linked to financial cost) we further restrict the set to 11 countries belonging to the Euro area: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal and Spain, with Finland sets as the reference country s. These countries not only belong to the same custom union but are also members of a common market, strengthening our identification strategy[114].

We resort to the following sources for the variables of the model: wages data (hourly compensation costs in manufacturing) come from U.S. Bureau of Labor Statistics, International Labor Comparisons, August 2013; population weighted distances are from CEPII and national GDP data from Penn World Table. Sector variable trade costs (τ_{ilt}^h) at HS 2 digit level are computed from OECD ITIC database[115] (Miao and Fortanier, 2017).

Due to intensive computation, we proceed to estimate our parameters only for a subset of sectors. Below, we chose to report results for the HS 22 sector (Beverages, Spirits and Vinegar), assuming this sector produces some of the most differentiated goods with low spatial correlation of preferences. As shown in Table 3.4, β^h is positive and significantly different from zero.

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[114] Choosing Finland as reference country, we try to reduce the correlation of parameter in the estimation process, reducing the time required for the MCMC procedure to explore efficiently the support of all the parameters. Considering that $\alpha_{slt}^h = \psi_{sl}^h + \psi_{lt}^h + \beta_s^h \sum_{i \neq l}^K \frac{1}{d_{li}} \left(\psi_{si}^h + \psi_{it}^h\right) + \beta_s^h \sum_{i \neq l}^L \frac{1}{d_{li}} \varepsilon_{sit}^h + \varepsilon_{slt}^h$ we might assume that consumers' preferences for the goods produced by Finnish firms are affected at a different level by the neighbours' preferences. If $\beta^h \neq \beta_s^h$, the lower correlation between the parameter can lead to shorter runtimes to achieve the true joint posterior distribution.
Anyway, the testing hypothesis $\beta^h \neq 0$ is always valid, because if $\beta^h \sum_{i \neq l}^L \frac{1}{d_{li}} \alpha_{slt}^h = 0 \implies \beta^h = 0$ given that α_{slt}^h is greater than 0 for each s ,l ,t, since we are considering only positive trade flows.

[115] http://oecdinsights.org/2016/11/02/statistical-insights-new-oecd-database-on-international-transport-and-insurance-costs/

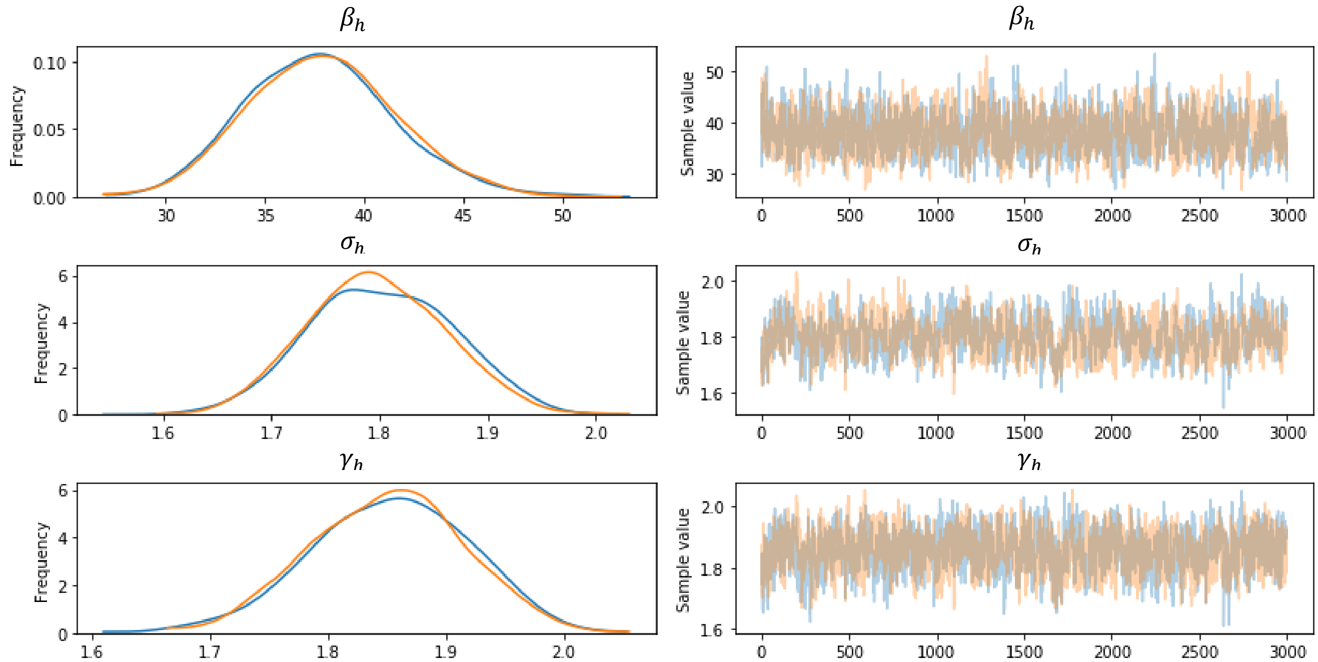
Table 3.4 – Parameters estimation of Equation 3.30 for the HS 22 Sector (Beverages, Spirits and Vinegar)

	Median	SD	MC Error	95% HPD Interval
β^h	37.87	3.69	0.12	[30.96, 45.33]
σ_h	1.80	0.064	0.003	[1.68, 1.92]
γ_h	1.85	0.065	0.002	[1.72, 1.97]

Note: This table shows the estimated values of the spatial correlation parameter (β^h), elasticity of substitution (σ_h) and productivity heterogeneity parameter (γ_h) of Equation 29 for sector HS 22. Values are computed using Hamiltonian Monte Carlo method (No-U-Turn Sampler), with a target acceptance rate of 0.95 for the sampler.

Inspecting the following Figure 3.3, which displays the distributions of the posterior means and traces of parameters of Table 3.4, we observe estimates converging to their medians.

Figure 3.3 – Posterior means and traces of parameters β^h, σ_h and γ_h of Table 3.3, for the HS 22 Sector (Beverages, Spirits and Vinegar)



Note: In Figure 3.3, we observe the distribution of the estimated spatial correlation parameter (β^h), elasticity of substitution (σ_h) and productivity heterogeneity parameter (γ_h) of Equation 3.30. Values are computed using Hamiltonian Monte Carlo method (No-U-Turn sampler), with a target acceptance rate of 0.95 for the sampler, discarding the first 1000 draws.

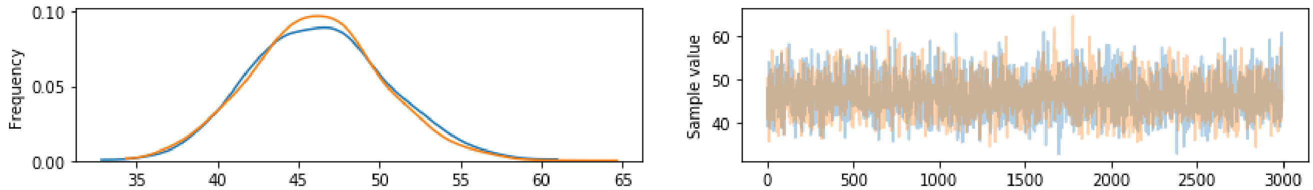
As shown in Figure 3.3, consumers' preferences are spatially correlated, at least for the HS 22 sector and for the consumers in the countries included in our analysis. Beverage market is influenced by neighbours' preferences, even if the effect is not very large, at least at national level.

Other products provide stronger results. As shown in Figure 3.4, the spatial correlation parameter of preferences for Apparel, Chemical products and Vehicles is bigger than for Beverages. Only Ceramic products provide an estimate that is comparable to the Beverages sector. These results suggest that some products could be sold worldwide and others not, because preferences can be focused on a local or global scale, depending by the product we consider. According to our results, beer, vinegar or ceramic wares are more perceived as local products than car or fashion brands. This should explain because companies in different sectors exhibit diverse marketing and development strategies. As example, corporations in the beer industry tend to expand their market shares buying local producers and maintaining the original brand names (AB InBev and Heineken own more than 240 local beer brands) while fashion brands or car producers promote their products globally.

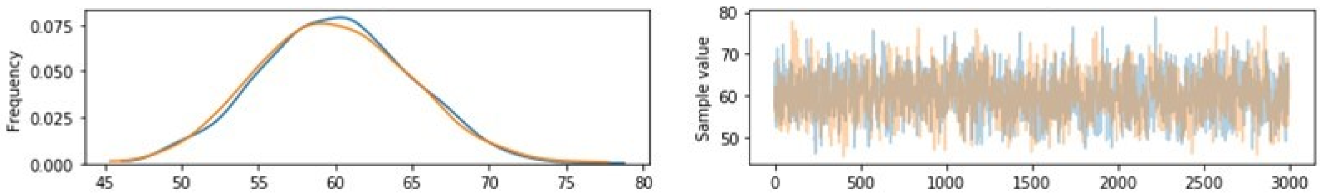
These outcomes are consistent with the findings of Davvetas and Diamantopoulos (2016). They prove that consumers rely on product category schemata to form perceptions of global versus local brand superiority in developed and emerging markets. Consumers perceive global brands as superior to local brands in product categories with strong functional character and extensive symbolic capacity.

Figure 3.4 – Posterior means and traces of parameters β^h for the 61, 38, 69 and 87 HS sectors

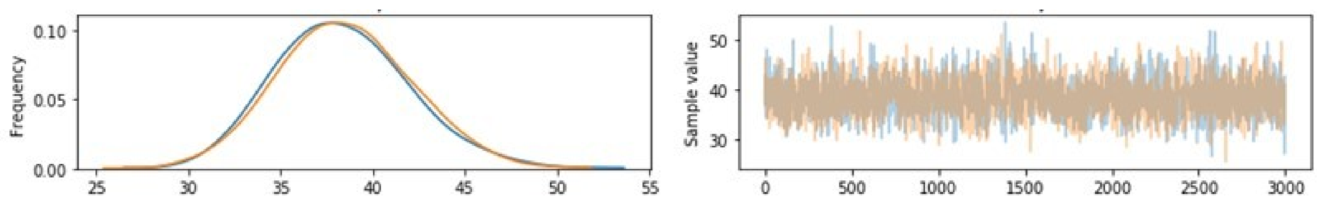
Sector 61 HS - Apparel and clothing accessories; knitted or crocheted.



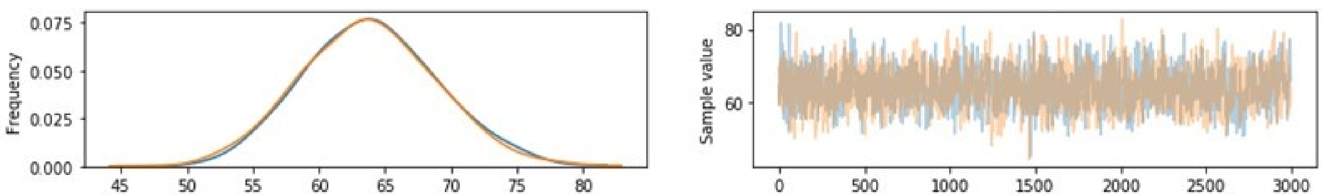
Sector 38 HS – Miscellaneous chemical products.



Sector 69 HS – Ceramic products.



Sector 87 HS – Vehicles; other than railway or tramway rolling stock.



Note: In Figure 3.4, we observe the distribution of the spatial correlation parameter (β^h) of equation 3.30 and its trace. Values are estimated using Hamiltonian Monte Carlo computation (No-U-Turn sampler), with a target acceptance rate of 0.95 (0.98 for HS61) for the sampler, discarding the first 1000 draws.

This simple way to model consumers' preferences is sufficient to prove that they are spatially correlated, confirming the assumption of correlated demand that is crucial for all the literature on search and learning models. In Appendix 3.E we compute the average influence of neighbors using a formal standard matrix approach, with a row-normalized distance matrix and approximating the MCMC using automatic differentiation variational inference (ADVI, Kucukelbir et al., 2017). Results of simulations confirms neighbors' influence on preferences.

3.5 Conclusion

Starting from empirical evidences of spatially correlated exports at the extensive and intensive margin of trade, this paper suggests a development of the traditional gravity model of trade in order to take into account spatially correlated preferences.

We find reduced-form evidence of a positive correlation between bilateral trade and the spatial distribution of exports to other countries; both the probability to export to a target market and the value exported increase the more the exporting country sells its goods to the countries close to the target market. The probability to export is higher if the foreign consumers import similar products (belonging to the same SITC class) from countries already reached by the exporter.

Following several empirical findings in the marketing literature, we assume consumers in different countries share similar preferences and are influenced by consumption's decisions of their neighbours. Introducing spatially correlated preferences in the Chaney (2008) model of trade, we are able to explain our empirical findings. Modelling preferences as spatially dependents, we derive an extended aggregate equation of trade that can explain the "extended gravity" and "spatial exporters" effects discovered by previous scholars. Spatially correlated preferences are then confirmed in a structural estimation of our model for a subset of products and countries. We identify the spatial correlation parameter of consumers' preferences considering, in a custom union, the ratio of export to the same country from different countries, in order to control for observable and unobservable fixed costs to export.

To the best of our knowledge, we are the first to investigate explicitly the impact of preferences on international trade, modelling them as spatially dependents, and we are the first to stress the importance of the spatial structure of export from a demand perspective.

With this paper, we support search and learning models developed by previous authors, given that they assume demand as imperfectly correlated among countries. We even hope to encourage the integration of preference structuring into the international trading literature. Other directions are to explore the relationship between globalization and preferences or to assess the role of migration within this framework.

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Appendix 3

3.A Estimating the impact of unobservable fixed cost and consumers' preferences.

To estimate the impact of excluding the unobservable exogenous preference parameter α_{ij}^{h} and the unobservable component of the fixed cost f_{ij}^{h}, we compute the aggregate trade value X_{ij}^{h}, predicted by a classical gravity model.

Log-linearizing Equation 3.16, we obtain:

$$lnX_{ij}^{h} = ln(\mu_h) - \ln(Y) + \ln(Y_i) + \ln\left(Y_j\right) - \gamma_h \ln\left(\tau_{ij}^{h}\right) - \gamma_h \ln(w_i) + \gamma_h \ln\left(\theta_j^{h}\right) +$$

$$+\left(1 - \frac{\gamma_h}{(\sigma_h - 1)}\right) lnf_{ij}^{h} + \left(\frac{\gamma_h}{(\sigma_h - 1)}\right) ln\alpha_{ij}^{h} \qquad (3.a.1)$$

where fixed cost f_{ij}^{h} can be decomposed in observable fixed cost, $f_{ij}^{h}(obs)$, and unobservable fixed cost $f_{ij}^{h}(unobs)$ using the following specification:

$$f_{ij}^{h} = e^{f_{ij}^{h}(obs) + f_{ij}^{h}(unobs)} \qquad (3.a.2)$$

We assume observable fixed costs being a linear combination of a vector of parameters β and a set of covariates χ_{obs}, such as regional trade agreement (*rta*), spatial contiguity (*contig*), common language (*comlang*), common religion (*com_rel,* capturing cultural similarity), common currency (*com_cur*), colonial relationship (*col*), GATT/WTO membership (*gat_memb*)[116], that are proxies for fixed costs to export between countries *i* and *j*. In the following equation, we omit the coefficient parameters β for simplification.

$$f_{ij}^{h}(obs) = \left(rta_{ij} + contig_{ij} + comlang_{ij} + col_{ij} + com_{rel_{ij}} + com_{cur_{ij}} + gat_{memb_i} +\right.$$

$$\left. + gat\_memb_j\right) \qquad (3.a.3)$$

For each sector and year[117], we estimate the predicted value ($\hat{X}_{ij}^{h} = X_{ij}^{h} - \varepsilon_{ij}^{h}$) of the following equation (as above, we omit the parameters' vector and subfix *h* and *t* for simplification) using a PPML model (Santos Silva and Tenreyro, 2007):

[116] These variables are widely used in literature as a set of control variables for fixed costs.
[117] We perform separate regression for each sector and year.

$$X_{ij} = cost + \ln(gdp_i) + \ln(gdp_j) - \ln(dist_{ij}) + \theta_i + \theta_j + rta_{ij} + contig_{ij} + com\_lang_{ij} + col_{ij} + com\_rel_{ij} + com\_cur_{ij} + gat\_memb_i + gat\_memb_j + \varepsilon_{ij}^h \quad (3.a.4)$$

where θ_i captures all the observable (such as the Gdp level) and unobservable features of i influencing the trade flows in sector h at time t while θ_j captures all the observable and unobservable characteristics of j[118] in sector h at time t.

The error term ε_{ij}^h therefore captures the unobservable bilateral component of fixed cost, $f_{ij}^h(unobs)$, the bilateral exogenous preference parameter α_{ij}^h and an error term $\eta_{ij}^h \sim N(0, \delta_\eta)$.

$$\varepsilon_{ij}^h = X_{ij}^h - \hat{X}_{ij}^h = \left(1 - \frac{\gamma_h}{(\sigma_h - 1)}\right)\left(ln\, e^{f_{ij}^h(unobs)} - ln\, e^{f_i^h(unobs)} - ln\, e^{f_j^h(unobs)}\right) - \left(\frac{\gamma_h}{(\sigma_h - 1)}\right)\left(ln\, \alpha_{ij}^h - ln\, \alpha_j^h - ln\, \alpha_i^h\right) + \eta_{ij}^h \quad (3.a.5)$$

Using country fixed effects to control for the unobservable features of countries i and j in sector h (given that we are estimating the model for each sector and year) we are already controlling for average preferences and average fixed cost to export and import for each country. The residual α_{ij}^h and $e^{f_{ij}^h}$ in ε_{ij}^h are therefore the specific bilateral deviation of the country's preferences and unobservable fixed costs to export.

Accordingly to the source of our data, we set $\hat{X}_{ij}^h$ equal to one if the predicted value of trade is greater than zero but lower than one[119], in order to make predicted and real trade flows comparable. A low difference between our theoretical prediction and the real value will point out as negligible the effect of the unobserved bilateral preferences and fixed costs to export. Otherwise, we should specify some functional form for α_{ij}^h and f_{ij}^h to explain the distribution of the difference. As a first check, we verify if the traditional gravity model correctly predicts if country i exports good h to country j. For each trading pair, we compute a binary variable equal to 1 if the predicted trade flow for the good h is greater than 1 and 0 otherwise.

Results in Table 3.A.1, show that the equation predicts very well if country i exports the good h to country j. The accuracy of the prediction (true positive) is about 99% and the rate of false positive is about 1%, however several problems arise for the prediction of zero trade flows. Observing a false positive rate of

[118] As Redding and Venables (2004), we estimate a theoretical founded gravity equation with fixed effects specification.
[119] Trade flows for each good between countries are in nominal thousands of US dollars ($1,000) and reported only if greater than 1,000 USD.

about 52%, we express some concerns that the omitted variables $(\alpha_{ij}^h, f_{ij}^h)$ could play a substantial role in the selection of the exporting markets.

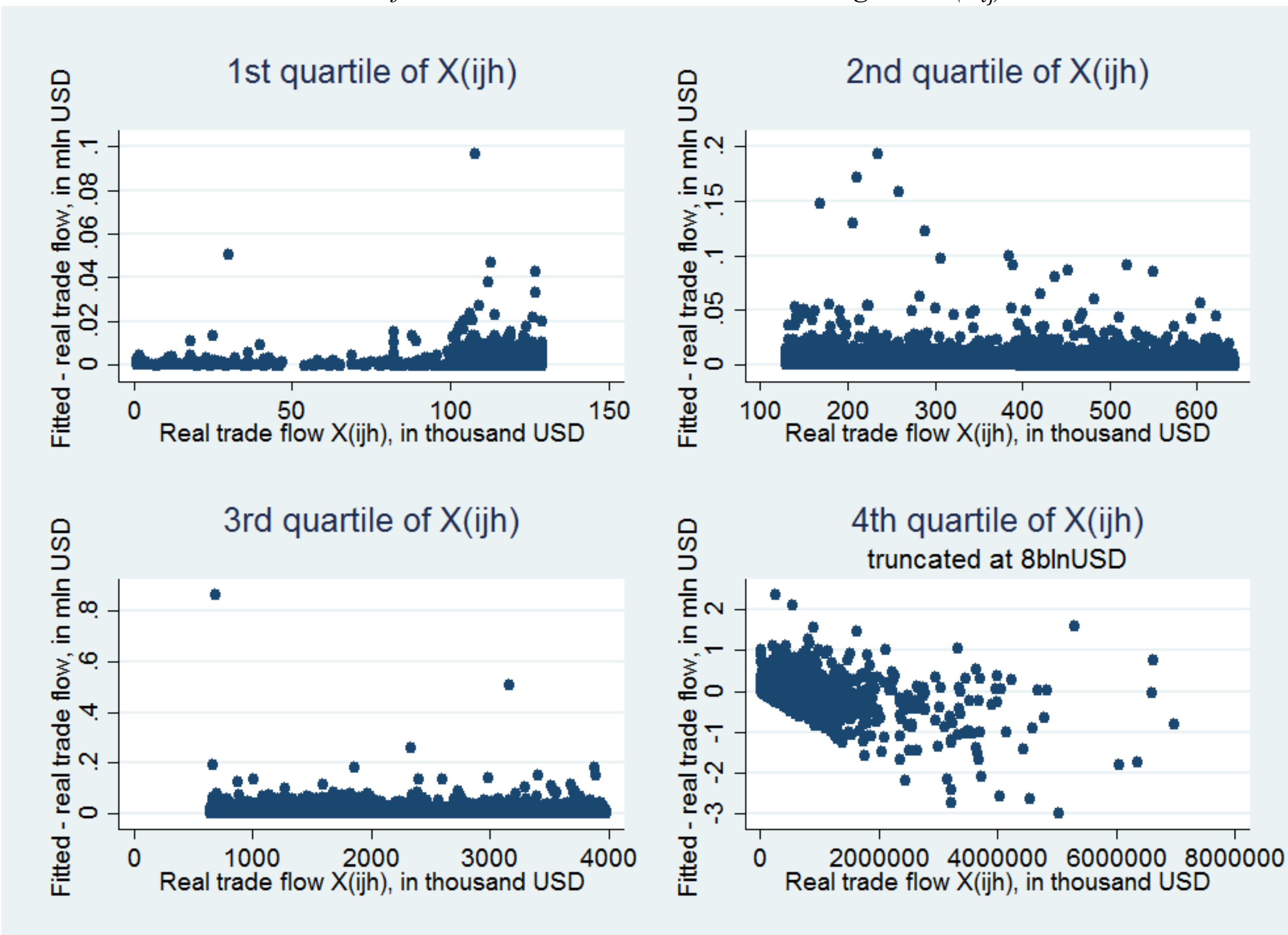
Table 3.A.1 – Distribution of true positive, false positive, true zero and false zero trade flow predicted by the traditional trade gravity equation

		$True\ Value\ (X_{ij}^h > 0)$	
		0	1
$Predicted\ value$ $(\hat{X}_{ij}^h > 0)$	0	48% (2,892,325)	1% (8,139)
	1	52% (3,083,279)	99% (635,713)
	Total	100% (5,975,604)	100% (643,852)

Note: $\hat{X}_{ij}^h$ are the predicted value of $X_{ij} = cost + ln(dist_{ij}) + \theta_i + \theta_j + rta_{ij} + contig_{ij} + comlang_{ij} + col_{ij} + com\_rel_{ij} + com\_cur_{ij} + gat\_memb_i + gat\_memb_j + \varepsilon_{ij}$. Subfix for sector h and time t and parameters notations are omitted for simplification. Parameters of equation are estimated using a Pseudo Poisson Maximum Likelihood (PPML) model, as in Santos Silva and Tenreyro (2007), running separate regressions for each year and sector, on a subsample of the data (years 1981, 1984, 1991, 1992, 1996, 1997) used in Chapter 3.2. The distribution of the results is extremely stable and similar among years and sectors.

Moreover, the distribution of the fitted values exhibits a particular pattern: the value of bilateral trade is overestimated for low values of real trade flows while is underestimated for high values. In Figure 3.A.1, we plot the difference between the fitted and observed values, conditioned to the value of the observed trade flows. It is straightforward to note that estimates computed with the traditional gravity model tend to underestimate larger observed values while overestimate the smallest. Our hypothesis is that the unobservable component of fixed cost and consumers' preferences lie at the root of the error.

Figure 3.A.1 – Negative error distribution (fitted value minus real value) of the traditional gravity model of trade conditioned to the true trading value (X_{ij}^h)



Note: This figure shows the distribution of the difference between the fitted values computed from the traditional gravity model of trade and the observed trade flow values. Predicted values are too large for low observed value and small for large observed values. The ratio of bilateral fixed costs to export and consumers' preferences seems to have some intuitive influence on the dynamic of trade.

3.B Error distribution and potential endogeneity or measurement problem

Considering X_{ij}^h and X_{kj}^h in Equation 3.24 as stochastic processes with, respectively, multiplicative errors ε_{ijt}^h and ε_{kjt}^h distributed as log-normal variables with mean and standard deviation of the natural logarithm equal to $\mu_{i,k}^h$ and $\sigma_{i,k}^h$, we can write Equation 3.29 as

$$\frac{X_{ijt}^h}{X_{kjt}^h} = \frac{Y_{it}}{Y_{kt}}\left(\frac{w_{it}\tau_{ijt}^h}{w_{kt}\tau_{kjt}^h}\right)^{-\gamma_h}\left(\frac{\psi_{ij}^h+\psi_{jt}^h+\left(\frac{Y_{st}}{Y_{it}}\left(\frac{w_{st}}{w_{it}}\right)^{-\gamma_h}\right)^{\frac{\sigma_h-1}{\gamma_h}}\beta^h\sum_{l\neq j}^{L}\frac{\alpha_{slt}^h}{d_{jl}^h}\left[\frac{X_{ilt}^h}{X_{slt}^h}\left(\frac{\tau_{slt}^h}{\tau_{ilt}^h}\right)^{-\gamma_h}\right]^{\frac{\sigma_h-1}{\gamma_h}}}{\psi_{kj}^h+\psi_{jt}^h+\left(\frac{Y_{st}}{Y_{kt}}\left(\frac{w_{st}}{w_{kt}}\right)^{-\gamma_h}\right)^{\frac{\sigma_h-1}{\gamma_h}}\beta^h\sum_{l\neq j}^{L}\frac{\alpha_{slt}^h}{d_{jl}^h}\left[\frac{X_{klt}^h}{X_{slt}^h}\left(\frac{\tau_{slt}^h}{\tau_{klt}^h}\right)^{-\gamma_h}\right]^{\frac{\sigma_h-1}{\gamma_h}}}\right)^{\frac{\gamma_h}{\sigma_h-1}-1}\left(\frac{\varepsilon_{ijt}^h}{\varepsilon_{kjt}^h}\right)$$

(Eq. 3.B.1)

If $ln(\varepsilon_{ijt}^h)\sim N(\mu_i^h,\sigma_{hi}^2)$ and $ln(\varepsilon_{kjt}^h)\sim N(\mu_k^h,\sigma_{hk}^2)$, the random variables ε_{ijt}^h and ε_{kjt}^h are said to have a log-normal distribution with means $M_i^h = exp\left(\mu_i^h+\frac{1}{2}\sigma_{hi}^2\right)$ and $M_k^h = exp\left(\mu_k^h+\frac{1}{2}\sigma_{hk}^2\right)$, respectively. Assuming $ln(\varepsilon_{ijt}^h)$ and $ln(\varepsilon_{kjt}^h)$ are independently distributed $\ln\left(\frac{\varepsilon_{ijt}^h}{\varepsilon_{kjt}^h}\right)$ has mean equal to $\mu_i^h-\mu_k^h+\frac{1}{2}(\sigma_{hi}^2-\sigma_{hk}^2)$. If $ln(\varepsilon_{ijt}^h)$ and $ln(\varepsilon_{kjt}^h)$ have mean $\mu_i^h$and μ_k^h equal to 0 (are random errors) and $\sigma_{hi}^2 = \sigma_{hk}^2$, $ln\left(\frac{\varepsilon_{ijt}^h}{\varepsilon_{kjt}^h}\right)$ has mean equal to 0 and variance[120] δ_h^2, $ln\left(\frac{\varepsilon_{ijt}^h}{\varepsilon_{kjt}^h}\right)\sim N(0,\delta_h^2)$.

Possible endogeneity measurement error on Equation 3.B.1 can derive from omitted variables captured by ε_{ijt}^h or ε_{ikt}^h that are correlated with X_{ilt}^hor X_{klt}^h respectively and are not captured by the spatially correlated structure of preference, α_{ijt}^h and α_{kjt}^h, neither by any structural parameters of Equation 3.B.1 and are not cancelled out by the ratio of fixed cost $\frac{f_{ijt}^h}{f_{kjt}^h}$. In our opinion, such variables should be variable cost not correctly accounted by $\tau_{ilt,klt}^h$ or productivity shocks (at national or firm level) that are not

[120] As shown by Zhou (1997), when $n_{i,k}$ are both large, the distribution approximate a standard normal.

assumed in the Chaney (2008) model of trade that do not affect the wage level ratio $\frac{w_{it}}{w_{kt}}$. In such cases, $\varepsilon^h_{ijt,kjt}$ should be correlated to $X^h_{ilt,klt}$ through $\varepsilon^h_{ilt,klt}$.

$$\frac{X^h_{ijt}}{X^h_{kjt}}$$

$$= \frac{Y_{it}}{Y_{kt}}\left(\frac{w_{it}\tau^h_{ijt}}{w_{kt}\tau^h_{kjt}}\right)^{-\gamma_h}\left(\frac{\psi^h_{ij}+\psi^h_{jt}+\beta^h\left(\frac{Y_{st}}{Y_{it}}\left(\frac{w_{st}}{w_{it}}\right)^{-\gamma_h}\right)^{\frac{\sigma_h-1}{\gamma_h}}\sum_{l\neq j}^{L}\frac{\alpha^h_{slt}}{d^h_{jl}}\left(\frac{\left(\widehat{X^h_{ilt}}\varepsilon^h_{ilt}\right)\left(\tau^h_{ilt}\right)^{\gamma_h}}{\left(\widehat{X^h_{slt}}\varepsilon^h_{slt}\right)\left(\tau^h_{slt}\right)^{\gamma_h}}\right)^{\frac{\sigma_h-1}{\gamma_h}}}{\psi^h_{kj}+\psi^h_{jt}+\beta^h\left(\frac{Y_{st}}{Y_{kt}}\left(\frac{w_{st}}{w_{kt}}\right)^{-\gamma_h}\right)^{\frac{\sigma_h-1}{\gamma_h}}\sum_{l\neq j}^{L}\frac{\alpha^h_{slt}}{d^h_{jl}}\left(\frac{\left(\widehat{X^h_{klt}}\varepsilon^h_{klt}\right)\left(\tau^h_{klt}\right)^{\gamma_h}}{\left(\widehat{X^h_{slt}}\varepsilon^h_{slt}\right)\left(\tau^h_{slt}\right)^{\gamma_h}}\right)^{\frac{\sigma_h-1}{\gamma_h}}}\right)^{\frac{\gamma_h}{\sigma_h-1}-1}\left(\frac{\varepsilon^h_{ijt}}{\varepsilon^h_{kjt}}\right)$$

(Eq. 3.B.2)

A solution to this possible measurement error is to compute the fitted value $\hat{X}^h_{ilt}$ and $\hat{X}^h_{klt}$ from the theoretical equation

$$X^h_{ijt} = \mu_h \frac{Y_{it}\,Y_{jt}}{Y_t}\left(\frac{w_{it}\tau^h_{ijt}}{\theta^h_{jt}}\right)^{-\gamma_h}\left(\frac{\alpha^h_{ijt}}{f_{ijt}^{h\,\frac{\gamma_h}{(\sigma_h-1-\gamma_h)}}}\right)^{\frac{\gamma_h}{(\sigma_h-1)}}\varepsilon^h_{ijt} \qquad \text{(Eq. 3.B.3)}$$

and substitute X^h_{ilt}, X^h_{klt} and X^h_{slt} in Equation 3.B.1 with the predicted value $\hat{X}^h_{ilt}, \hat{X}^h_{klt}$ and $\hat{X}^h_{slt}$ computed from Equation 3.B.3.

Log linearizing Equation 3.B.3, we usually control for θ^h_{jt} and Y_{jt} using time varying importer fixed effects, while Y_{it} and w_{it} are absorbed by time varying exporter fixed effects. However, to provide fitted values of trade flows from country *i* to country *j* for sector *h* that are fully compliant with the assumptions of our model, we need to add time varying sector pair country fixed effects, to control for the ratio $\frac{f^h_{ijt}}{\alpha^h_{ijt}}$. The identification of this kind of fixed effect is possible exploiting the product structure of trading data. Assuming $\alpha^h_{ijt}, f^h_{ijt}$ and γ_h, σ_h to be the same for products *h+i* belonging to the same upper class *H*, we can add to our sample all goods *h+i* that are similar to our target good h belonging to the *H* upper class[121].

[121] For example, to compute time varying fixed effect for the HS 6101 class product (Men's coats) we can add to our sample products HS 6102 (Girl's coats), HS 6103 (Men's Suits), HS 6104 (Women's suits) and so on. Using a higher detail (HS at 6 digit) permits to consider a higher number of similar products.

It follows that $\left(\frac{\alpha_{ijt}^{h}}{f_{ijt}^{h\,\frac{\gamma_h}{(\sigma_h-1-\gamma_h)}}}\right)^{\frac{\gamma_h}{(\sigma_h-1)}} = \left(\frac{\alpha_{ijt}^{h+1}}{f_{ijt}^{h+1\,\frac{\gamma_{h+1}}{(\sigma_{h+1}-1-\gamma_{h+1})}}}\right)^{\frac{\gamma_{h+1}}{(\sigma_{h+1}-1)}} = \eta_{ijt}^{H}$. Therefore, Equation 3.B.3 can be estimated using the following Equation 3.B.4.

$$X_{ijt}^{h} = \mu_h \frac{Y_{it}\, Y_{jt}}{Y_t} \left(\frac{w_{it}\tau_{ijt}^{h}}{\theta_{jt}^{h}}\right)^{-\gamma_h} \left(\eta_{ijt}^{H}\right) \varepsilon_{ijt}^{h} \qquad \text{(Eq. 3.B.4)}$$

Exploiting this new sample, we are able to identify η_{ijt}^{H} as a time varying fixed effect and compute fitted value of $\hat{X}_{ilt}^{h}, \hat{X}_{klt}^{h}$ and $\hat{X}_{slt}^{h}$ derived directly from the theoretical framework.

Because of the error correlation structure, we have moreover to consider a different distribution for the ratio of log-normal error in Equation 3.B.1. To identify the parameter in equation 3.B.1 we should solve the system of equation that include equation 3.B.4 and 3.B.2 considering ε_{ijt}^{h} distributed as log-normal variables[122].

Including national productivity shifter in the model is simpler. Following Feenstra et al. (2018), we define A_i the average productivity shifter for country i. It follows

$$\frac{X_{ijt}^{h}}{X_{kjt}^{h}} = \frac{Y_{it}}{Y_{kt}}\left(\frac{w_{it}\tau_{ijt}^{h}}{w_{kt}\tau_{kjt}^{h}}\frac{A_{kt}}{A_{it}}\right)^{-\gamma_h} \left(\frac{\psi_{ij}^{h} + \psi_{jt}^{h} + \beta^{h}\left(\frac{Y_{st}}{Y_{it}}\left(\frac{w_{st}A_{it}}{w_{it}A_{st}}\right)^{-\gamma_h}\right)^{\frac{\sigma_h-1}{\gamma_h}} \sum_{l\neq j}^{L}\frac{\alpha_{slt}^{h}}{d_{jl}^{h}}\left(\frac{\left(\widehat{X_{ilt}^{h}}\varepsilon_{ilt}^{h}\right)\left(\tau_{ilt}^{h}\right)^{\gamma_h}}{\left(\widehat{X_{slt}^{h}}\varepsilon_{slt}^{h}\right)\left(\tau_{slt}^{h}\right)^{\gamma_h}}\right)^{\frac{\sigma_h-1}{\gamma_h}}}{\psi_{kj}^{h} + \psi_{jt}^{h} + \beta^{h}\left(\frac{Y_{st}}{Y_{kt}}\left(\frac{w_{st}A_{kt}}{w_{kt}A_{st}}\right)^{-\gamma_h}\right)^{\frac{\sigma_h-1}{\gamma_h}} \sum_{l\neq j}^{L}\frac{\alpha_{slt}^{h}}{d_{jl}^{h}}\left(\frac{\left(\widehat{X_{klt}^{h}}\varepsilon_{klt}^{h}\right)\left(\tau_{klt}^{h}\right)^{\gamma_h}}{\left(\widehat{X_{slt}^{h}}\varepsilon_{slt}^{h}\right)\left(\tau_{slt}^{h}\right)^{\gamma_h}}\right)^{\frac{\sigma_h-1}{\gamma_h}}}\right)^{\frac{\gamma_h}{\sigma_h-1}-1} \left(\frac{\varepsilon_{ijt}^{h}}{\varepsilon_{kjt}^{h}}\right)$$

[122] Value of ε_{ijt}^{h} and $\widehat{X_{ilt}^{h}}$ can be computed or sampled using Equation 3.B.4, specifying a particular spatial correlation structure of ε_{ijt}^{h}.

3.C Estimation of Equation 30 on simulated data

To assess the performance of our identification and estimation strategy, we compute the parameters of Equation 3.30 on some simulated datasets. Number of countries (*i,j,k,l*) and time periods (*t*) are equals to 10. ψ_{ij}^{h} is distributed in the domain [0,1], ψ_{jt}^{h} is equal to 0.1, 0.15, 0.05, 0.06, 0.07, 0.09, 0.12, 0.11, 0.13, 0.08 for *j*=1,...,10 and *t* equal to 1 while, for *t* greater than 1, ψ_{jt}^{h} is equal to $\psi_{jt-1}^{h} + N(0,1)/100$. α_{slt}^{h} is equal to 0.7, 0.8, 0.9, 1, 1.1, 1.2, 1.3, 1.25, 0.85, 0.95 for *t* = 1 and *l*=1,…,10, while, for *t* greater than 2, is equal to $\alpha_{slt-1}^{h} + N(0,1)/10$. τ_{ijt}^{h}, Y_{it} and w_{it} are uniformly distributed in the domain [1.1, 1.15], [150000, 3580000] and [358, 1500] respectively. Finally, δ and d_{jl}^{h} are set equal to one for all *j,l*.

To estimate model's parameters according to the theoretical framework, we use the following objective priors:

$\sigma = 1 + \sigma_1$

$\gamma = 1 + \sigma_1 + \gamma_1$

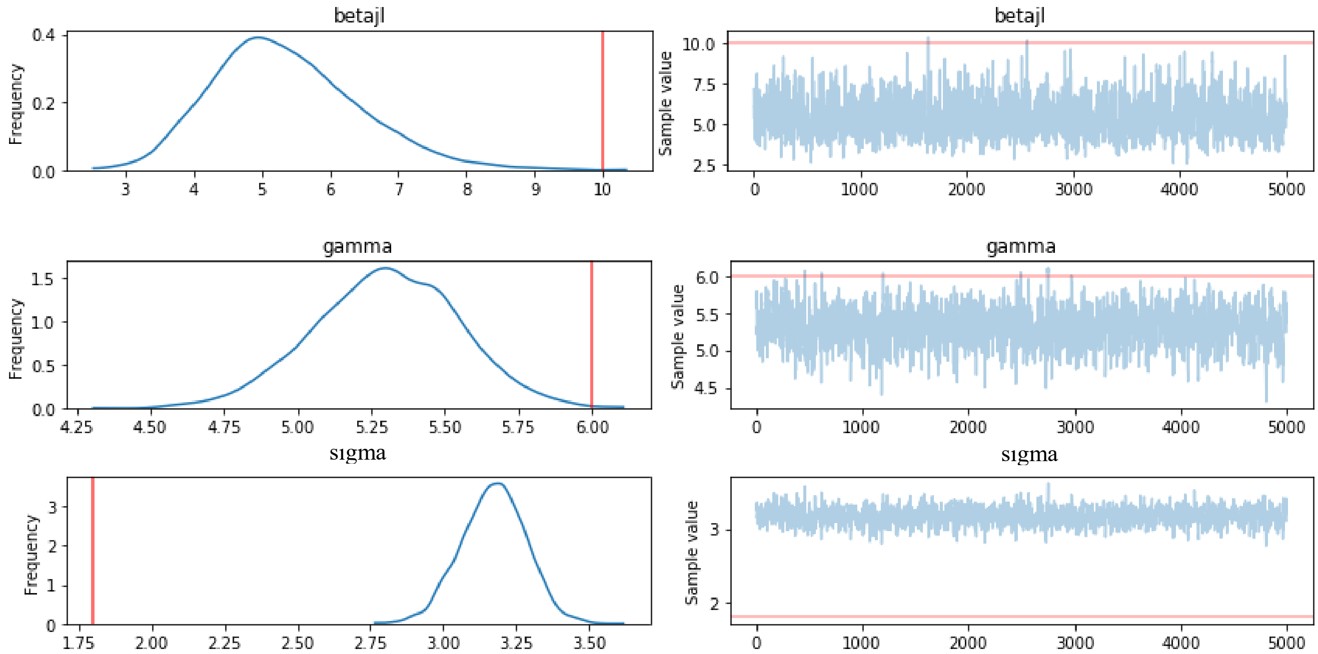
$\psi_{ij}^{h}, \psi_{jt}^{h}, \alpha_{sl}^{h}, \sigma_1, \gamma_1 \sim \exp(1.5)$

$\delta \sim HalfCauchy(5)$

All parameters are sampled using a No-U-Turn sampler (Hoffman and Gelman, 2014) and estimates are computed using 10000 draws, discarding the first 5000.

For the first simulation, γ_h and σ_h are set equal to 6 and 1.8 respectively while β^{h} is equal to 10. Results are in Figure 3.B.1.

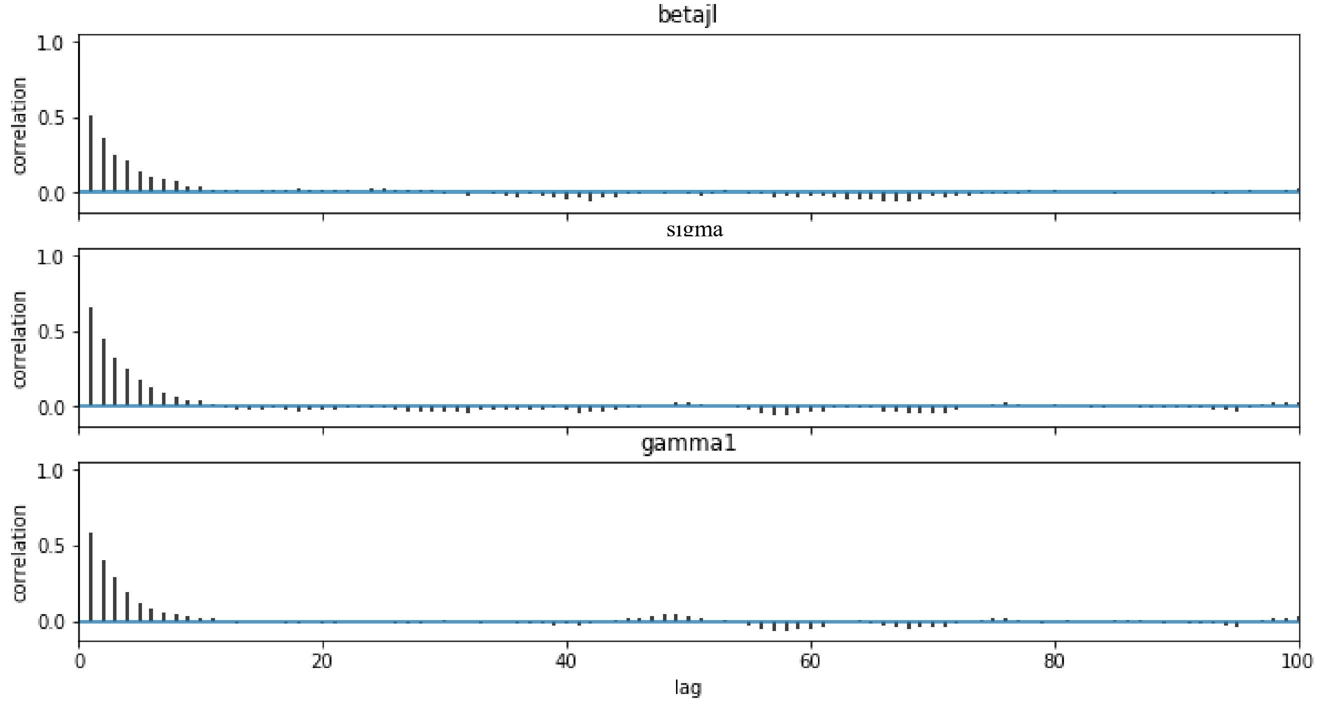
Figure 3.C.1 – Posterior means and traces of parameters β^h, γ_h and σ_h for the simulated dataset, with true values 10, 6 and 1.8.



Note: In Figure 3.b.1 we observe the distribution of the estimated spatial correlation parameter (β^h), elasticity of substitution (σ_h) and productivity heterogeneity parameter (γ_h) of Equation 3.30 for a simulated dataset. Values are computed using Hamiltonian Monte Carlo method, with a target acceptance rate of 0.95 for the No-U-Turn sampler and 10.000 draws (with 5.000 burned draws). Red lines are true values of the parameters in the simulated dataset.

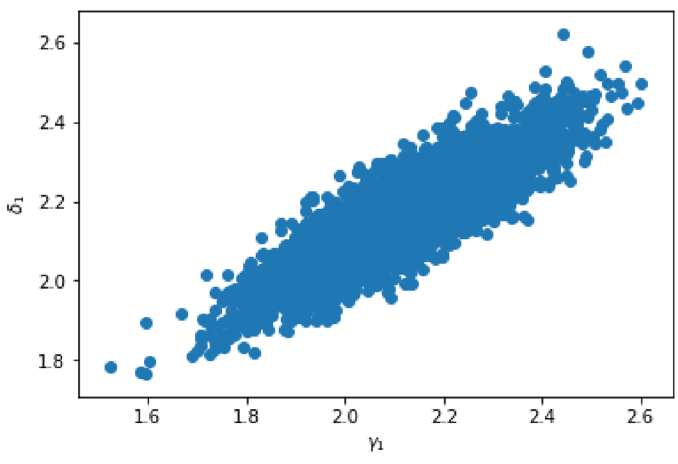
It is easy to show that estimates for β^h and γ_h are downward biased while σ_h is overestimated. A visual inspection of autocorrelation in the trace of parameter (Figure 3.B.2) does not exhibit a high level of correlation, after discarding 5.000 draws.

Figure 3.C.2 – Autocorrelation plot of the posterior means for parameters β^h, σ_1 and γ_1 for the simulated dataset with true values 10, 1.8 and 6.



Note: In Figure 3.B.2 we observe the autocorrelation plot of a subset of parameters of Equation 3.30. Values are computed using Hamiltonian Monte Carlo computation, with a target acceptance rate of 0.95 for the No-U-Turn sampler and 10.000 draws (with 5.000 burned draws).

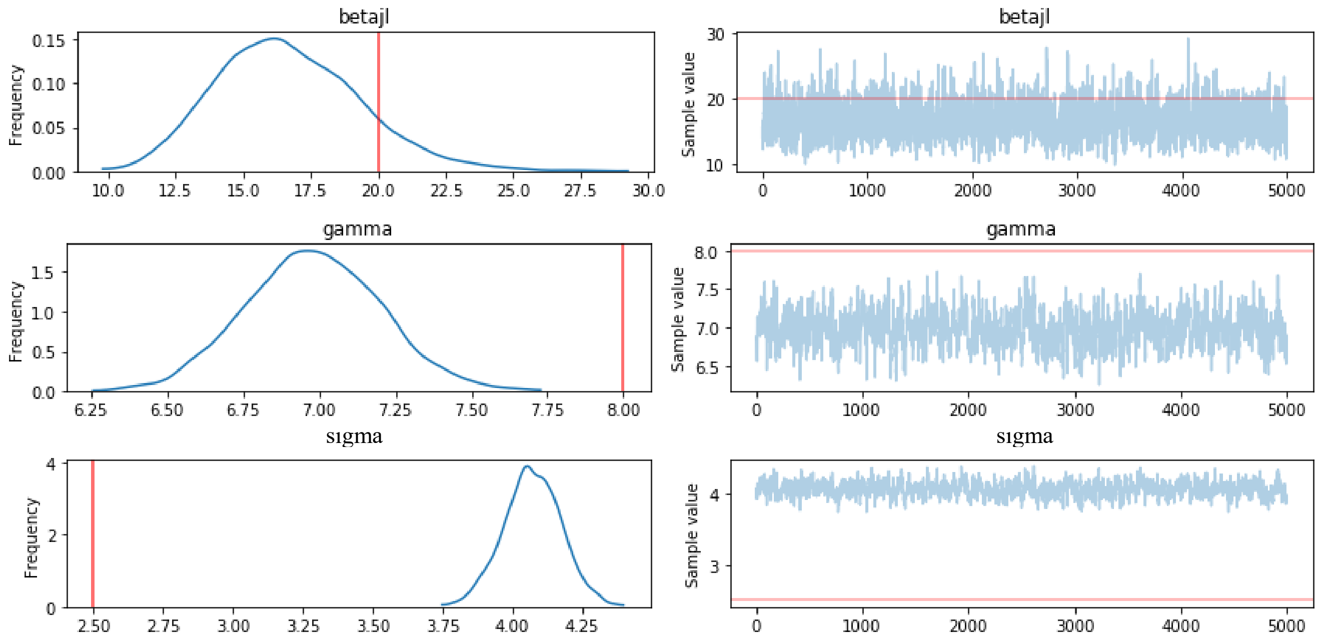
Figure 3.C.3 – Distribution of the posterior means of σ_1 and γ_1 for the simulated dataset



Note: In figure 3.B.3 we observe the jointed distribution of posterior means for σ_1 and γ_1 for the simulated dataset.

Simulating a new dataset with higher values of γ_h, σ_h and β^h, equal respectively to 8, 2.5 and 20, the bias in absolute value for estimates of γ_h and σ_h increases while β^h accuracy improves. The spatial correlation parameter β^h is now included in the 95% confidence interval. With this new simulated dataset, the true posterior mean is about 14% higher for γ_h, 38% lower for σ_h and 20% higher for β^h. From a relative point of view, higher true parameters' values gives best posterior estimates.

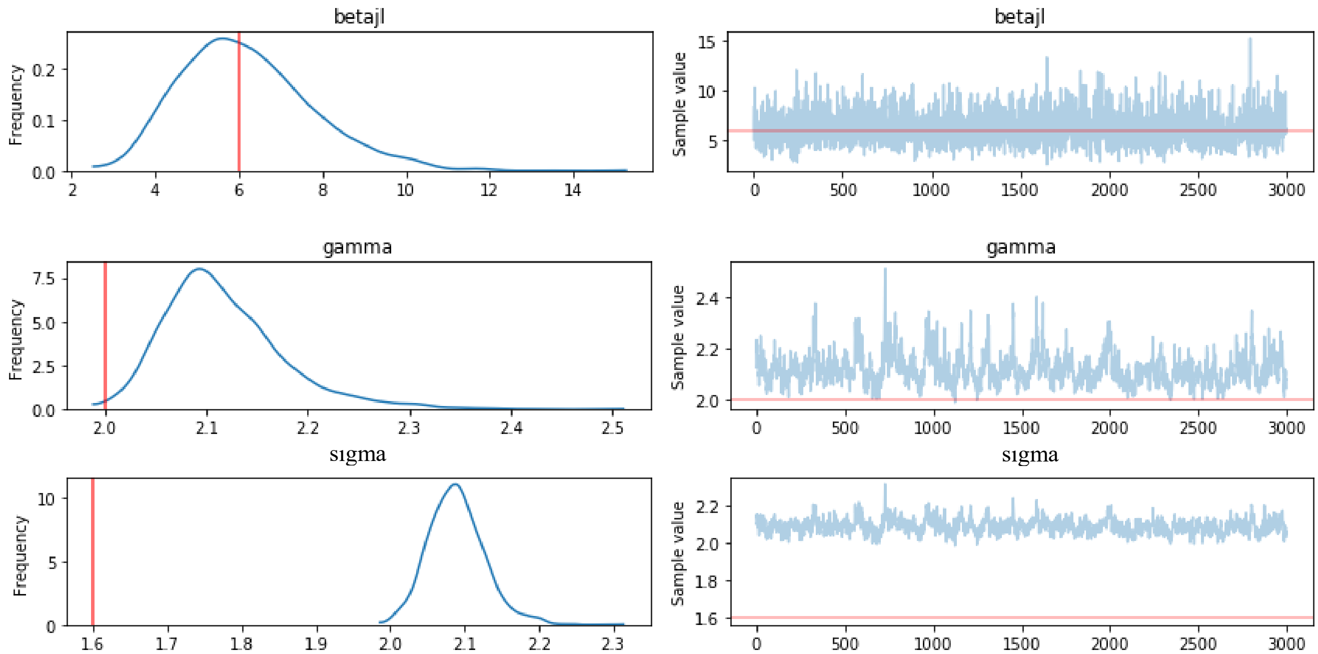
Figure 3.C.4 – Posterior means and traces of parameters β^h, γ_h and σ_h for the simulated dataset, with true values 20, 8 and 2.5.



Note: In this figure we observe the distribution of the estimated spatial correlation parameter (β^h), elasticity of substitution (σ_h) and productivity heterogeneity parameter (γ_h) of Equation 3.30. Values are computed using Hamiltonian Monte Carlo method, with a target acceptance rate of 0.95 for the No-U-Turn sampler and 10.000 draws (with 5.000 burned draws). Red lines are true values of the parameters in the simulated dataset.

Using a third simulated dataset with values close to our estimates (β^h, γ_h, and σ_h equal to 6, 2 and 1.6 respectively), the posterior means of the parameters tend to be closer to their true values. The coefficient of the spatial lag, β^h, is close to its exact value and even the other parameters exhibit lower bias (Figure 3.B.5).

Figure 3.C.5 – Posterior means and traces of parameters β^h, γ_h and σ_h for the simulated dataset, with true values 6, 2 and 1.6.



Note: In this figure we observe the distribution of the estimated spatial correlation parameter (β^h), elasticity of substitution (σ_h) and productivity heterogeneity parameter (γ_h) of Equation 3.30. Values are computed using Hamiltonian Monte Carlo method, with a target acceptance rate of 0.95 for the No-U-Turn sampler and 6.000 draws (with 3.000 burned draws). Red lines are true values of the parameters in the simulated dataset.

To conclude, estimates of β^h tend to be within the confidence interval or, in the worst case, are downward bias. Given that the hypothesis we test in this paper is $\beta^h > 0$, because we suppose preferences are spatially correlated, the downward bias does not affect negatively our conclusion. However, at this moment, we cannot affirm that the posterior means of σ_h and γ_h are the true elasticity of substitution and heterogeneity distribution parameter of good h.

3.D Estimates of Equation 3.30 in Chapter 3.4.2

In order to estimate the parameters of Equation 3.30, we use the following objective priors:

$\sigma = 1 + \sigma_1$

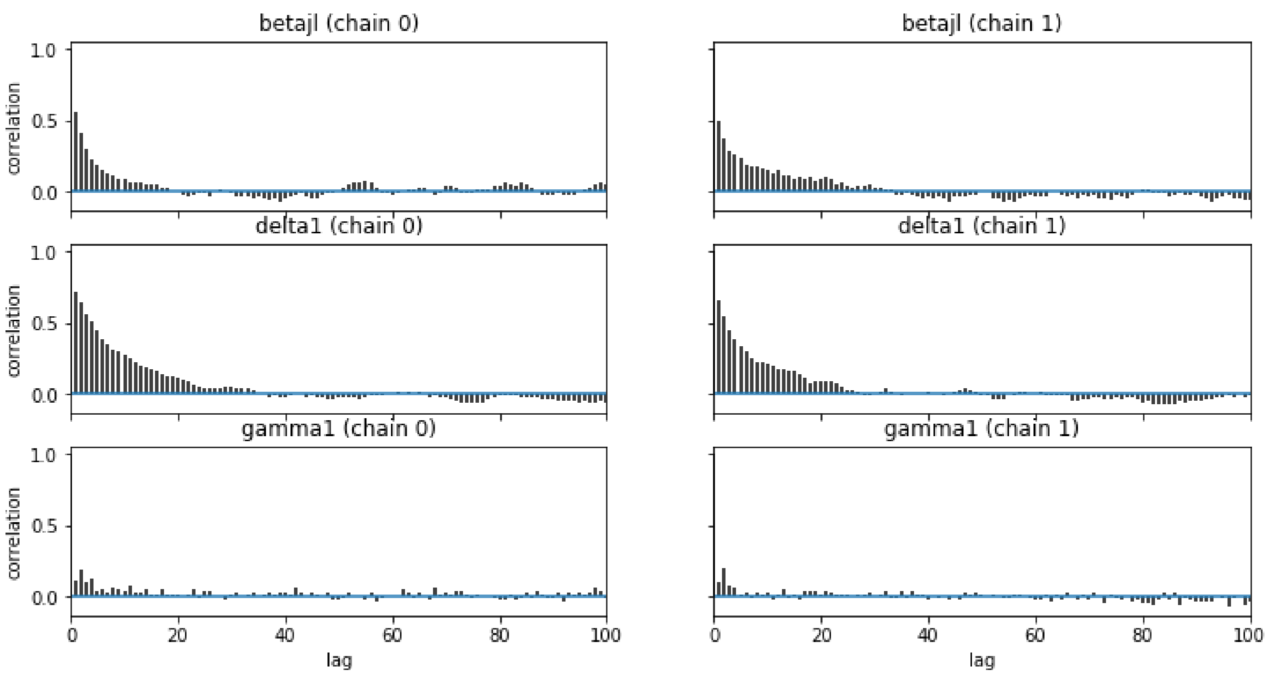
$\gamma = 1 + \sigma_1 + \gamma_1$

$\psi_{ij}^h, \psi_{jt}^h, \alpha_{slt}^h, \sigma_1 \sim \exp(1.5)$

$\gamma_1 \sim \exp(0.8)$

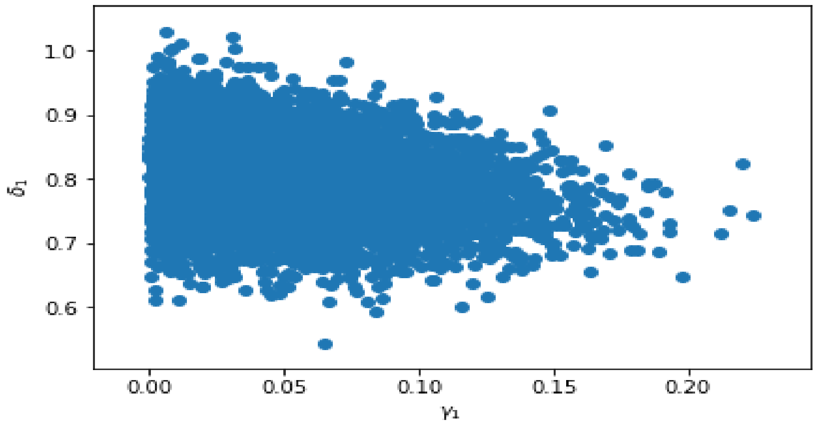
The posterior mean of parameters are computed on the value estimated using the Hoffman and Gelman (2014) No-U-Turn sampler. Results and diagnostic are in the following figures, for the subset of sectors.

Figure 3.D.1 – Autocorrelation plot of the posterior means for parameters β^h, σ_1, γ_1, σ_1, γ_h, σ_h for product 22 HS (beverages, spirits and vinegar)



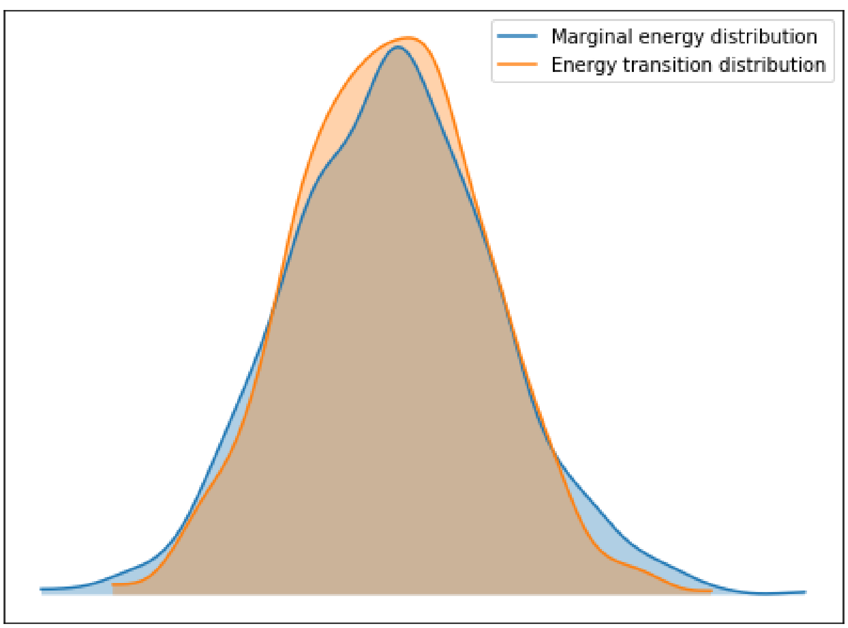
Note: In this figure we observe the autocorrelation plot of a subset of parameters of Equation 3.30. Values are estimates using Hamiltonian Monte Carlo computation, with a target acceptance rate of 0.95 for the No-U-Turn sampler.

Figure 3.D.2 – Distribution of the posterior means of σ_1 and γ_1 for product 22 HS (beverages, spirits and vinegar)



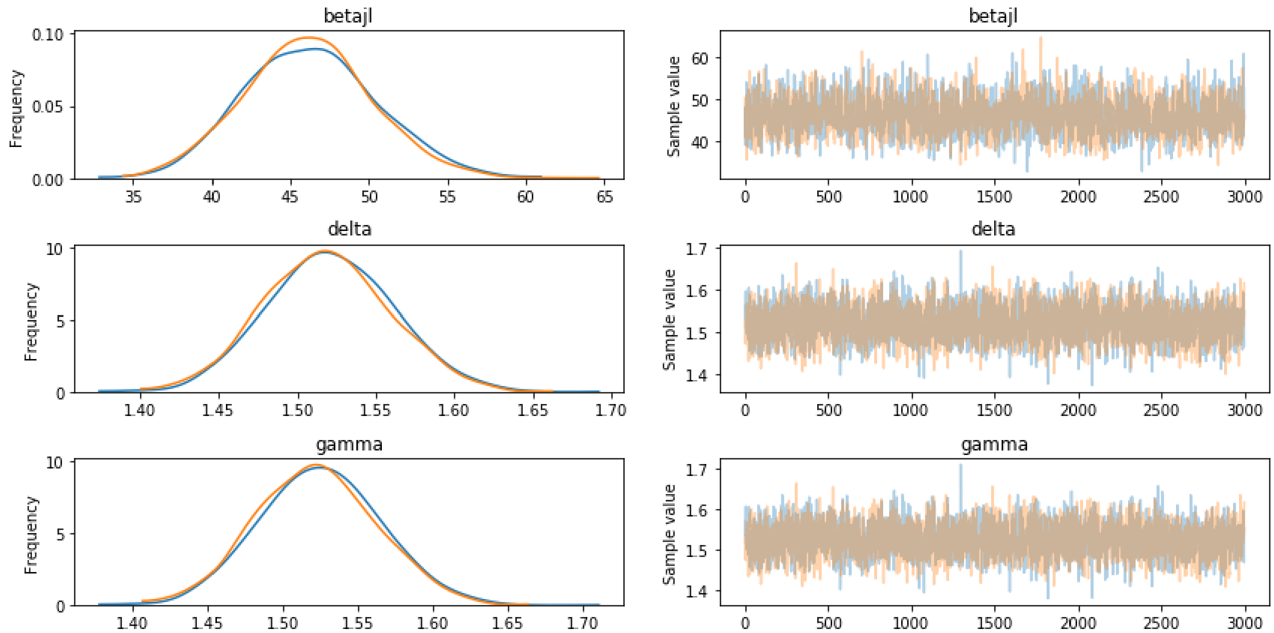
Note: This figure shows the joint posterior means distribution of σ_1 and γ_1.

Figure 3.D.3 – Energy plot distribution for product 22 HS (beverages, spirits and vinegar)



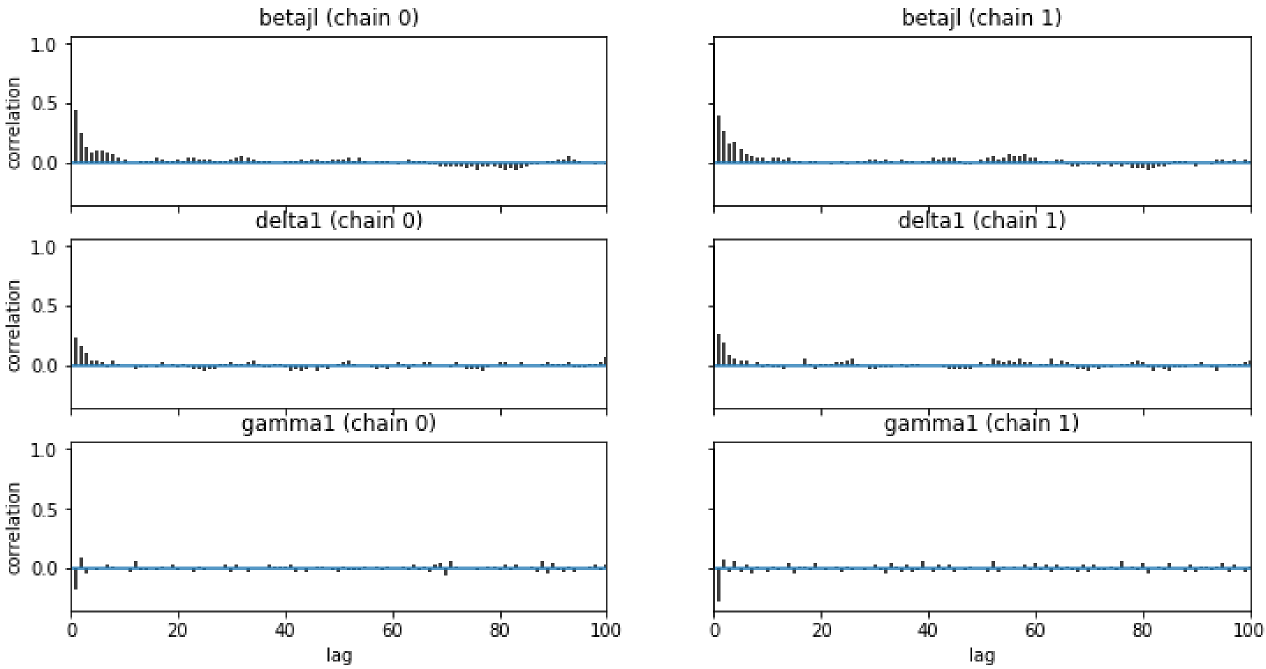
Note: Plot energy transition distribution and marginal energy distribution in order to diagnose poor exploration by HMC algorithm.

Figure 3.D.4 – Posterior means and traces of parameters β^h, σ_h and γ_h of Table 3.3, for the HS 61 Sector (Apparel and clothing accessories; knitted or crocheted)



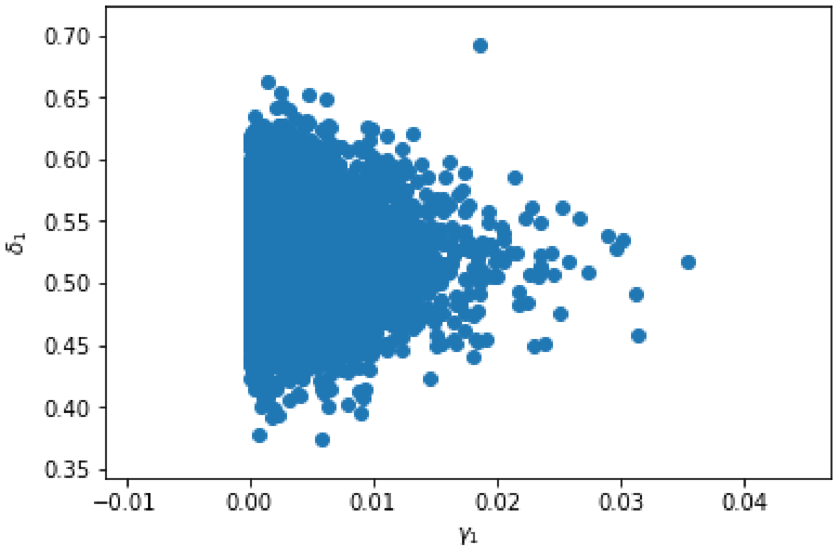
Note: This figure displays the distribution of the estimated spatial correlation parameter (β^h), elasticity of substitution (σ_h) and productivity heterogeneity parameter (γ_h) of Equation 3.30. Values are computed using Hamiltonian Monte Carlo method, with a target acceptance rate of 0.95 for the No-U-Turn sampler.

Figure 3.D.5 – Autocorrelation plot of the posterior means for parameters $\beta^h, \sigma_1, \gamma_1, \sigma_1, \gamma_h, \sigma_h$, for the HS 61 Sector (Apparel and clothing accessories; knitted or crocheted)



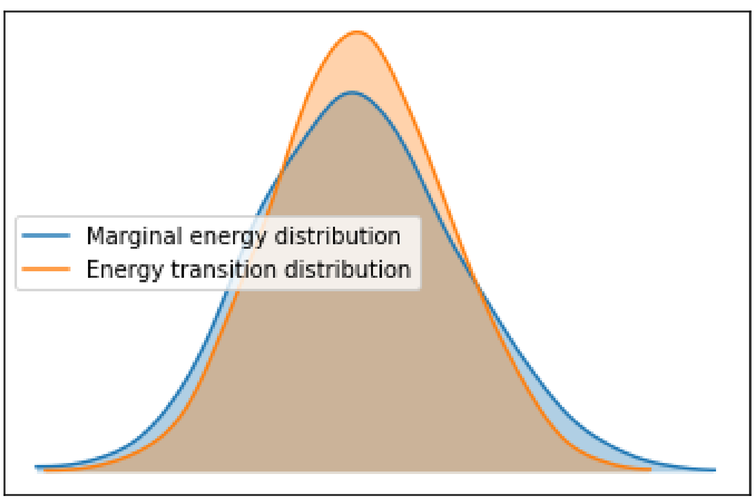
Note: In this figure we observe the autocorrelation plot of a subset of parameters of Equation 3.30. Values are estimates using Hamiltonian Monte Carlo computation, with a target acceptance rate of 0.95 for the No-U-Turn sampler.

Figure 3.D.6 – Distribution of the posterior means of σ_1 and γ_1 for the HS 61 Sector (Apparel and clothing accessories; knitted or crocheted)



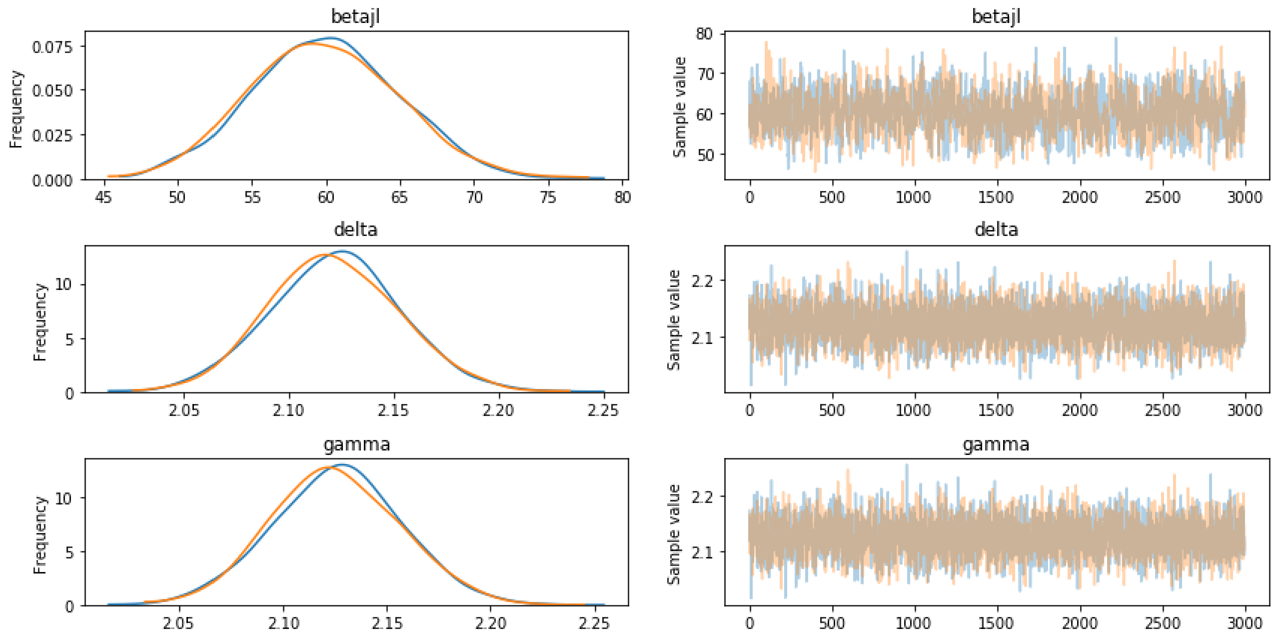
Note: This figure shows the joint posterior mean distribution of σ_1 and γ_1.

Figure 3.D.7 – Energy plot distribution for the HS 61 Sector (Apparel and clothing accessories; knitted or crocheted)



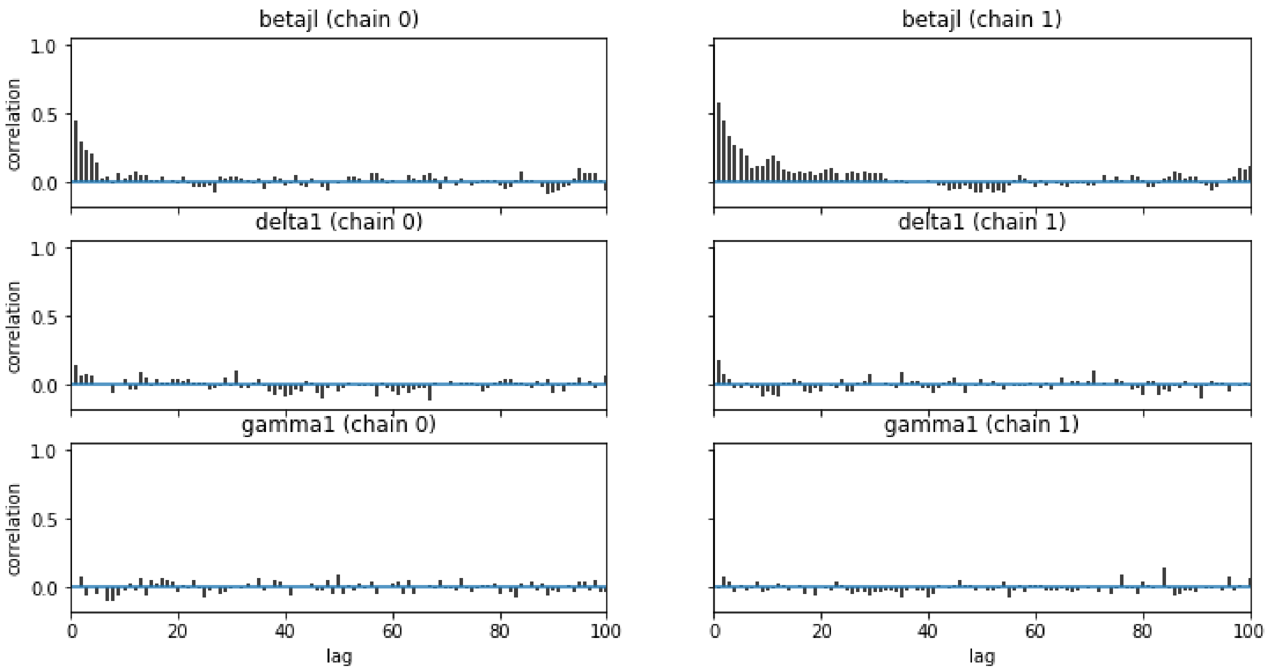
Note: Plot energy transition distribution and marginal energy distribution in order to diagnose poor exploration by HMC algorithm.

Figure 3.D.8 – Posterior means and traces of parameters β^h, σ_h and γ_h of Table 3.3, for the HS 38 Sector (Miscellaneous chemical products)



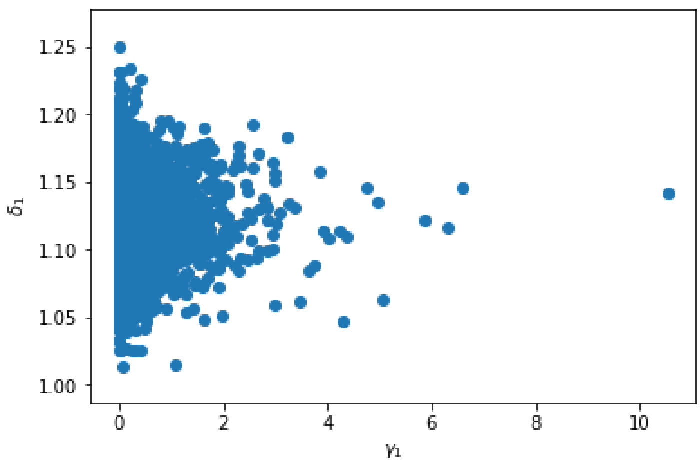
Note: This figure displays the distribution of the estimated spatial correlation parameter (β^h), elasticity of substitution (σ_h) and productivity heterogeneity parameter (γ_h) of Equation 3.30. Values are computed using Hamiltonian Monte Carlo method, with a target acceptance rate of 0.95 for the No-U-Turn sampler.

Figure 3.D.9 – Autocorrelation plot of the posterior means for parameters β^h, σ_1, γ_1, σ_1, γ_h, σ_h, for the HS 38 Sector (Miscellaneous chemical products)



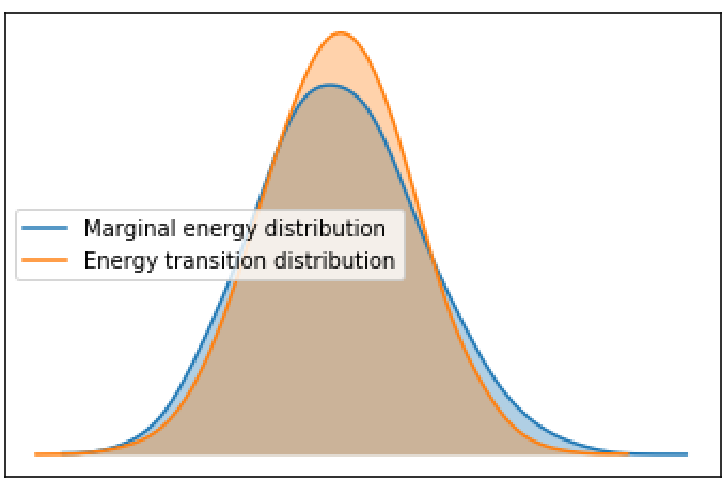
Note: In this figure we observe the autocorrelation plot of a subset of parameters of Equation 3.30. Values are estimates using Hamiltonian Monte Carlo computation, with a target acceptance rate of 0.95 for the No-U-Turn sampler.

Figure 3.D.10 – Distribution of the posterior means of σ_1 and γ_1 for the HS 38 Sector (Miscellaneous chemical products)



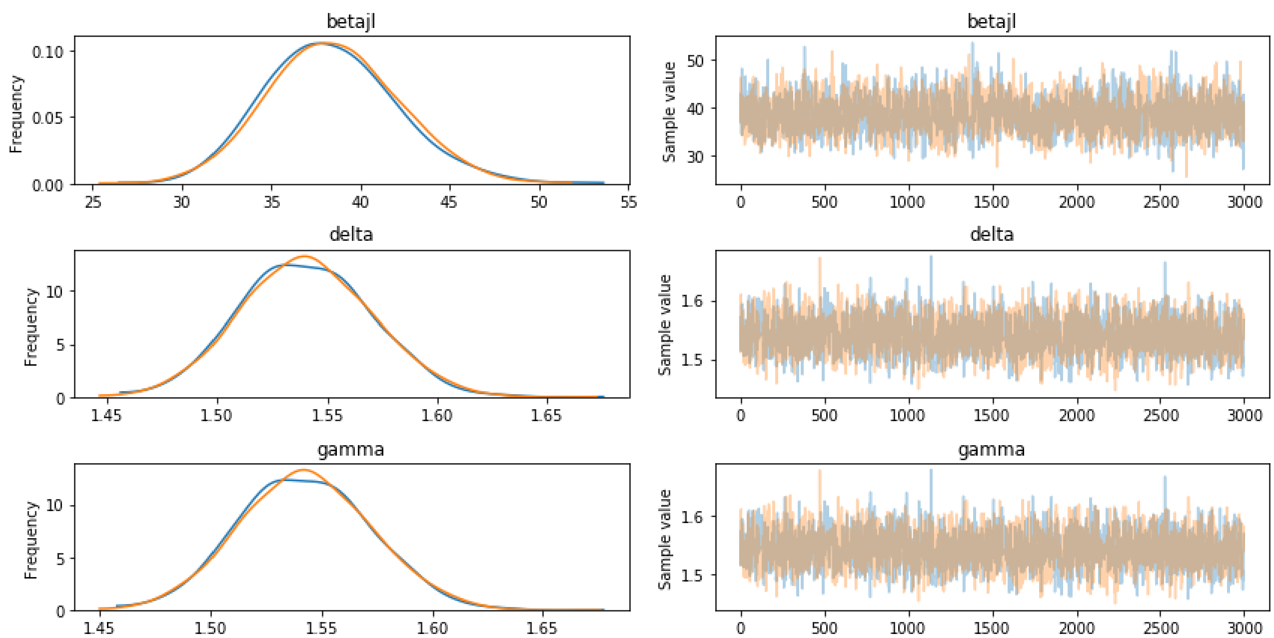
Note: This figure shows the joint posterior mean distribution of σ_1 and γ_1.

Figure 3.D.11 – Energy plot distribution for the HS 38 Sector (Miscellaneous chemical products)



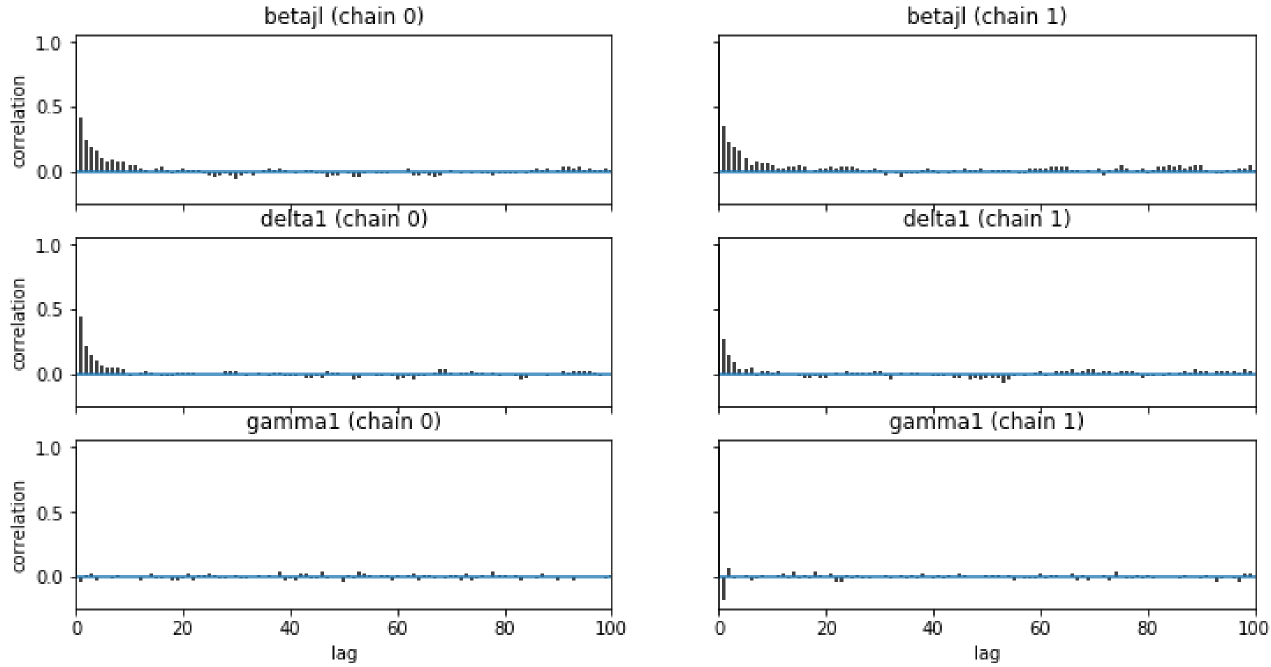
Note: Plot energy transition distribution and marginal energy distribution in order to diagnose poor exploration by HMC algorithms.

Figure 3.D.12 – Posterior means and traces of parameters β^h, σ_h and γ_h of Table 3.3, for the HS 69 Sector (Ceramic products).



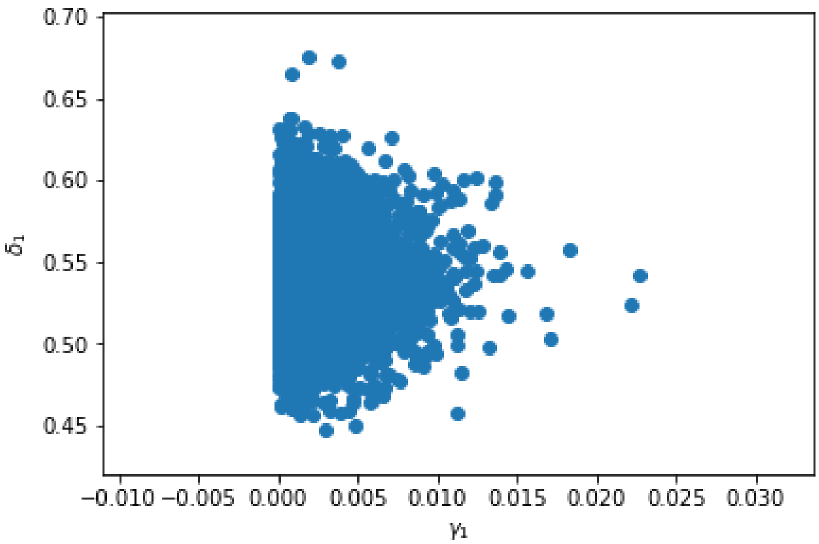
Note: This figure displays the distribution of the estimated spatial correlation parameter (β^h), elasticity of substitution (σ_h) and productivity heterogeneity parameter (γ_h) of Equation 3.30. Values are computed using Hamiltonian Monte Carlo method, with a target acceptance rate of 0.95 for the No-U-Turn sampler.

Figure 3.D.13 – Autocorrelation plot of the posterior means for parameters β^h, σ_1, γ_1, σ_1, γ_h, σ_h, for the HS 69 Sector (Ceramic products).



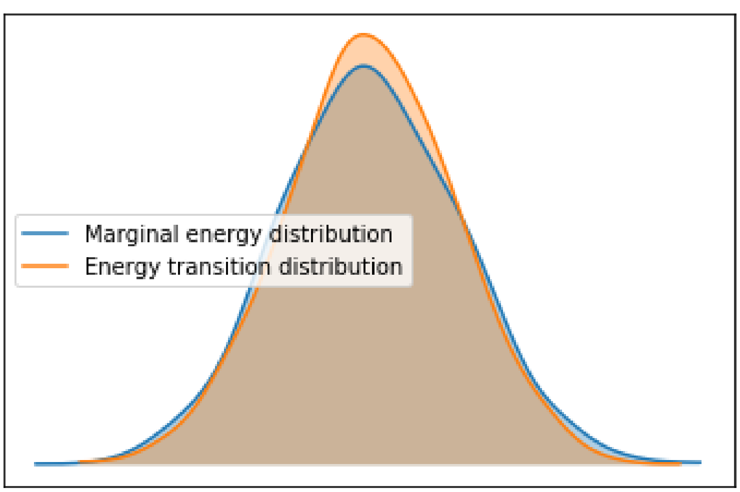
Note: In this figure, we observe the autocorrelation plot of a subset of parameters of Equation 3.30. Values are estimates using Hamiltonian Monte Carlo computation, with a target acceptance rate of 0.95 for the No-U-Turn sampler.

Figure 3.D.14 – Distribution of the posterior means of σ_1 and γ_1 for the HS 69 Sector (Ceramic products).



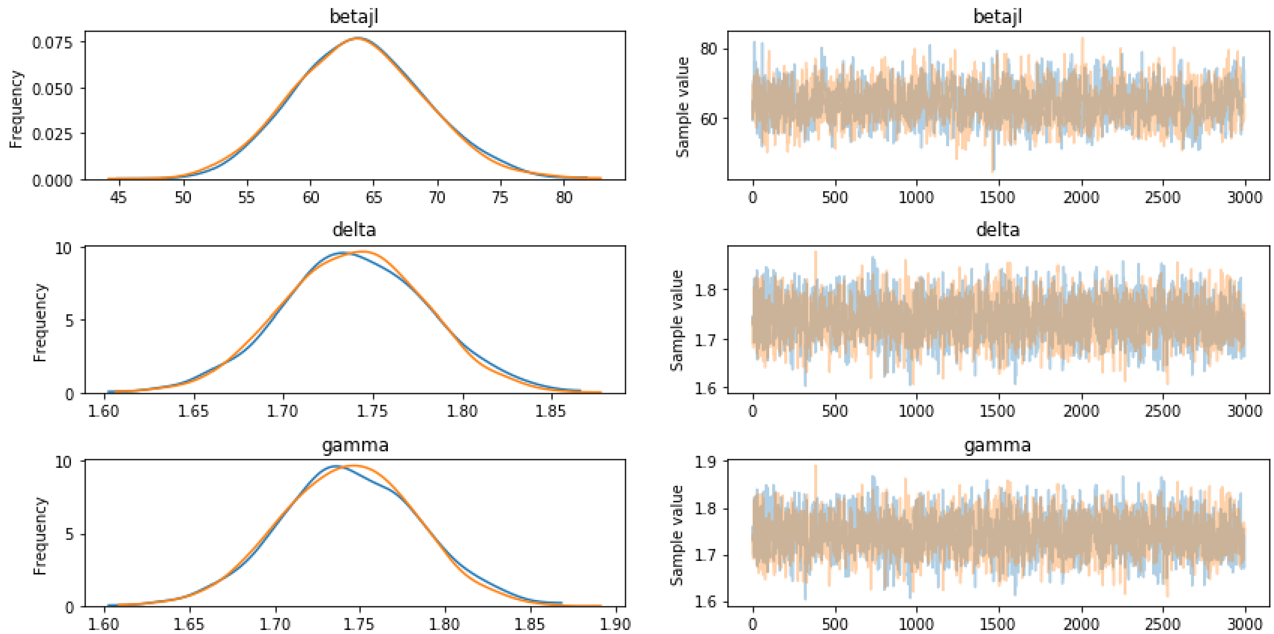
Note: This figure shows the joint posterior mean distribution of σ_1 and γ_1.

Figure 3.D.15 – Energy plot distribution for the HS 69 Sector (Ceramic products).



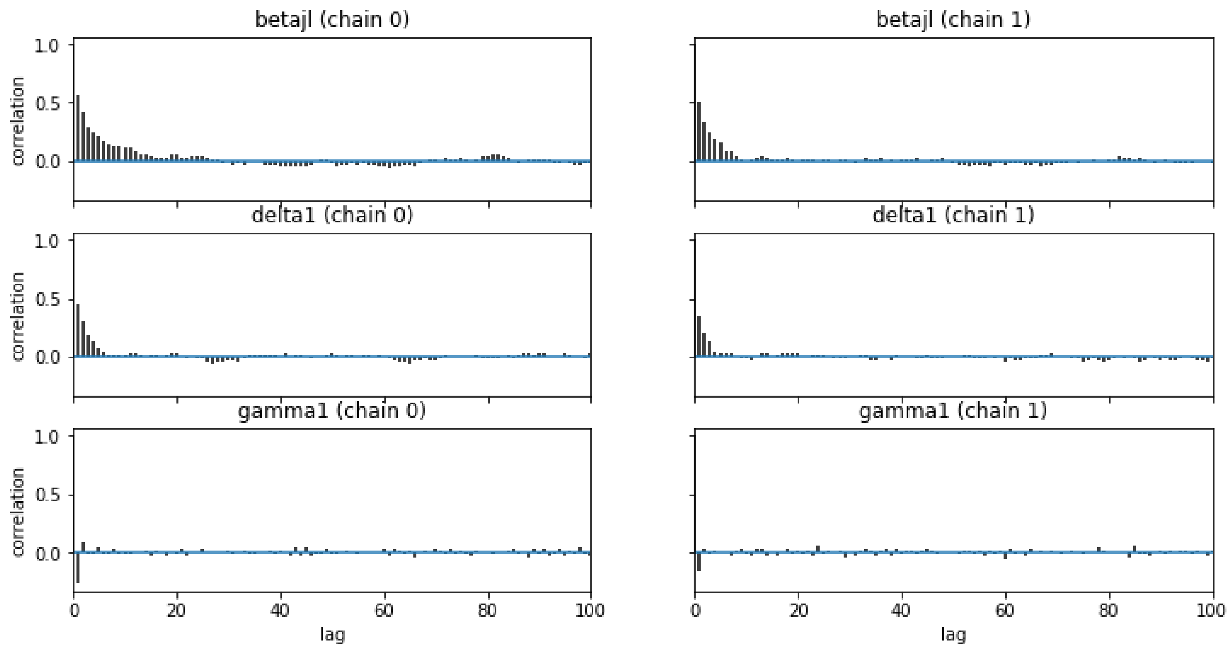
Note: Plot energy transition distribution and marginal energy distribution in order to diagnose poor exploration by HMC algorithms.

Figure 3.D.16 – Posterior means and traces of parameters β^h, σ_h and γ_h of Table 3.3, for the HS 87 Sector (Vehicles; other than railway or tramway rolling stock).



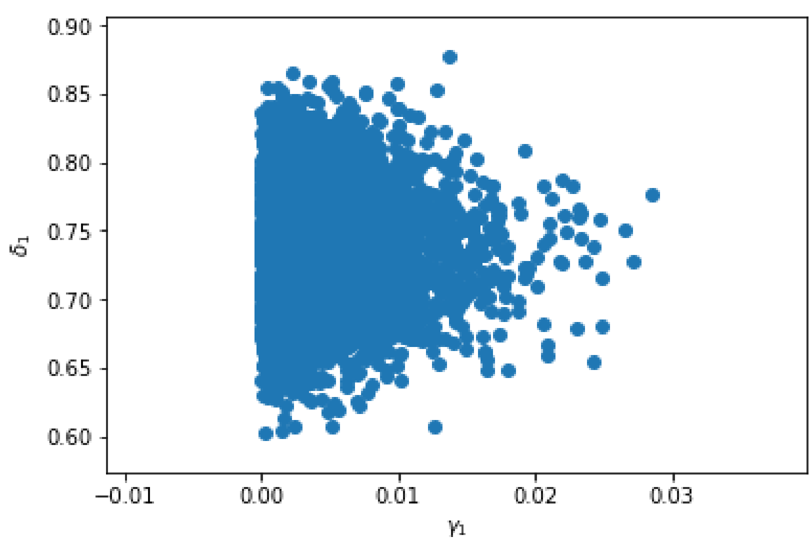
Note: This figure displays the distribution of the estimated spatial correlation parameter (β^h), elasticity of substitution (σ_h) and productivity heterogeneity parameter (γ_h) of Equation 3.30. Values are computed using Hamiltonian Monte Carlo method, with a target acceptance rate of 0.95 for the No-U-Turn sampler.

Figure 3.D.17 – Autocorrelation plot of the posterior means for parameters β^h, σ_1, γ_1, σ_1, γ_h, σ_h, for the HS 87 Sector (Vehicles; other than railway or tramway rolling stock).



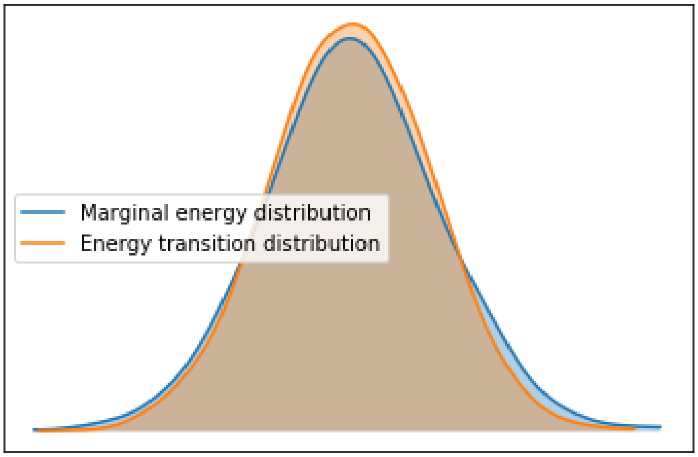
Note: In this figure we observe the autocorrelation plot of a subset of parameters of Equation 3.30. Values are estimates using Hamiltonian Monte Carlo computation, with a target acceptance rate of 0.95 for the No-U-Turn sampler.

Figure 3.D.18 – Distribution of the posterior means of σ_1 and γ_1 for the HS 87 Sector (Vehicles; other than railway or tramway rolling stock).



Note: this figure show the joint posterior mean distribution of σ_1 and γ_1.

Figure3.D.19 – Energy plot distribution for the HS 87 Sector (Vehicles; other than railway or tramway rolling stock).



Note: Plot energy transition distribution and marginal energy distribution in order to diagnose poor exploration by HMC algorithms.

3.E Non normalized and row-normalized distance matrices

In order to give more interpretable results, we try to estimate our spatial correlation parameter in a more formal way, using the standard matrix approach. Adding an error term to Equation 3.17 and rewriting in a matrix notation we have:

$$A_i^h = (I - \beta^h W)^{-1} Z_i^h + (I - \beta^h W)^{-1} \varepsilon_i^h \qquad (3.d.1)$$

where A_i^h is the vector of preferences α_{ij}^h, I is the identity matrix of dimension *n* (where *n* is the number of countries in the custom union), β^h the spatial correlation parameter, W the inverse distance matrix whose elements are $\frac{1}{d_{jk}}$ before row-normalizing, Z_i^h the vector of idiosyncratic preferences $z_{ij}^h \phi$, and ε_i^h is the vector of error terms ε_{ij}^h distributed as a normal with zero mean, variance δ_{ij}^2, and $cov(\varepsilon_{ij}^h, \varepsilon_{ik}^h) = 0$.

The last term of Equation 3.d.1 can therefore be written as a multivariate Normal distributed variable $\xi \sim N_j(0, \Sigma)$ where $\Sigma = (I - \beta^h W)^{-1} \varepsilon (I - \beta^h W')^{-1}$ and ε is a square matrix of dimension J with $\varepsilon_{jj} = \delta_{ij}^2$, $\varepsilon_{jk} = 0$. More generally, Equation 3.d.1 can be written as a multivariate Normal distribution $A_i^h \sim N_j\big((I - \beta^h W)^{-1} Z_i^h;\ (I - \beta^h W)^{-1} \varepsilon (I - \beta^h W')^{-1}\big)$.

Adding the time dimension *t*, we have *t*i* vectors of A_{it}^h and Z_{it}^h for each product *h.* Our preference parameters α_{ijt}^h are therefore computed from the multivariate Gaussian distributions $A_{it}^h = N_{jt}\big((I - \beta^h W)^{-1} Z_{it}^h;\ (I - \beta^h W)^{-1} \varepsilon (I - \beta^h W')^{-1}\big)$ where β^h, ε are unknown parameters and Z_{it}^h are vectors of unobservable idiosyncratic preferences z_{ijt}^h, equal to:

$$z_{ijt}^h = \psi_{ij}^h + \psi_{jt}^h + \psi_{it}^h \qquad (3.d.2)$$

where ψ_{ij}^h, ψ_{jt}^h and ψ_{it}^h are respectively the time invariant preferences of consumers in country *j* for the good *h* produced by country *i*, the time varying preferences of consumers in country *j* for product *h* and the time varying preferences for good *h* produced by *i*, across the consumers in all the countries considered. Because $z_{ijt}^h \phi$ are supposed to be greater or equal to zero, we assume the values of all parameters ψ^h being distributed as exponential.

We set δ_{jj}^2 unique across all the goods *h,* time *t* and country preferences *ij*. In order to have values of α_{ij}^h gathered in the positive domain we bound the value of δ_{jj}^2 to a set of maximum values[123] imposing an upper constraint to the prior distribution. From a theoretical perspective, we are limiting the irrationality and non-persistent component of national preferences. The distribution of σ_h and γ_h is a function of exponential, as in the previous setting. Values of β^h are assumed to be distributed as an exponential when we compute the non-normalized distance matrix W. When W is row-normalized[124], as usual in spatial econometric, β^h can be interpreted as the average influence of neighbors and their values are constrained in the (-1;+1) domain, to have positive semi-definite covariance matrix. β^h priors are therefore modelled as a Uniform distribution in the bounded space.

To estimate the parameters of our model we recur to variational inference (Blei et al., 2017) and specifically to the ADVI algorithm implemented by Kucukelbir et al. (2017). Variational inference turns the task of computing a posterior into an optimization problem finding the member of distributions that minimizes the Kullback-Leibler (KL) divergence to the exact posterior. ADVI transforms constrained latent variables to unconstrained real valued latent variables and computes derivatives of the joint distribution, expressing the gradient as an expectation over the family of the distributions and reparametrizing the gradient in term of a standard Gaussian. To compute Monte Carlo approximations we need therefore only to sample from a standard Gaussian. To simplify the simulation process, we estimate our parameters with a mean field Gaussian approximation that assume zero correlation among the transformed unconstrained latent variables[125].

Results for the non-normalized inverse distance matrix are shown in Table 3.E.1. These are experimental results given that most of the estimations (especially when $\delta_{jj} > 0.001$) do not achieve stable convergences. In these cases, values around the minimum KL divergence are used.

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[123] Preference parameters must be greater or equal to 0. Excluding zero flows trade, in order to avoid Inf and NaN values for the observed variable (given that we are considering the ratio of trade flows), restricts the domain of α_{ij}^h to strictly positive values. In our maximization process, we set α_{ij}^h equal to 1E-06 if the value sampled from the distribution is lower or equal to 0. Changing this lower bound does not affect significantly the result of our simulations. Imposing low constrains on the value of σ_{jj}^2 reduce frequency of negative values, increasing the stability of simulations.

[124] In a row-normalized distance matrix each element is equal to $\frac{(1/d_{jk})}{\Sigma_k(1/d_{jk})}$.

[125] As a robustness test, we compute the parameters using even a full rank Gaussian approximation, where the covariance matrix is estimated using a Cholesky factorization, to ensure the matrix remaining positive semi definite.

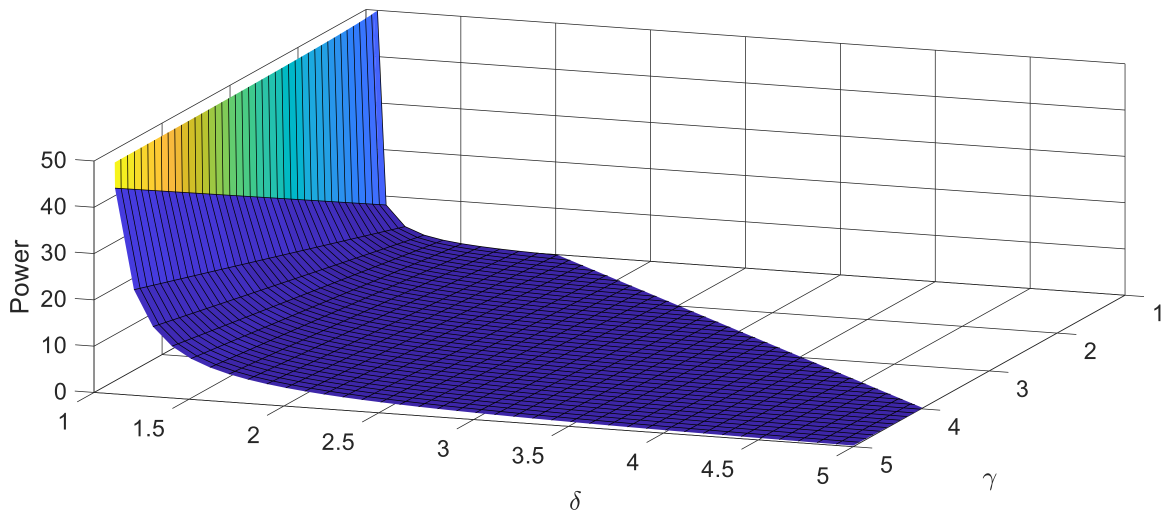
Table 3.E.1 – Simulation of the correlation parameter β^h, residual variance δ_h and elasticity of substitution σ_h for sector 22, 87, 61, 38 using an inverse non-normalized distance matrix W

Sector	δ_{jj} prior bounded to	Median	SD	2.5 Quartile [HPD 2.5]	97.5 Quartile [HPD 97.5]	δ_h: Median	σ_h: Median
β^{22}	0.1	6.332	5.583	1.086	20.512	2.743	4.682
β^{22}	0.01	16.319	90.31	5.27	39.36	1.785	3.109
β^{22}	0.001	12.651	5.247	5.329	25.135	0.969	2.284
β^{87}	0.1	3.706	1.988	1.193	8.697	2.477	4.396
β^{87}	0.01	7.153	1.988	4.002	11.894	1.899	4.417
β^{87}	0.001	20.909	6.793	10.49	36.764	0.72	2.282
β^{61}	0.1	5.166	3.708	1.116	15.175	2.343	4.862
β^{61}	0.01	26.515	13.213	9.497	60.112	1.212	2.563
β^{61}	0.001	21.317	9.955	8.071	46.22	0.613	1.871
β^{38}	0.1	5.854	4.728	1.131	18.071	2.662	4.527
β^{38}	0.01	14.732	7.961	4.963	34.469	1.913	3.578
β^{38}	0.001	17.496	7.943	6.709	37.086	1.048	2.007
β^{69}	0.1	5.363	3.947	1.127	15.64	2.546	4.675
β^{69}	0.01	11.924	6.118	4.176	27.626	1.846	3.522
β^{69}	0.001	6.548	2.584	2.886	12.857	1.271	2.443

Note: This table displays simulation of the spatial correlation parameter (β^h) specified in Eq. 3.d.1. The residual variance (δ_h^2) is the variance of the error term for the distribution $N \sim (\mu, \delta_h^2)$ approximating our dependent variable $\ln\left(\frac{X_{ijt}^h}{X_{kjt}^h}\right)$, with μ specified in Equation 3.25. Lower value of δ_h imply a better fitting of the distribution. Priors are $\beta^h \sim exp(0.2)$, $\delta_h \sim HalfCauchy(5)$, $\delta_{jj} \sim Unif[0, Bound(\delta_{jj})]$. W is the inverse distance matrix whose elements are $(1/d_{jk})$. Values are computed using variational inference (Blei et al., 2017), with ADVI algorithm (Kucukelbir et al., 2017).

With a large constrain on the variance of the consumers' preference shock (δ_{jj}^2), the unexplained variance (δ_h^2) surges. The intuition is that increasing the upper bounds of δ_{jj}, estimates for σ_h rises, as shown in Figure 3.E.1, because of the structure of Equation 3.25, in an attempt to minimize the random component of preference.

Figure 3.E.1 – Value of $\frac{\gamma_h}{(\sigma_h - 1)}$ *conditioned to the joint distribution of* $\gamma_h > \sigma_h > 1$



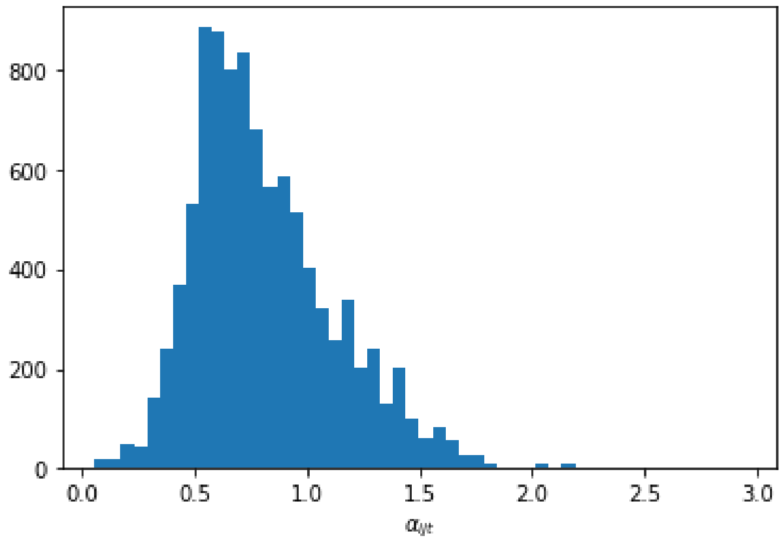
As a result, δ_h growths and $\frac{d\,ln\left(X_{ij}^h/X_{kj}^h\right)}{d\beta^h}$ decrease. Consequently, even the proposed value of β^h stuck near their initial values. Estimates for σ_h and, as a consequence of the nested structures, γ_h are indeed higher increasing the upper limit of δ_{jj}. Conversely, with low values for the upper limit of δ_{jj}, estimates of γ_h and σ_h tend to converge to the values previously estimated in Equation 3.30, as shown in table 5.

Table 3.E.2 – Estimates of β^h *for the subset of sectors with different parameter specification*

Sector	$\boldsymbol{estimates\ of\ eq.3.30}$		$\boldsymbol{estimates\ of\ eq.3.30\ and\ of\ eq.3.d.1}$ with σ_{jj} bounded to 0.001 and W not normalized		$\boldsymbol{stimates\ of\ eq.3.30\ and\ of\ eq.3.d.1}$ with σ_{jj} bounded to 0.001 and W row-normalized	
	$\boldsymbol{\beta^h}$	σ_h	$\boldsymbol{\beta^h}$	σ_h	$\boldsymbol{\beta^h}$	σ_h
22	37.87	1.80	12.7	2.28	0.282	2.374
87	63.87	1.73	20.9	2.28	0.455	2.019
69	38.42	1.54	6.6	2.44	0.18	2.065
38	59.98	2.12	17.5	2.07	0.511	1.713
61	47.23	1.52	21.3	1.87	0.529	1.61

Note: Table 3.D.2 show estimate of the spatial correlation parameter (β^h) of Equation 3.25 with preference parameters specified in Eq. 3.d.1.

Table 3.E.1 – Distribution of the parameter α_{ijt} for sector 22 with with σ_{jj} bounded to 0.001 and distance matrix W normalized



Conclusions

This thesis explores how different dimensions of proximity impact several outputs related to international trade. Boschma (2005), studying the relationship between distance and "learning and innovation" process of firms, identifies 5 measures of proximity. He claims that the geographical dimension of proximity is not a sufficient condition for interactions to take place. It surely facilitates contacts but cannot be separated from considering other forms of distance, identified by cognitive, organizational, social and institutional proximities. Moreover, too high level of proximity may be detrimental to learning and innovation because too much coordination and control prevent openness and flexibility. In this thesis, we apply few of the ideas developed by Boschma (2005) to different economics topics.

Institutional proximity, captured by the legal origin family variable, affects the behaviour of different countries. Countries whose legal rules are originated from the same code of laws exhibit similar economic structures and paths of development, showing comparable approaches to economic and government decisions. Countries with high institutional proximity display homogenous results on exports after bidding for a Mega-event, as found in the first chapter of this thesis. Institutional distance, defined by Edquisit and Johnson (1997) as "sets of common habits, routines, established practices, rules, or laws that regulate the relations and interactions between individuals and groups", is found to substantially affect this economic output. In the first chapter, we find German law countries (having a hybrid legal system that shares some elements of French and Common law countries) export a priori more than the French civil law countries but less than the Common law countries.

The detrimental role of distance (as specified by Boschma referring to concentration) instead emerges in our second chapter, where we measure the cognitive proximity using the trade network structure. Cognitive distance is defined as the knowledge of economic actors, who are subject to bounded rationality. The trade network, approximating the communication structure of economic agents, bounds the set of knowledge of the agents about the world possibilities. Since knowledge is disperse among different agents or organizations (Antonelli, 2000) and knowledge creation and learning depend on combining diverse, complementary capabilities of heterogeneous agents within and between organizations (Nooteboom, 2000), organizations should guarantee access to several sources of information and openness to the outside world (Saviotti, 1996). The availability of external sources is exactly what we are measuring with our bargaining power index. Countries with lower external possibilities (in other words, too concentrated cognitive proximity or social embedded relationships) are more affected by the partner's behaviours. Indeed, having a bigger and heterogeneous set of partners increases the set of bargaining possibilities, improving the economic outcome.

Social proximity is then considered in the last chapter. As shown by Polanyi (1944) and Granovetter (1985) even social ties and relations affect economic outcomes. Relations between agents at the micro-level are socially embedded when involve friendship, kinship or experience. This is related to our measure of spatial correlated preferences. Social interactions, shaping preferences, facilitate consumption of goods that are consumed by close neighbours. We proxy this dimension of distance with the ratio between our spatial correlation parameter and the geographic distance among consumers in different countries.

This thesis provides moreover new insights on some relevant topics in international trade. In the first chapter, we claim that Olympics are only sub-elements of the wider Mega-event effect and that an identification problem arises trying to separate the permanent effect on exports among different kinds of Mega-events, because countries nearly always bid and host more than a single event. We provide evidence of an interaction effect between legal families and the impact on exports of bidding, successfully or unsuccessfully, for a Summer Olympic or others Mega-events. Civil law countries exhibit a positive, strong and persistent effect on exports after bidding for a Mega-event while common law countries display no significant effect. We propose a possible explanation for this heterogeneous response introducing Trade tariffs and Capital controls variables. Common law countries have, ex-ante, lower trade tariffs that do not change after the bidding, differently from capital openness that is increased. Capital controls have an ambiguous effect on exports because, in an export versus FDI model of trade with heterogeneous firms (Helpman et al., 2004), reducing the fixed cost of FDI can push a greater number of firms toward FDI instead of exports, as it is shown in our first paper.

In the second chapter, we find a new methodology to identify the relative bargaining power of trading firms moving out from the standard assumptions implied by the global market shares. Our index identifies a proxy for the bargaining strength of a country relative to the others, capturing the asymmetry and restrictions of the trade network structure. As such, we add to the literature on the currency denomination of trade by the implication of bargaining process and a network effect, which should be included in future theoretical models and used as a control in future empirical researches. We propose as a future work to assess the impact of the network position on the exchange-rate pass-through (that measures how responsive international prices are to changes in exchange rates) or on the mark-up charged by firms.

In the third chapter, we suggest a development of the traditional gravity model of trade in order to take into account the new empirical findings on the extended gravity and spatial, or sequential, exporters. Introducing in the Chaney (2008) model of trade country pairs consumers' preferences and shaping them as spatially dependents, we derive an extended aggregate equation of trade incorporating these new empirical findings. We find reduced-form evidence of a relation between bilateral trade and the spatial distribution of exports to other countries; both the probability to export to a market and the value exported increase the more the exporting country exports to countries close to the target market. Spatially correlated preferences are then confirmed in a structural estimation of the model on a subset of products and countries. We identify the spatial correlation parameter considering, in a custom union, the ratio of exports to the same country from different countries, in order to control for observed and unobserved fixed costs to export. Expressing some concerns on possible measurement problems, we even propose in appendix some strategies to deal with them.

This thesis confirms reality is complex, but tools to deal with complexity are becoming increasingly available, both in the theoretical and technical field. In the third chapter, it has been possible to estimate model's structural parameters thanks to probabilistic programming and recent developments in computer science.

In this thesis, the crucial role of proximity and individuals' interactions emerges. These should be included in future theoretical and empirical works and considered by policy makers. Distance, specified by a large set of attributes, influences many economic outcomes. People are more likely to act similarly to their neighbours, as economic outcomes are more likely to be similar for countries having similar laws, rules and institutions. Therefore, impacts of economic policies can be magnified or reduced and the same applies to the transmission of shocks. These considerations are important in each process of market integration, as it has been recently shown with Brexit, where the only common law country in Europe voted positively to leave the European Union, expressing the willingness to create a free trade agreement with another common law country, the US. In the same way, consumers are more likely to accept trade agreement and import goods that are consumed by their neighbours or by consumers that are "socially" related or perceived as similar.

According to the result of our first paper, we should observe in the future more Mega-events hosted by emerging economies or by countries interested in global openness, that want to signal their intention to liberalize. This seems empirically confirmed by the last World Cup (South Africa in 2010, Brazil in 2014, Russia in 2018 and Qatar in 2022) and Summer Olympic Games (China in 2008, Brazil in 2016 and Japan in 2020) hosting countries. Future researches should try to explain the behaviour of countries that submit repeated or multiple bids for Mega-events or host more Mega-events. A possible research direction is to investigate if countries submitting multiple bids sequentially liberalize different fields of economy (capital market, regulatory framework) or signal new infrastructure investments to the market.

With our second chapter, we can draw some conclusions about bargaining and market structure. The real bargaining power of small countries or marginal producers/consumers could be higher when communication networks are constrained and asymmetric. On the other side, producers with high market shares could exhibit low bargaining power when compared to their importers. Our bargaining mechanism is even able to explain why bigger and strongest countries prefer to bargain separately with small countries to sign trade agreements (as US are trying to do), or why some policy makers try to limit the exporting (importing) destinations of their main importing (exporting) markets. Other implications refer to antitrust laws that are mainly focused on global or bilateral market shares. Finally, we contribute to the industrial organization literature providing a framework to identify supply or demand side market structures.

In the third chapter, some other interesting implications emerge. Consumers' gains from trade liberalizations could be higher thanks to spatially correlated preferences, and small dimensional countries would be more open because of the spatial correlation. With our third paper, we find a new empirical method to identify products categories with local or global preferences, where different branding strategies should be applied. As a technical improvement, we propose to apply genetic algorithm (evolutionary computation) to estimate equations with complex multidimensional space, with no closed solution. Other research directions are to explore the relationship between globalization and preferences and to assess the role of migration within our framework. Integrate empirical marketing evidences into the international trading literature or to evaluate separately the impacts of fixed cost and preferences on trade, using trade regional data, are other interesting research areas.

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