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Abstract

This article examines the extent to which national institutional conditions affect bilateral sectoral trade flows, as well as whether the conditioning role of institutions for trade has been waxing or waning with time. Based on a new trade theory foundation that allows us to model bilateral trade flows at sectoral level, we derive the associated gravity equation and analyse bilateral trade flows of 186 countries for the period 1996-2012, with a total of 125,703 observations. The results indicate that both the institutional conditions at destination and the institutional distance between the countries involved in trade are relevant factors in determining the overall volume and composition of bilateral trade. They also show, however, that their sway on trade flows is only a fraction of that of other more traditional determinants of trade, notably geographical distance, with the exception of trade in the service sector, where institutional quality is of paramount importance. Finally and contrary to expectations, the magnitude of institutional quality for trade has not waxed over the last few years. If anything, it has waned and the resource boom of the 2000s is to be blamed for this evolution.

JEL Classification: D02, F10, K4, Z14 and Z18
Keywords: gravity equation, institutional quality, international trade and public policy

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1. Introduction

The role of institutions as a driver of economic development has been attracting considerable attention in the literature on long-run economic growth. It has been widely acknowledged that local institutional conditions shape growth trajectories in different parts of the world (Acemoglu et al., 2005; Rodríguez-Pose and Storper, 2006). Trade is also considered a fundamental driver of economic growth. Yet, our knowledge about how the local quality of institutions impinges on trade trends remains rather limited. It has been claimed that good institutional environments facilitate bilateral trade. High institutional quality reflects pluralistic and inclusive political institutions that facilitate the existence of a level playing field, where individual economic agents cannot abusive market power monopolizing trade in their favour (e.g., tariffs and quotas), thereby restricting flows as a result of rent-seeking activities. Indeed, institutional quality and smaller gaps in governance drive trade flows (De Groot et al., 2004), while weak or inadequate institutions may restrain trade in magnitudes which are not dissimilar to those related to the introduction of tariffs (Anderson and Marcouiller, 2002). Specific institutional dimensions have also been found to affect trade. Low levels of trust, for example, have been associated with lower bilateral trade in the European context (Guiso et al., 2009), whereas both an efficient rule of law and a good endowment of informal institutions can facilitate trade (Yu et al., 2015).

Beyond these general indicators, the association between institutions and trade is still poorly understood. This modest grasp of the role institutions play in bilateral trade is possibly related to problems in both defining and measuring institutions. It has been argued that "defining institutions is notoriously difficult and the current literature on the topic does not agree on a common definition" (Rodríguez-Pose, 2013: 1037). Measuring institutions across different territorial contexts has also proven difficult. In particular, informal institutions – individual habits, values, group routines and social norms – have proven much more difficult to assess and value than formal ones – laws, rules, and organization (Amin, 1999).

The aim of this paper is precisely to shed greater light on the role of different types of institutions on bilateral trade. The paper focuses on two key issues: a) whether local institutional quality affects the volume of trade by any given country and at sectoral level; and b) whether the impact of institutions has been waxing or waning with time. In trying to answer these two questions, the paper improves our understanding of which institutions matter for international trade both from a theoretical and applied perspectives. To provide a theoretical foundation to the gravity equation, we propose a model that considers Anderson and van Wincoop's (2003) multilateral resistance framework within a new trade theory model that includes as determinants of trade a labour competitiveness measure in origin (in terms of productivity and wages) and sectoral income shares at destination, as well as the institutional conditions in the countries of origin and destination. From an applied perspective we compile the most comprehensive and representative database of sectoral trade flows. It contains data on trade on tangible goods (commodities) as well as services, covering 186 countries over the period between 1986 and 2012. We hypothesise that better institutional quality reduces transaction costs and promotes international trade. Institutions will be introduced in two different ways: a) as a barrier at destination, and b) as the difference between the institutional indicators of the exporting and importing countries, which constitutes a measure of institutional distance. Geographical distance, common border, and language are also accounted for, so as to control for additional transport costs and trade barriers.

To achieve these aims, the paper adopts the following structure. The next section presents the theoretical model on which the analysis is based. Section 3 dwells on the data used in the empirical analysis and its sources. The effects of institutional barriers on sectoral countries across the world are estimated in section 4, allowing us to address the questions of whether institutions matter for trade and whether, if that is the case, their influence has been waxing or waning over time. The analysis also unveils disparities across sectors in the relationship between institutional quality and trade patterns. Finally, Section 5 draws relevant conclusions.

2. Model

We estimate the effect of institutional barriers on trade flows between any two economies *i* and *j* relaying on a theoretically founded specification of the gravity equation based on the so-called new trade theory, NTT. The model is characterized by the Dixit-Stiglitz-Krugman assumptions regarding "love-for-variety" preferences, increasing returns to scale technologies and iceberg transport costs. Following Barbero et al. (2015) it allows for multiple countries and multiple differentiated sectors regarding the definition of trade flows (exports and imports), thereby extending the different specifications surveyed by Berhens and Ottaviano (2009). These authors summarize the NTT analytical framework including the effect of transport and non-transport related trade costs for the case of two countries. We extend this model and include our independent variable of interest, institutional quality, as yet another barrier to sectoral trade, and empirically test if it affects trade flows in alternative sectors in different ways.

2.1 Sectoral trade framework

We derive the sectoral gravity equation allowing for a continuum of varieties within multiple sectors and countries.

2.1.1 Consumer preferences and demands

The preferences of a consumer in economy *j* are given by:

$$U_j = \prod_s D_{sj}^{\mu_{sj}}, \tag{1}$$

where D_{sj} is the aggregate consumption of the differentiated good in sector *s* in country *j*; and $0 < \mu_{sj} < 1$ is the income share spent on each sector *s* by consumers in *j*. The aggregate consumption of each differentiated good, D_{sj}, corresponds to the following constant elasticity of substitution (CES) subutility function:

$$D_{sj} = \left[\sum_i \int_{\Omega_{si}} d_{sij}(\omega)^{(\sigma-1)/\sigma}\, d\omega\right]^{\frac{\sigma}{\sigma-1}}, \tag{2}$$

where $d_{sij}(\omega)$ is the individual consumption of sector *s* variety ω produced in *i* and consumed in *j*; and Ω_{si} is the set of varieties of sector *s* produced in *i*. The parameter $\sigma > 1$ measures the elasticity of substitution between any two varieties, as well as the price elasticity of demand. Let $p_{sij}(\omega)$ denote the price of sector *s* variety ω produced in *i* and consumed in *j*; and w_j be the wage rate in region *j*.

Maximizing the utility (1) subject to the budget constraint:

$$\sum_s \sum_i \int_{\Omega_{si}} p_{sij}(\omega) d_{sij}(\omega) d\omega = w_j, \tag{3}$$

yields the following individual demand for each variety (Appendix A.1):

$$d_{sij}(\omega) = \frac{p_{sij}(\omega)^{-\sigma}}{P_{sj}^{1-\sigma}} \mu_{sj} w_j, \tag{4}$$

where P_{sj} is the CES price index in sector *s* and region *j*, defined as:

$$P_{sj} = \left[\sum_i \int_{\Omega_{si}} p_{sij}(\omega)^{1-\sigma} d\omega\right]^{\frac{1}{1-\sigma}}. \tag{5}$$

2.1.2 Firms: technology and trade

Taking labour to be immobile across economies, firms in country *i* and sector *s* produce the same variety of goods and services with increasing returns to scale. Trade in the differentiated products between countries is hampered by transport and non-transport related barriers (trade costs) and is of the standard "iceberg" form, which implies that the cost of each variety from sector *s* and country *i* is multiplied by $\tau_{sij} \geq 1$, resulting in the delivered price at country *j*. The labour requirement for producing the output in sector *s* and country *i* is given by $l_{si} = F_i + c_i \sum_i \tau_{sij} d_{sij}$, where F_i and c_i represent country specific fixed costs and marginal labour requirements, respectively.

A country *i* firm producing in sector *s* maximizes profit:

$$\pi_{si} = \sum_j p_{sij} d_{sij} - \left(F_i + c_i \sum_j \tau_{sij} d_{sij}\right) w_i. \tag{6}$$

Assuming that markets are characterized by monopolistic competition, with free entry and the absence of strategic interactions, first-order conditions under price competition yield the following equilibrium price (Appendix A.2):

$$p_{sij} = \left(\frac{\sigma}{\sigma-1}\right) c_i w_i \tau_{sij}, \tag{7}$$

so there is a constant mark-up $\left(\frac{\sigma}{\sigma-1}\right)$, decreasing in σ.

Therefore, bilateral trade flows are obtained aggregating the value of exports from country *i* to country *j* as follows:

$$x_{sij} = L_j p_{sij} d_{sij} = \left[\left(\frac{\sigma}{\sigma-1}\right) c_i w_i\right]^{1-\sigma} \left(\tau_{sij}\right)^{1-\sigma} \left[\left(P_{sj}{}^{\sigma-1}\right) \mu_{sj} w_j L_j\right], \tag{8}$$

which represents the specific gravity equation for bilateral trade in the proposed analytical framework. The value of sector *s* export flows from *i* to *j* depends inversely on transport costs τ_{sij} and a measure of labour competitiveness jointly represented by the marginal factor requirements and wages of the exporter region: $c_i w_i$, rendering country *i* more competitive as the required labour inputs and salaries decrease, thereby reducing mill prices (and vice versa). Conversely, exports are directly related to the price index P_{sj} of the importing country, its share of income spent in sector *s*, μ_{sj}, as well as its aggregate income $w_j L_j$.

2.2 Econometric specification

From the gravity equation in (8) and taking logs, we obtain the following specification:

$$\ln x_{sij} = (1-\sigma)\ln\left(\frac{\sigma}{\sigma-1}\right) + (1-\sigma)\ln(c_i w_i) + (1-\sigma)\ln\tau_{sij} + (\sigma-1)\ln P_{sj} + \ln(\mu_{sj}) + \ln(w_j L_j) \quad (9)$$

Consequently, considering time period *t*, the functional form to be estimated corresponds to the following econometric specification:

$$\ln x_{sijt} = \beta_0 + \beta_1 \ln(c_{it} w_{it}) + \beta_2 \ln\tau_{sijt} + \beta_3 \ln P_{sjt} + \beta_4 \ln\mu_{sjt} + \beta_5 \ln(w_{jt} L_{jt}) + \delta_{si} + v_{sijt} \quad (10)$$

where $\beta_0 = (1-\sigma)\ln\left(\frac{\sigma}{\sigma-1}\right)$, δ_{si} represents the individual effects in origin, and v_{sijt} is the error term. Equation (10) can be consistently estimated using single equation methods.

Trade barriers τ_{sijt} are further specified to include the institutional factors of interest conditioning trade, and additional variables related to both transport related costs, proxied by physical distance (*dist)* and geographical contiguity (*cont)* to control for border effects, or cultural distance (*lang*, common language). We propose two alternative specifications for the institutional barriers:

$$\ln\tau^{l}_{sijt} = \gamma_k I_{jkt} + \alpha \ln d_{ij} - \varphi cont_{ij} - \rho lang_{ij}, \qquad k = 1\ldots6, \quad (11a)$$

$$\ln\tau^{d}_{sijt} = \gamma_k I_{ijkt} + \alpha \ln d_{ij} - \varphi cont_{ij} - \rho lang_{ij}, \qquad k = 1\ldots6, \quad (11b)$$

whose only difference lies in the definition of the indicators I_{jkt} and I_{ijkt} representing governance in terms of *Control of corruption*, *Government effectiveness*, *Political stability*, *Rule of law*, *Regulatory quality*, and *Voice and accountability*—discussed in the next section. In equation (11a) we consider these indicators in *levels* (*l*) at the destination country *j* to determine to what extent weak institutional quality is capable of holding back import flows. Equation (11b), by contrast, focuses on the *difference* (*d*) in the levels corresponding to the exporting and importing countries: $|I_{ijkt}| = |I_{ikt} - I_{jkt}|$. This represents a measure of institutional distance between *i* and *j* that is defined in absolute value. As for the contiguity and common language variables, these dummies take value one when countries *i* and *j* have a common border or share the same language, respectively.

3. Data and sources

The empirical analysis is performed on a comprehensive data set compiled from several sources. Data on bilateral trade of tangible goods is gathered from the UN Comtrade database, whereas that corresponding to services stems from the UN Service Trade. The data are collected for the periods 1996-2012 and 2000-2012, respectively. This data set is developed by the United Nations Statistics Division (UNSD) and provides bilateral statistics among 186 countries for tangibles and 181 in the case of services. Trade data of tangibles is disaggregated into the primary (agriculture and raw materials) and industry sectors to test for trade differences between them.

Country-specific variables correspond to labour competitiveness, sectoral price indices, sectoral income shares, and Gross Value Added (GVA) in the

importing—destination—country *j*. Data on labour competiveness depending on productivity and wages is proxied by the GVA per worker of the exporting country. The income share represents the participation of sectoral GVA on total GVA. Employment is taken from the World Databank elaborated by The World Bank. GVA in current and 2005 US dollars constant prices by type of economic activity are extracted from UN data.

Geographical distances, adjacency, and common language are idiosyncratic characteristics that are taken into account for each pair of countries, as they may represent relevant enablers/barriers to bilateral trade. Distances between countries, as well as information about contiguity and common official language, are obtained from the GeoDist database elaborated by Mayer and Zignago (2011). We use geodesic distances, calculated by computing the distance between the most populated cities of each country.

We study the role played by institutions in promoting or hindering trade and contend that better institutions promote bilateral trade, often counterbalancing the potentially negative effects associated to existing trade barriers, such as longer distances, lack of contiguity, and cultural differences. Our measure of institutional quality at country level stems from the World Bank's World Governance Indicators (WGI), elaborated by Kaufmann et al. (2010). While not exempt from controversy, the WGI is the most detailed and geographically comprehensive array of institutional indicators currently available. The WGI provides six governance indicators for 215 economies over the period 1996-2013, capturing different aspects of institutional quality at a national level. We discuss the main elements in the composition of these six indicators in turn:

- *Control of corruption* (CC) is a measure of anti-corruption policy; i.e., how a society prevents that public power is used by individuals to obtain private gains. It measures, among other things, the level of irregular payments, the degree of corruption in administrations and companies, and the frequency of corruption in public institutions. It is assumed that corruption increases transaction costs and introduces a component of uncertainty in economic transactions which is likely to hamper bilateral trade.
- *Government effectiveness* (GE) measures the quality and satisfaction of the general public with public services, bureaucracy, infrastructure, as well as the credibility of governments. This measure is a proxy for the ability of a government to deliver efficient and effective policies.
- *Political stability and absence of violence* (PV) is an indicator of politically motivated violence, terrorism, social unrest, armed conflicts. Lower political stability and greater violence are expected to be detrimental to trade.
- *Rule of law* (RL) captures confidence in the judicial system, contract enforcement, property rights, law enforcement against violent and organized crime, and judicial independence. It is a proxy for the overall quality of the legal system.
- *Regulatory quality* (RQ) measures the ability of the government to implement policies to promote private sector development. It considers the capacity to tackle unfair competition practices, the ease of starting a new business, the presence of anti-trust policy, financial freedom and tax effectiveness, as well as the presence or absence of impose price controls, excessive protections,…. It complements the indicators depicting *Control of corruption* and *Rule of law*.
- *Voice and accountability* (VA) captures the extent to which citizens are able to participate in choosing their government representatives, as well as the existence of civil liberties, free press, freedom of speech, freedom of association, and human rights.

Combining all 186 countries for the period 1996-2012, the data set includes a total of 125,703 observations of bilateral trade flows of tangible goods.[1] For bilateral trade in services the sample size is reduced to 23,661 observations for the period 2000-2012. The descriptive statistics for the variables considered in the analysis are presented in Table 1.

Table 1: Descriptive statistics

Variables	***Mean***	***Std. Dev.***	***Min***	***Max***	***Change Rate 1996-2012* (%)**
Trade of tangible goods (in millions USD)	856.508	7,007.278	0.000	353,782.700	1.296
Distance (in km)	6,801.110	4,601.369	59.617	19,812.040	0.041
Labour competitiveness in origin (exporter) (in thousands USD)	29.617	31.179	0.182	234.475	0.566
Sectoral price at destination (importer)	1.116	0.342	0.177	2.885	0.700
Sectoral income share at destination (importer)	0.421	0.153	0.069	0.977	-0.058
Institutional indicators in the importing country, I_{jkt}					
Control of corruption	0.163	1.085	-1.924	2.586	-0.581
Government effectiveness	0.216	1.035	-2.450	2.430	-0.310
Political stability	-0.016	0.961	-3.324	1.938	-3.946
Rule of law	0.123	1.035	-2.669	2.000	-0.346
Regulatory quality	0.211	1.012	-2.675	2.247	-0.361
Voice and accountability	0.039	1.021	-2.284	1.826	-0.990
Institutional distance as the difference in indicators between exp. and imp. countries, I_{ijkt}					
Control of corruption	1.282	0.942	0.000	4.387	-0.104
Government Effectiveness	1.219	0.858	0.000	4.688	-0.062
Political Stability	1.073	0.797	0.000	4.533	-0.026
Rule of Law	1.221	0.856	0.000	4.498	-0.035
Regulatory Quality	1.156	0.829	0.000	4.644	-0.016
Voice and Accountability	1.135	0.820	0.000	3.986	-0.028
Control of Corruption	1.282	0.942	0.000	4.387	-0.104

[1] 1999 and 2001 are not considered in the analysis, as the World Governance Indicators were not collected in those years.

4. Estimating the effect of institutional barriers on sectoral trade in world countries

As in the recent literature examining the impact of institutions on trade (Anderson and Marcouiller, 2002; De Groot et al., 2004; Linders et al., 2005; Yu et al., 2015), we base our analysis on the gravity equation theoretically obtained in section 2. We analyse the extent to which institutional conditions affect bilateral sectoral trade flows, using what we consider to be the most complete database that has been collected for this purpose. A further novelty is the inclusion of a labour competitiveness measure in origin and sectoral income shares at destination as determinants of sectoral trade flows in line with the literature that analyses the implications of income inequality on trade (Rodriguez-Pose, 2012).

4.1 Do institutions matter for trade?

In a first stage we estimate the gravity model (10) for total tangible commodities. All model specifications include year and exporter fixed effects to control for their corresponding specific factors, such as supply and market capacity, as well as to control for trade policy features of exporting countries. The analysis is dually developed in terms of institutional quality levels and differences as presented in equations (11a-b), and controlling for geographical distances, common border and language, as determinants of trade costs. The rationale behind these two measures is that better institutional conditions in the importing country would guarantee legal security and reduce uncertainty, whereas a lower institutional distance between the exporting and the importing country may reduce the risk related to differences and/or lack of familiarity with formal procedures, business practices, norms of behaviour and contract enforcement—e.g., by sanctioning international agreements, De Groot et al., (2004). Traditionally, the majority of bilateral trade has taken place between countries with high levels of institutional quality and, therefore, with small differences in their indicators. We therefore hypothesise that better institutional quality at destination and a lower institutional distance between trading partners lower trade barriers by reducing transactions costs thereby facilitating overall trade. In contrast, large institutional differences between two countries resulting from asymmetric institutional frameworks discourage bilateral trade and prevent its consolidation and growth.

Table 2 presents the estimation results of the analysis for trade in tangible goods according to the gravity equation. As there is a high correlation between the six different institutional indicators we run separate regressions for each one. Results show that labour competitiveness of the exporting country—in origin—resulting from lower factor requirements and wages, as well as the aggregate GVA of the importing country (national income at destination) affect bilateral trade in positive ways. Regarding the GVA at destination it represents market size and contributes to increase economic relations as expected. As for the sectoral price index in the importing country it represents the multilateral resistance term, firstly introduced by Anderson and van Wincoop (2003).[2] It allows taking into account the relative position of countries in terms of competitiveness at the destination country. The negative coefficients of this variable indicate that inflationary trends of import prices reduce bilateral trade.[3,4] These latter results are in line with those observed in the literature analysing trade on the basis of gravity equation models.[5]

[2] Anderson and van Wincoop (2003) extend the original specification presented by Anderson (1979), who provides a theoretical foundation for the gravity models in trade, but also introduces a method to deal with cross price index terms, constituting the multilateral resistance term.

[3] Indeed, the price index (5) is homogenous of degree $(1-\sigma)^2$ in prices; therefore if individual country prices increase proportionally, the aggregate index increases according to that degree.

The model proposed implies that internal demand drives trade flows. This results in a gravity equation including the share of domestic income that is spent in the sector at destination, and whose empirical approximation is sectoral GVA. Its negative sign in the estimations indicates that increasing sectoral production at destination diminishes trade in goods, a result that corroborates the idea that foreign countries export less when domestic production at destination is enough to meet demand.

Finally, besides institutional quality, trade barriers depend on distance, sharing borders, and common language. Geographical distance is used as an approximation of transport (physical) costs, as studied in Limao and Venables (2001), Combes and Lafourcade (2005), and Zofío et al. (2014). Our results confirm that geographical distance influence trade flows. Our distance elasticities are a tad below -1.3, which is higher than the -0.93 and the -0.91 reported by Disdier and Head (2008) and Head and Mayer (2013), respectively, but this may be a result of using a larger sample, including a larger number of countries over a longer time period, than these authors. Contiguity (border) and cultural linkages (common language) effects display very similar positive values, with coefficients around 0.9.[6]

Focusing now on our variables of interest, we find that most institutional indicators display significant coefficients with the expected sign. The exceptions are *Political stability* and *Voice and accountability*. In particular, the strongest connections with bilateral trade volumes are exhibited by *Control of corruption*, *Government effectiveness*, *Rule of law*, and *Regulatory quality*. This is in line with studies signalling that corruption, legal security, and market competition are some of the most serious concerns in economic relations, conditioning economic growth and hampering trade. Such is the case of Yu at el. (2015), who remark the importance of institutional quality, in general, and rule of law, in particular, or Anderson and Marcouiller (2002) and Jansen and Nordas (2004), who stress the role of corruption as a fundamental impediment to trade. Overall, our results strongly suggest that an improvement in institutional quality in importing countries positively affects trade.

[4] Several authors propose different estimation methods when multilateral resistance terms are unobserved (e.g., Rose and van Wincoop, 2001; Redding and Venables, 2004; Feenstra, 2004; Baier and Bergstrand, 2009).
[5] Head and Mayer (2013) offer a chronological overview on the most common and/or efficient methods in the empirical estimation of gravity equations.
[6] Tadesse and White (2010) find that cultural distances contribute to reduce trade based on data for US State level exports to 75 countries. Common language can be considered as a proxy of cultural proximity.

Table 2: The influence of institutions in the importing country on total trade

	Tangible					
Variables	***(1)***	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***
Labour competitiv. in origin (exporter) $(\ln(c_i w_i))$	0.511***	0.511***	0.511***	0.511***	0.510***	0.511***
	(20.36)	(20.36)	(20.37)	(20.36)	(20.34)	(20.37)
Control of corruption (I_{jt1})	0.0438***					
	(7.181)					
Government effectiveness (I_{jt2})		0.0522***				
		(7.378)				
Political stability (I_{jt3})			-0.00321			
			(-0.589)			
Rule of law (I_{jt4})				0.0260***		
				(4.031)		
Regulatory quality (I_{jt5})					0.0490***	
					(7.100)	
Voice and accountability (I_{jt6})						0.00189
						(0.307)
Distance (lnd_{ij})	-1.297***	-1.296***	-1.297***	-1.296***	-1.295***	-1.297***
	(-204.9)	(-204.6)	(-204.8)	(-204.6)	(-204.4)	(-204.8)
Contiguity $(cont_{ij})$	0.953***	0.954***	0.944***	0.951***	0.953***	0.945***
	(36.27)	(36.30)	(35.94)	(36.15)	(36.24)	(35.97)
Common language (len_{ij})	0.989***	0.992***	0.989***	0.991***	0.992***	0.989***
	(72.36)	(72.59)	(72.26)	(72.47)	(72.59)	(72.36)
Sectoral price at destination (importer) (lnP_{sjt})	-0.197***	-0.197***	-0.220***	-0.207***	-0.203***	-0.218***
	(-7.978)	(-8.017)	(-8.947)	(-8.399)	(-8.286)	(-8.859)
Sectoral inc. share at destin. (importer)$(ln\mu_{sjt})$	-0.242***	-0.233***	-0.314***	-0.271***	-0.237***	-0.307***
	(-16.05)	(-14.89)	(-23.65)	(-17.87)	(-15.29)	(-20.26)
GVA at destination (importer) $(\ln(w_{tj}L_{jt}))$	0.797***	0.794***	0.804***	0.800***	0.796***	0.804***
	(339.2)	(311.9)	(372.6)	(338.5)	(326.6)	(363.0)
Constant	-0.731***	-0.657**	-0.963***	-0.833***	-0.704***	-0.951***
	(-2.817)	(-2.517)	(-3.733)	(-3.208)	(-2.707)	(-3.678)
Exporter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	125,703	125,703	125,703	125,703	125,703	125,703
R-squared	0.717	0.717	0.717	0.717	0.717	0.717

t-statistic in parenthesis. *** p<0.01, **p<0.05, *p<0.1

Using standardized coefficients allows us to compare the different dimensions of the estimated parameters directly.[7] The results of this type of analysis indicate that geographical distance is the most important factor determining bilateral trade (eqs. 11a-b). A significant result is that, in comparison with transport costs, the significant and positive coefficients for *Control of corruption*, *Government effectiveness*, *Rule of law*, and *Regulatory quality* play a minor role in trade, to the tune of 3.94%, 4.47%, 2.23% and 4.12% of the effect of geographical distance, respectively. Hence, while institutional factors play a significant role in bilateral trade flows, their magnitude is limited in comparison to that of geographical distance, the most important factor shaping bilateral trade. These results also show that there is no

[7] Results are available upon request.

significant difference in the dimension of the association with trade among the different institutional indicators considered in the analysis. The four relevant institutional factors—*Control of corruption*, *Government effectiveness*, *Rule of law*, and *Regulatory quality*—display roughly the same coefficients, strongest in the case of *Government effectiveness*, and weakest for *Rule of law*. *Voice and accountability* and *Political stability*, by contrast, display insignificant coefficients, meaning that they are disconnected from bilateral trade. The use of standardized coefficients allows us to qualify previous findings as those by De Groot et al. (2004) and Linders et al. (2005)—also using Kaufmann et al.'s (2010) six institutional dimensions—who indicate that institutional quality, regardless of the indicator considered, always mattered for trade, but without exposing its relative importance.

In Table 3 we present the estimation results of looking at the institutional distance between two countries, rather than just at the quality of institutions at destination. All institutional variables are calculated as the absolute value of the *difference* between the indicators of country of destination and that of origin. The results for the control variables are similar to those reported in Table 2. The variables that represent market size, multilateral resistance term, and sectoral income share at destination all show the expected signs and have similar values to those in the previous specification. Once again, bilateral flows are negatively affected by distance, while contiguity and common language are associated with increases in trade.

Table 3: The influence of institutional distance between exporting and importing countries on total trade

	Tangible					
Variables	***(1)***	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***
Labour competitiv. in	0.509***	0.509***	0.502***	0.501***	0.505***	0.513***
origin (exporter) $(\ln(c_i w_i))$	(20.29)	(20.29)	(20.02)	(20.02)	(20.16)	(20.49)
Control of corruption	-0.0836***					
(I_{jt1})	(-15.16)					
Government effectiveness		-0.0890***				
(I_{jt2})		(-15.00)				
Political stability			-0.0802***			
(I_{jt3})			(-13.25)			
Rule of law				-0.117***		
(I_{jt4})				(-20.06)		
Regulatory quality					-0.133***	
(I_{jt5})					(-22.06)	
Voice and accountability						-0.115***
(I_{jt6})						(-19.09)
Distance	-1.288***	-1.284***	-1.292***	-1.281***	-1.279***	-1.284***
(lnd_{ij})	(-202.5)	(-201.2)	(-203.8)	(-201.1)	(-200.7)	(-201.8)
Contiguity	0.920***	0.922***	0.930***	0.915***	0.917***	0.919***
$(cont_{ij})$	(35.00)	(35.07)	(35.40)	(34.85)	(34.95)	(34.99)
Common language	0.983***	0.981***	0.988***	0.980***	0.983***	0.966***
(len_{ij})	(71.95)	(71.76)	(72.38)	(71.75)	(72.06)	(70.56)
Sectoral price at destination	-0.227***	-0.230***	-0.222***	-0.236***	-0.233***	-0.229***
(importer) (lnP_{sjt})	(-9.289)	(-9.421)	(-9.066)	(-9.653)	(-9.525)	(-9.356)
Sectoral inc. share at destin.	-0.314***	-0.298***	-0.297***	-0.298***	-0.285***	-0.274***
(importer)$(ln\mu_{sjt})$	(-26.84)	(-25.48)	(-25.33)	(-25.48)	(-24.34)	(-23.13)
GVA at destination	0.807***	0.804***	0.804***	0.806***	0.803***	0.807***
(importer) $(\ln(w_{tj}L_{jt}))$	(373.4)	(373.3)	(373.4)	(374.2)	(373.2)	(374.1)
Constant	-0.944***	-0.862***	-0.734***	-0.812***	-0.777***	-0.979***
	(-3.666)	(-3.347)	(-2.845)	(-3.153)	(-3.020)	(-3.803)
Exporter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	125,703	125,703	125,703	125,703	125,703	125,703
R-squared	0.718	0.718	0.718	0.718	0.718	0.718

T-statistic in parenthesis. *** p<0.01, **p<0.05, *p<0.1

The institutional distance in all six governance indicators are statistically significant and negative. These results suggest that institutional distance between the exporter and importer represent, as expected, an important impairment for trade, irrespective of the institutional conditions at destination. Countries with similar levels of institutional quality (and with better overall institutions) tend, everything else being equal, to trade more. Lower institutional distance and a greater familiarity with the institutional environment at destination reduces transaction costs. Institutional distance remains, however, a minor player in comparison to geographical distance when it comes to bilateral trade. Comparing standardized coefficients, the relative impact (weight) of the different indicators of institutional distance with respect to geographical distance ranges between 5.30% for *Rule of*

law, and 9.27%, in the case of *Regulatory quality*. Again these results regarding the relative importance of institutional distance complement recent results by Yu et al. (2015).

4.2 Evolution of the impact of geographical distance and institutional barriers on trade

The second research question in this study refers to whether the role of institutional quality for trade has been increasing over time. We address it by studying the stability of the coefficients associated to both geographical and institutional distance by means of interacting the institutional indicators with time dummies. This way we can compute the marginal effects of the institutional variables for every year. This type of analysis can be then transformed into annual figures, facilitating the visual inspection of the association between each variable and trade over time.

Figure 1: Evolution of the impact of geographical distance

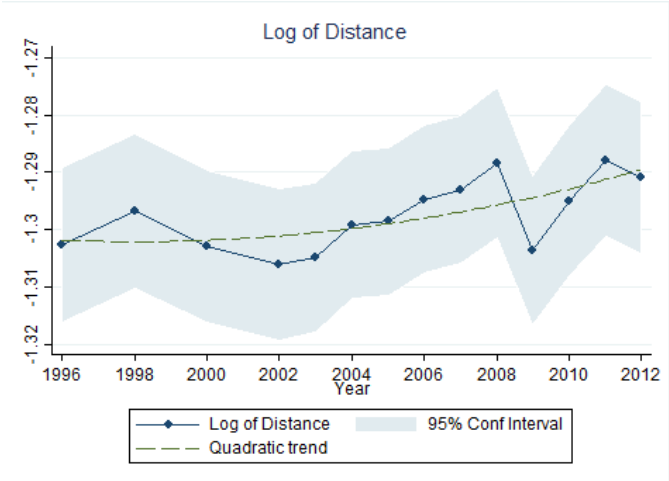


Figure 1 shows the evolution of the coefficients estimating the association of geographical distance with bilateral trade. The persistence of the negative impact of distance on trade, as generally established in the literature for the last half the 20th century, is confirmed by the negligible decline in this coefficient in the first decade of the 21st century; e.g., the above mentioned meta-analysis by Disdier and Head (2008). The explanations for this continuing and undiminishing effect of geographical distance can be found in the composition of trade in a large number of countries that appears to be biased toward industries where distance still heavily determines the propensity to trade. It may also be the case, as hypothesized by Duranton and Storper (2008), that greater trade in sophisticated goods with higher transaction costs may offset the effects of the decline in transport costs.

Figure 2 presents the evolution of the coefficients of institutional quality in the importing country, whereas Figure 3 displays the annual variation of the institutional distance between origin and destination in absolute values. Given increasing globalisation and overall rising trade levels, a rising connection between institutional quality and bilateral trade over time would be expected. However, for virtually all the indicators of institutional quality at destination, a downward sloping trend is observed throughout the period. In spite of some upsurges in the dimension of the coefficients in the last years, the overall trajectory indicates a lower relevance of institutional factors in the importing country until the early 2010s, relative to the late 1990s s and early 2000s. This may be simply a factor of the commodity boom of the 2000s, with raw materials badly needed for industrial production often found in countries with weaker institutions—as confirmed in the following section. The end of the boom is then associated with the revival of the role of institutions observed in the early 2000s. It also seems to reflect the rapid rise of new players in trade presenting

relatively lower institutional indicators, such as China, with importing countries adopting a realpolitik attitude based on practical considerations and respecting countries' internal affairs. Finally, it captures the overall decline in institutional quality as presented in the change rates of the governance indicators (Table 1); particularly in regions of the world that were relatively open to trade in previous years and whose trade flows did not wane.

As for the different institutional indicators representing institutional distances, rather than the quality of institutions at destination, there is a consistent behaviour among them as shown in Figure 3. Here more/less intense negative associations imply increasing/declining differences and hence higher/lower barriers to trade in terms of our regression results. Accordingly, institutional distances between countries increase their negative effects as trade barriers. These trends are particularly marked for *Control of corruption*, *Political stability*, and *Regulatory quality*, with reductions in their parameter estimates to the tune of 100% when taking as reference a quadratic tendency. Contrarily, *Government Effectiveness*, *Rule of law* and *Voice and accountability* do not exhibit noticeable changes with practically the same values for the initial and last years. In the case of *Voice and accountability*, a moderately flat U-shaped is observed (using an inverted scale on the *y*-axis) with the downward trend reverting since 2004.

Figure 2: Evolution of the impact of institutions in the importing country.

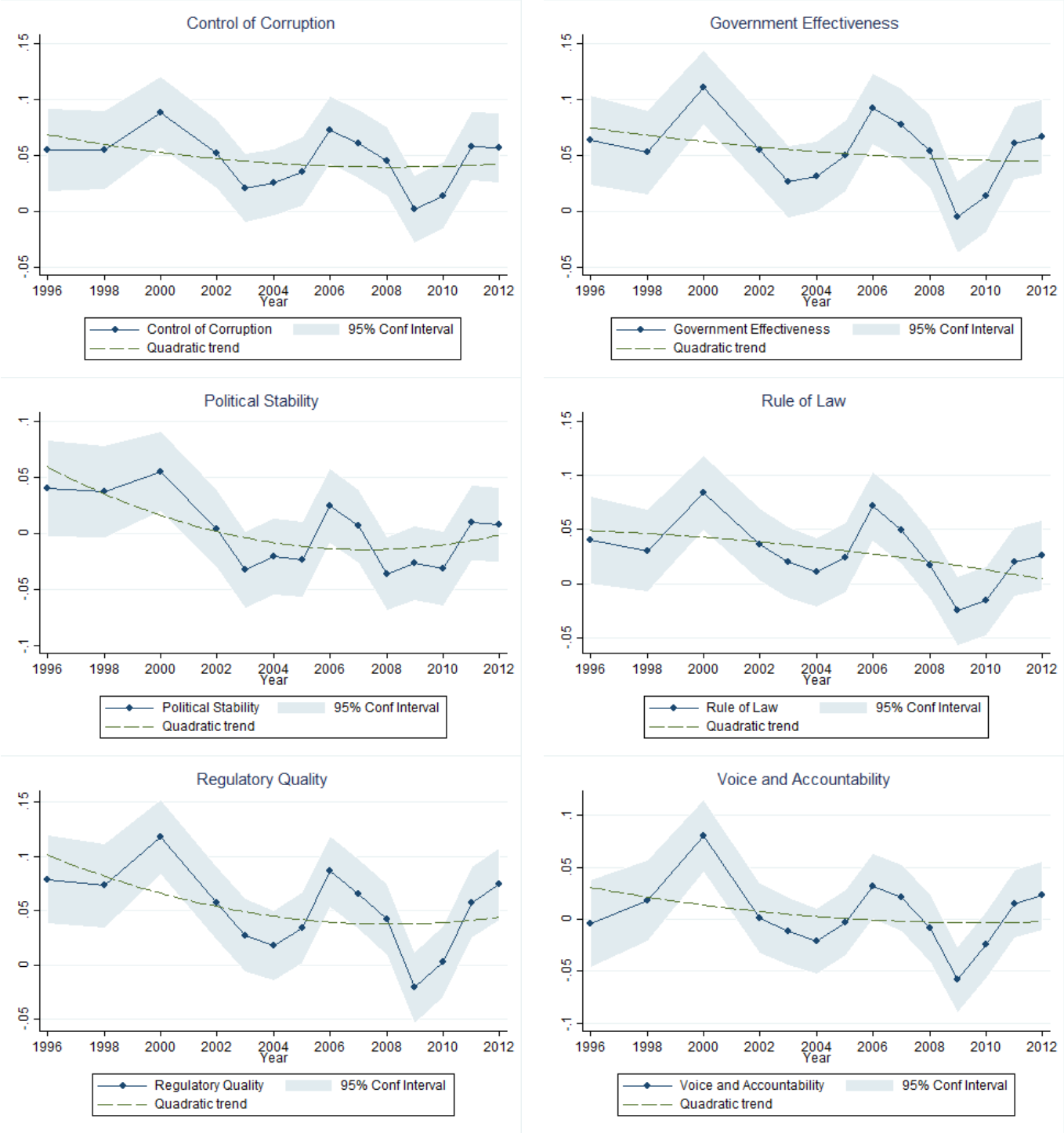
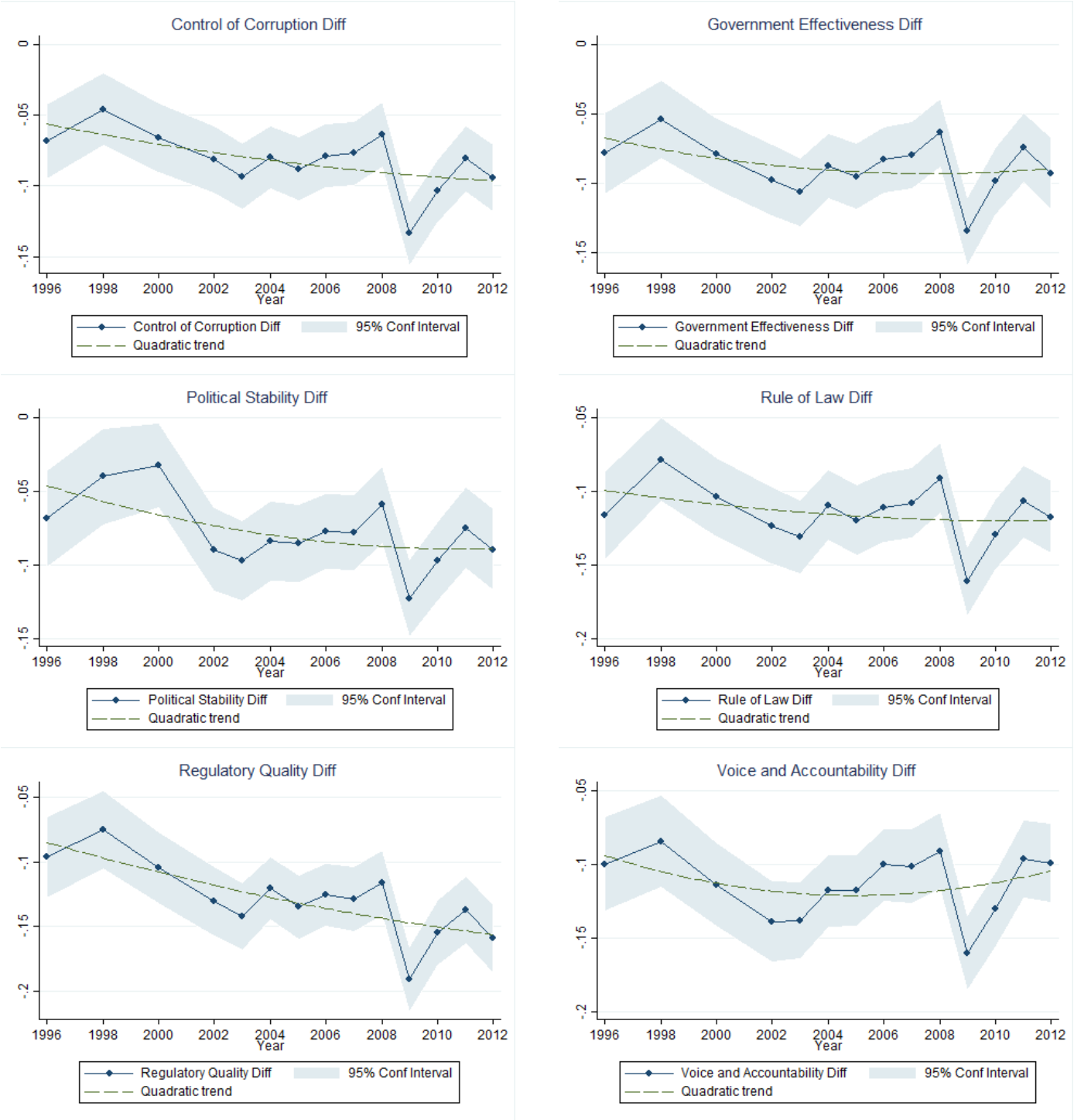


Figure 3: Evolution of the impact of institutional distance indicators between exporting and importing countries



4.3 What sector is most sensitive to institutions?

In order to assess the robustness of previous results, we further perform a series of equivalent regressions for trade flows in different economic sectors, and compare the obtained results to those obtained in section 4.1. We first analyse the connection between institutions and trade by sectors, with the aim of assessing whether differences exist depending on the nature of the products—goods or services—being traded. Tables 4 and 5

report the results estimating the gravity equation (10) for trade in the primary sector (agriculture and natural resources), industry, and services, including trade barriers with institutional quality indicators in the importing country and institutional distances between exporters and importers, (11a-b) respectively. As the different variables in the gravity equation present the expected signs when statistically significant, we only report the coefficients and *t*-student significance statistics for the institutional quality variables. Columns (1) and (3) offer the estimated coefficients for tangible goods separated into the primary sector and industry, as well their difference with respect to the previously estimated coefficients for the aggregate trade in tangibles already reported in Tables 2 and 3, which are subtracted from the new estimates—columns (2) and (4). In addition, we report the relationship between institutions and flows of services in column (5), also in terms of institutions at destination and institutional distances. Finally, in the last column (6), we also present the difference with the coefficients of total trade—tangibles and services, restricted to those countries in the sample where services trade data are available.[8]

Table 4 shows that the influence of institutional quality at destination on trade in agricultural goods and natural resources greatly differs from that of industry, columns (1) and (3). Institutions quality lead to improvements in trade to a much lower extent for agriculture and natural resources than for industry. Whereas better institutional quality in the importing country facilitates bilateral trade in industrial products, greater *Political stability*, *Regulatory quality*, and *Voice and accountability* have been associated with lover volumes of trade when it comes to agricultural produce and natural resources. Indeed, the relationship with primary sector production is only positive and significant for *Control of corruption* and *Rule of law*. This may simply be, as convincingly argued by Méon and Sekkat (2008), a consequence of the characteristics of natural resources—bulkier to transport, often requiring no transformation at the point of origin. It may also reflect how the greater price volatility of these products affects trade patterns. However, our contention is that this is an indication of how the resource boom has affected the role of institutional factors for trade since the early 2000s. In light of the increasing need to use natural resources and raw materials to feed industrial production as a result of rising demand, bilateral trade involving countries with weaker institutional quality has blossomed in this sector, as the Chinese case previously remarked. This is, however, not the case for the industry sector, where a better quality of government is a fundamental factor facilitating trade.

Restricted data availability for trade in services reduces the sample for this sector to 23,661 observations in the period 2000-2012. Results show that institutional quality is a fundamental factor for bilateral trade, column (5). The standardized value of the coefficient in the case of services is now about half in magnitude to that reported for geographical distance—50%, implying that for services having a good institutional setting at destination is an essential element for fostering trade and overcome the negative effect of distance. This is a remarkable result given that the effect of institutional indicators for trade in tangibles—less than 10%—was rather small when compared to distance.

[8] Results of these regressions, including 23.661 observations, are available upon request.

Table 4: The influence of institutions in the importing country on trade by sectors

Variables	*Primary sector*		*Industry*		*Services*	
	Value (1)	Difference (2)	Value (3)	Difference (4)	Value (5)	Difference (6)
Control of corruption	0.0284***	-0.0154*	0.0881***	0.0443***	0.413***	0.171***
(I_{jt1})	(3.133)		(15.48)		(36.74)	
Government effectiveness	0.0085	-0.0438***	0.0881***	0.0359***	0.525***	0.212***
(I_{jt2})	(0.838)		(15.48)		(39.17)	
Political stability	-0.0587***	-0.0619***	0.0785***	0.0753***	0.347***	0.117***
(I_{jt3})	(-6.782)		(14.20)		(31.80)	
Rule of law	0.0371***	0.0111	0.0827***	0.0274***	0.452***	0.181***
(I_{jt4})	(3.928)		(13.93)		(36.66)	
Regulatory quality	-0.0181*	-0.0671***	0.114***	0.065***	0.515***	0.193***
(I_{jt5})	(-1.829)		(18.36)		(38.65)	
Voice and accountability	-0.0498***	-0.0480***	0.0655***	0.0636***	0.414***	0.19***
(I_{jt6})	(-6.564)		(11.08)		(32.08)	

Note: The difference columns for the Primary Sector and Industry is the difference with respect to the estimated coefficient for Tangibles in Tables 2 and 3. The difference column for Services is the difference with respect the estimated coefficient of an estimation of Total trade (Primary Sector + Industry + Services) restricted to the sample where service trade data is available (only 23,661 observations).
T-statistic in parenthesis. *** p<0.01, **p<0.05, *p<0.1

The analysis of the link between institutional quality and trade for different sectors considering institutional distances yields similar results, Table 5. As before, a negative value in the columns (1), (3) and (5) indicates that greater institutional differences between the exporting and importing countries reduce bilateral trade. Institutional differences between origin and destination not only present a higher negative effect in the industry sector than in the primary sector, but also in comparison with the aggregate of tangible goods, columns (2) and (4). Again, the magnitude of the negative coefficients is in general the greatest for trade in services, especially in the cases of large differences in *Political Stability*, *Regulatory Quality*, and *Voice and accountability*. Hence, greater institutional distances between countries affect trade in industrial goods and in services to a greater extent than trade in natural resources and agricultural produce.

Table 5: The influence of institutional distance between exporting and importing countries on trade by sectors

Variables	*Primary sector*		*Industry*		*Services*	
	Value (1)	Difference (2)	Value (3)	Difference (4)	Value (5)	Difference (6)
Control of corruption	-0.0232***	-0.0604***	-0.105***	0.0214***	-0.0587***	-0.1383***
(I_{jt1})	(-2.832)		(-16.52)		(-4.776)	
Government effectiveness	0.0103	-0.0993***	-0.127***	0.0380***	-0.170***	-0.1230***
(I_{jt2})	(1.170)		(-18.61)		(-11.96)	
Political stability	-0.0267***	-0.0535***	-0.131***	0.0508***	-0.296***	0.0460***
(I_{jt3})	(-2.976)		(-18.91)		(-24.01)	
Rule of law	-0.0190**	-0.0980***	-0.159***	0.0420***	-0.187***	-0.0970***
(I_{jt4})	(-2.197)		(-23.86)		(-14.32)	
Regulatory quality	-0.0324***	-0.1006***	-0.171***	0.038***	-0.274***	-0.0520***
(I_{jt5})	(-3.624)		(-24.72)		(-19.27)	
Voice and accountability	-0.131***	0.0160***	-0.132***	0.0170***	-0.287***	0.0310**
(I_{jt6})	(-14.81)		(-19.34)		(-21.35)	

T-statistic in parenthesis. *** p<0.01, **p<0.05, *p<0.1

5. Conclusions

This paper explores the extent to which institutional quality affects bilateral trade across the majority of countries in the world and whether the role of institutions for trade has been waxing or waning over the last two decades. Based on the extension of the canonical new trade theory model to multiple countries and sectors by Barbero et al. (2015), we derive a novel—sector specific—gravity equation that allows us to consider trade barriers in light of the institutional conditions in levels for the importing country, as well as the institutional difference—distance—between the countries engaged in bilateral trade. In particular, we have been able to assess the role of institutions for trade, controlling for geographical distance, labour cost competitiveness in origin (involving productivity and wages), trade costs, sectoral prices, and incomes shares at destination. All controls display the expected signs and significance.

The results of the analysis confirm the hypothesis that the quality of institutions—both in levels and in differences—matter for trade. With few exceptions, mostly centred on *Political stability* and *Voice and accountability*, all institutional variables considered in the analysis are closely connected to trade trends. The better the institutional quality in the importing country and the lower the institutional distance, the greater the bilateral trade. However, our results also show that the influence of institutional quality on bilateral trade is still a fraction of the capacity of other factors to affect exchanges between countries, especially geographical distance. This is particularly the case for trade in agricultural produce and natural resources—primary sector—where institutional quality plays a relatively minor role, if at all, on trade patterns. By contrast, institutions matter much more for trade in manufactured goods and can be considered as one of the most important factors for trade in services, given their intangible, complex, and interactive nature. The analysis also puts in evidence that, contrary to our expectations, the effect of institutional quality on trade has tended to wane rather than to wax with time.

The commodity boom both in trade and prices of the 2000s, goes a long way in explaining these patterns, IMF (2008). When industry and consumers require commodities and energy sources, institutional conditions do not seem to be a hindrance for trade. Trade is established regardless of the quality of institutions and governance at the origin and destination. Institutional distance is also a minor impediment in this respect. This is however not the case for trade in manufacturing goods and, particularly, in services. In these two sectors institutional quality and institutional distance considerably affect with whom one trades. The end of the commodity boom may thus very well signal a new rise in the relationship between trade and institutional quality, not just in services and manufacturing, but also in the primary sector. This is particularly relevant for developing economies whose chances to succeed in integrating into the global economy will require better quality institutions and policies, as compared with geographic location or factor endowments.

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Appendix A.1: derivation of the demand function

The minimization of the cost of attaining a certain amount of goods D_{sj} is an optimization problem:

$$\min \sum_i \int_{\Omega_{si}} p_{sij}(\omega) d_{sij}(\omega) d\omega$$

$$s.t. \left[\sum_i \int_{\Omega_{si}} d_{sij}(\omega)^{(\sigma-1)/\sigma} \, d\omega \right]^{\frac{\sigma}{\sigma-1}} = D_{sj}$$

With Lagrangean:

$$L = \sum_i \int_{\Omega_{si}} p_{sij}(\omega) d_{sij}(\omega) d\omega + \lambda \left(\left[\sum_i \int_{\Omega_{si}} d_{sij}(\omega)^{(\sigma-1)/\sigma} \, d\omega \right]^{\frac{\sigma}{\sigma-1}} - D_{sj} \right)$$

Differentiating with respect to varieties ω and m:

$$\frac{\partial L}{\partial d_{sij}(\omega)} = p_{sij}(\omega) + \lambda \frac{\sigma}{\sigma-1} \left[\sum_i \int_{\Omega_{si}} d_{sij}(\omega)^{(\sigma-1)/\sigma} \, d\omega \right]^{\frac{\sigma}{\sigma-1}-1} \frac{\sigma-1}{\sigma} d_{sij}(\omega)^{(\sigma-1)/\sigma-1}$$

$$\frac{\partial L}{\partial d_{sij}(m)} = p_{sij}(m) + \lambda \frac{\sigma}{\sigma-1} \left[\sum_i \int_{\Omega_{si}} d_{sij}(m)^{(\sigma-1)/\sigma} \, dm \right]^{\frac{\sigma}{\sigma-1}-1} \frac{\sigma-1}{\sigma} d_{sij}(m)^{(\sigma-1)/\sigma-1}$$

Dividing:

$$\frac{d_{sij}(\omega)^{-1/\sigma}}{d_{sij}(m)^{-1/\sigma}} = \frac{p_{sij}(\omega)}{p_{sij}(m)}$$

Solving for variety ω:

$$d_{sij}(\omega)^{-1/\sigma} = \frac{p_{sij}(\omega)}{p_{sij}(m)} d_{sij}(m)^{-1/\sigma}$$

$$d_{sij}(\omega) = \left(\frac{p_{sij}(\omega)}{p_{sij}(m)} \right)^{-\sigma} d_{sij}(m)$$

Substituting $d_{sij(\omega)}$into the constraint:

$$\left[\sum_i \int_{\Omega_{si}} d_{sij}(\omega)^{(\sigma-1)/\sigma} \, d\omega \right]^{\frac{\sigma}{\sigma-1}} = D_{sj}$$

$$\left[\sum_i \int_{\Omega_{si}} \left(\left(\frac{p_{sij}(\omega)}{p_{sij}(m)} \right)^{-\sigma} d_{sij}(m) \right)^{(\sigma-1)/\sigma} d\omega \right]^{\frac{\sigma}{\sigma-1}} = D_{sj}$$

Solving for $d_{sij}(m)$, we obtain the demand for variety *m*:

$$\left(p_{sij}(m)\right)^{-\frac{1}{\sigma}} d_{sij}(m)\left[\sum_i \int_{\Omega_{si}} p_{sij}(\omega)^{1-\sigma} d\,\omega\right]^{\frac{\sigma}{\sigma-1}} = D_{sj}$$

$$d_{sij}(m) = \frac{\left(p_{sij}(m)\right)^{-\sigma}}{\left[\sum_i \int_{\Omega_{si}} p_{sij}(\omega)^{1-\sigma} d\,\omega\right]^{\frac{\sigma}{\sigma-1}}} D_{sj}$$

Operating in the denominator:

$$d_{sij}(m) = \frac{\left(p_{sij}(m)\right)^{-\sigma}}{\left[\sum_i \int_{\Omega_{si}} p_{sij}(\omega)^{1-\sigma} d\,\omega\right]^{\frac{-\sigma}{1-\sigma}}} D_{sj}$$

We get the individual demand for variety *m*:

$$d_{sij}(m) = \frac{p_{sij}(m)^{-\sigma}}{P_{sj}^{-\sigma}} D_{sj}$$

Where P_{sj} is the CES price index in sector *s* and region *j*, defined as:

$$P_{sj} = \left[\sum_i \int_{\Omega_{si}} p_{sij}(\omega)^{1-\sigma} d\omega\right]^{\frac{1}{1-\sigma}}$$

The upper problem utility maximization is:

$$\max U_j = \prod_s D_{sj}^{\mu_{sj}}$$

$$s.t. \sum_s P_{sj} D_{sj} = w_j$$

The Lagrangean is:

$$L = \prod_s D_{sj}^{\mu_{sj}} + \lambda\left(\sum_s P_{sj} D_{sj} - w_j\right)$$

Differentiating with respect to sectors *s* and *v*:

$$\frac{\partial L}{\partial D_{sj}} = \mu_{sj} D_{sj}^{\mu_{sj}-1} \prod_s D_{sj}^{\mu_{sj}} + \lambda P_{sj}$$

$$\frac{\partial L}{\partial D_{vj}} = \mu_{vj} D_{vj}^{\mu_{vj}-1} \prod_s D_{sj}^{\mu_{sj}} + \lambda P_{vj}$$

Dividing both:

$$\frac{\mu_{sj} D_{sj}^{-1}}{\mu_{vj} D_{vj}^{-1}} = \frac{P_{sj}}{P_{vj}}$$

Solving for $P_{sj}D_{sj}$:

$$P_{sj}D_{sj} = \frac{\mu_{sj}}{\mu_{vj}} D_{vj}P_{vj}$$

Inserting $P_{sj}D_{sj}$ into the constraint:

$$\sum_{s} \frac{\mu_{sj}}{\mu_{vj}} D_{vj}P_{vj} = w_j$$

Solving for D_{vj}:

$$D_{vj} = \sum_{s} \frac{\mu_{vj}}{\mu_{sj}} \frac{w_j}{P_{vj}}$$

Inserting D_{vj} in the budget constraint and solving for D_{sj}:

$$P_{sj}D_{sj} + \sum_{v \neq s} P_{vj}D_{vj} = w_j$$

$$P_{sj}D_{sj} + \sum_{v \neq s} P_{vj} \sum_{s} \frac{\mu_{vj}}{\mu_{sj}} \frac{w_j}{P_{vj}} = w_j$$

$$P_{sj}D_{sj} + \sum_{v \neq s} \sum_{s} \frac{\mu_{vj}}{\mu_{sj}} w_j = w_j$$

Since $\sum_s \mu s_j = 1$

$$P_{sj}D_{sj} + \sum_{v \neq s} \mu_{vj} w_j = w_j$$

Since $\sum_{v \neq s} \mu_{vj} = 1 - \mu_{sj}$

$$P_{sj}D_{sj} + (1 - \mu_{sj}) w_j = w_j$$

$$P_{sj}D_{sj} = w_j - (1 - \mu_{sj}) w_j$$

$$D_{sj} = \frac{\mu_{sj}}{P_{sj}} w_j$$

Inserting this last expression for D_{sj} in the demand for variety ω becomes: (back to the last equation before the Upper maximization problem but changing *m* for ω)

$$d_{sij}(\omega) = \frac{p_{sij}(\omega)^{-\sigma}}{P_{sj}^{-\sigma}} D_{sj}$$

$$d_{sij}(\omega) = \frac{p_{sij}(\omega)^{-\sigma}}{P_{sj}^{-\sigma}} \frac{\mu_{sj}}{P_{sj}} w_j$$

$$d_{sij}(\omega) = \frac{p_{sij}(\omega)^{-\sigma}}{P_{sj}^{1-\sigma}} \mu_{sj} w_j$$

Appendix A.2: equilibrium price index

A firm in sector *s* maximizes profit

$$\pi_{si} = \sum_j p_{sij} d_{sij} - \left(F + c_i \sum_j \tau_{sij} d_{sij} \right) w_i$$

Inserting $d_{sij}(\omega)$

$$\pi_{si} = \sum_j p_{sij} \frac{p_{sij}(\omega)^{-\sigma}}{P_{sj}^{1-\sigma}} \mu_{sj} w_j - \left(F + c_i \sum_j \tau_{sij} \frac{p_{sij}(\omega)^{-\sigma}}{P_{sj}^{1-\sigma}} \mu_{sj} w_j \right) w_i$$

$$\pi_{si} = \sum_j \left(p_{sij} - c_i \tau_{sij} w_i \right) \frac{p_{sij}(\omega)^{-\sigma}}{P_{sj}^{1-\sigma}} \mu_{sj} w_j - F w_i$$

Maximizing w.r.t all prices p_{sij}, and taking the price indices and the wages as given:

$$\max \pi_{si} = \sum_j \left(p_{sij} - c_i \tau_{sij} w_i \right) \frac{p_{sij}(\omega)^{-\sigma}}{P_{sj}^{1-\sigma}} \mu_{sj} w_j - F w_i$$

$$\frac{\partial \pi_{si}}{\partial p_{sij}} = \frac{{p_{sij}}^{-\sigma}}{P_{sj}^{1-\sigma}} \mu_{sj} w_j - \sigma \left(p_{sij} - c_i \tau_{sij} w_i \right) \frac{{p_{sij}}^{-\sigma-1}}{P_{sj}^{1-\sigma}} \mu_{sj} w_j = 0$$

$$\frac{{p_{sij}}^{-\sigma}}{P_{sj}^{1-\sigma}} \mu_{sj} w_j = \sigma \left(p_{sij} - c_i \tau_{sij} w_i \right) \frac{{p_{sij}}^{-\sigma-1}}{P_{sj}^{1-\sigma}} \mu_{sj} w_j$$

$${p_{sij}}^{-\sigma} = \sigma \left(p_{sij} - c_i \tau_{sij} w_i \right) {p_{sij}}^{-\sigma-1}$$

$${p_{sij}}^{-\sigma} = \sigma p_{sij}(\omega)^{-\sigma} - \sigma c_i \tau_{sij} w_i {p_{sij}}^{-\sigma-1}$$

$$1 = \sigma - \sigma c_i \tau_{sij} w_i {p_{sij}}^{-1}$$

$$1 - \sigma = -\sigma c_i \tau_{sij} w_i {p_{sij}}^{-1}$$

$$p_{sij} = -\frac{\sigma}{1-\sigma} c_i \tau_{sij} w_i$$

And we get the pricing rule:

$$p_{sij} = \frac{\sigma}{\sigma - 1} c_i w_i \tau_{sij}$$

Appendix A.3: gravity equation of bilateral trade

The value of the bilateral trade is given by: (We don't multiply by τ_{sij} since we don't compute the extra units needed due to the iceberg cost)

$$x_{sij} = L_j p_{sij} d_{sij}$$

Inserting d_{sij}:

$$x_{sij} = L_j p_{sij} \frac{{p_{sij}}^{-\sigma}}{P_{sj}^{1-\sigma}} \mu_{sj} w_j$$

$$x_{sij} = L_j \frac{{p_{sij}}^{1-\sigma}}{P_{sj}^{1-\sigma}} \mu_{sj} w_j$$

$$x_{sij} = L_j {p_{sij}}^{1-\sigma} P_{sj}^{\sigma-1} \mu_{sj} w_j$$

Inserting the price rule p_{sij}:

$$x_{sij} = L_j \left(\frac{\sigma}{\sigma - 1} c_i w_i \tau_{sij}\right)^{1-\sigma} P_{sj}^{\sigma-1} \mu_{sj} w_j$$

We arrive at the gravity equation of bilateral trade:

$$x_{sij} = L_j p_{sij} d_{sij} = \left[\left(\frac{\sigma}{\sigma - 1}\right) c_i w_i\right]^{(1-\sigma)} \left(\tau_{sij}\right)^{1-\sigma} \left[\left({P_{sj}}^{\sigma-1}\right) \mu_{sj} w_j L_j\right]$$