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The limits to integration before and after the great financial crisis

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Abstract

This paper examines the impact of different trade-enhancing factors on international trade before and after the financial crisis. Using a sample of 399,225 annual bilateral trade flows over the period 1988-2015, we test if cultural, institutional and geographical factors stimulate bilateral trade by applying a gravity equation model. The great financial crisis reinforced geographical factors and weakened institutional ones. Overall, cultural factors had a positive effect on trade overcompensating the smaller benefit of RTAs and common currencies. It suggests a potential efficient substitution effect between culture and institutions that is largely dominated by the larger negative impact of geographical factors.

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1 Introduction

The recent recurrence of nationalist sentiment has exacerbated trade tensions and renewed the interest in international trade.[1] Despite a long period of globalization, geographical distance has remained one of the most weighty impediments to trade. The attempts to minimise transportation costs to create even costless data transfers, did not solve the problem of distance and the "end of geography" is not coming soon (Brei and von Peter 2018). Nevertheless, these attempts have extended the core trade models to test cultural differences (such as language, religion, political conflicts) or/and their influence on different financial institutions across the globe (see also Rauch 1999, Melitz 2008 and Brei and von Peter 2018).

This paper compares geographical, cultural, and institutional factors to determine their impact on trade before and after the 2008-2009 financial crisis. Our main hypothesis is that nationalism reduces the impact of institutional factors increasing the importance of geographical and cultural factors. As Poisson-family estimators do not converge, we use ordinary least squares, fixed effects, and random effects (OLS, FE, and RE respectively henceforth). Results corroborate our hypothesis suggesting a substitution effect between institutional and cultural trade-enhancing factors.

The paper is structured as follows. Section 2 presents the methodological approach, derive estimable equations and formalize expectations. Section 3 is devoted to data and descriptive statistics. In Section 4 we present the main results and conclude in the last section.

2 Empirical Specification

We employ a gravity equation model to estimate the impact of different trade-enhancing factors on international trade. The original form of gravity equation models bilateral trade flows *X* from origin country *i* to destination country *j* as follows:

$$X_{ij} = G\frac{Y_i Y_j}{DIST_{ij}} \tag{1}$$

where *G* is a gravitational constant, $Y_i Y_j$ is the product of origin and destination country GDP, and $DIST_{ij}$ is the geodetic distance. This model is very closely related to Newton's law of universal gravitation but, in economic terms, this translates that economically larger and neighbouring countries trade more than distant and small ones. Ravenstein employed this model informally since 1885, but a first formal usage is recorded only in the last six decades with an increasing popularity in recent years (Ahmad and Hall 2017). Considerable advances are made on finding determinant factors other than distance (see also Anderson and van Wincoop 2004, and Fratianni 2009). For instance, recently Li et al. (2017) reconfirm the significance of (physical) geography, language and colonisation history as enhancing factor for trade. Also, Shulgin et al. (2017) propose a unique approach to test cultural differences by identifying differences in values of individuals (i.e. " neighbours in values"). Aggarwal et al. (2012) find a hitherto unreported separated positive effect of cultural differences on foreign portfolio investment that offsets the negative impact of geographical factors. It is also common to apply GE models to test the impact of different Regional Trade Agreements (RTAs henceforth) (Fratianni and Oh 2009). The outcome is often mixed: some partnership stimulates the trade while others show no significant impact (Kahouli and Omri 2017).

Our empirical specification is similar to Fratianni and Marchionne (2011, 2012) who focus on three trade-enhancing vectors, i.e. cultural affinities (*CULT*), institutions (*INST*) and (physical) geography (*GEO* and *DIST*). Our testable gravity equation is as follows:

[1] Brexit and the resurgence of US protectionism (e.g. threat to leave the WTO, increase in the tariffs) could dent global growth and potentially harm the living standards (Guardian, 2017).

$$lnX_{ijt} = \alpha_0 + \alpha_1 lnY_{it} + \alpha_2 lnY_{jt} + \beta lnDIST_{ij} \quad \text{(CORE)}$$

$$+\gamma_1 LANGUAGE_{ij} + \gamma_2 COLONY_{ij} + \gamma_3 RELIGION_{ij} \quad \text{(CULT)}$$

$$+\delta_1 BORDER_{ij} + \delta_2 MONEY_{ijt} + \delta_3 RTA_{ijt} \quad \text{(INST)}$$

$$+\theta_1 LANDLOCK_{ij} + \theta_2 LATITUDE_{ij} + \theta_3 LONGITUDE_{ij} + \theta_t + \mu_{ij} + \varepsilon_{ijt} \quad \text{(GEO)}$$

Greek letters indicate parameters. Reported subscripts *i*, *j*, and *t* (i.e. exporter, importer and time) specify the dimensions of variability for each variable (e.g. distance $DIST_{ij}$ does not change over time) whereas θ_t, μ_{ij}, and ε_{ijt} indicate respectively year dummies, country pair dummies and idiosyncratic error term. According to the gravity equation literature, we expect a positive effect of country incomes on trade flows, i.e. $\alpha_1 > 0$ and $\alpha_2 > 0$, and a negative impact of bilateral distance, i.e. $\beta < 0$. Three variables capture cultural effects: *LANGUAGE*, *COLONY* and *RELIGION*. *LANGUAGE* and *COLONY* are equal to one if the partner countries share respectively the same official language and a common previous colonizer. *RELIGION* is an index calculated by adding the products of the shares of Catholics, Protestants and Muslims in the exporting and importing countries. We expect positive γ coefficients. Similarly, institutional factors consist of three dummies: *BORDER*, *MONEY* and *RTA*. If countries are adjacent, share a common currency or are member of the same regional trade agreement, than the corresponding dummy aquires a value of unity; otherwise it is zero. Again, we expect positive δ coefficients.

Finally, geographical effects are modelled through *DISTANCE* and additional variables *LANDLOCK*, *LATITUDE* and *LONGITUDE*. *LANDLOCK* is a dummy equal to one if at least one of the country partners is land-locked, zero otherwise. It recognises the importance of maritime trade and captures the difficulties of countries without access to the sea. The expected sign of the coefficient is negative. *LATITUDE* and *LONGITUDE* are the absolute difference in latitude and longitude respectively between the main city of county *i* and country *j*. *LATITUDE* captures the differences in climatic zones (i.e. temperature and precipitation) and landscape configurations (i.e. mountains, plains, seas, etc.). By definition, *LONGITUDE* is affected only by the latter. Their difference implicitly identifies the effect of climatic "endowment" whereas *LONGITUDE* is a proxy for the natural resources of the country. We expect that differently climate-endowed and/or resource-endowed countries trade more. Note that the difference is a relative measure and the starting point of *LONGITUDE* and *LATITUDE* is irrelevant.

Table I: Summary of testable hypotheses

	Description	H_0	H_a
H1.1	Income	$\alpha = 0$	$\alpha > 0$
H1.2	Distance	$\beta = 0$	$\beta < 0$
H2.1	Culture	$\gamma_1, \gamma_2, \gamma_3 = 0$	$\gamma_1, \gamma_2, \gamma_3 > 0$
H2.2	Institutions	$\delta_1, \delta_2, \delta_3 = 0$	$\delta_1, \delta_2, \delta_3 > 0$
H2.3	Geography	$\theta_1, \theta_2, \theta_3 = 0$	$\theta_1 < 0; \theta_2, \theta_3 > 0$
H3.1	Culture	$(\gamma_1, \gamma_2, \gamma_3)^{pre} = (\gamma_1, \gamma_2, \gamma_3)^{post}$	$(\gamma_1, \gamma_2, \gamma_3)^{pre} < (\gamma_1, \gamma_2, \gamma_3)^{post}$
H3.2	Institutions	$(\delta_1, \delta_2, \delta_3)^{pre} = (\delta_1, \delta_2, \delta_3)^{post}$	$(\delta_1, \delta_2, \delta_3)^{pre} > (\delta_1, \delta_2, \delta_3)^{post}$
H3.3	Geography	$(\theta_1, \theta_2, \theta_3)^{pre} = (\theta_1, \theta_2, \theta_3)^{post}$	${\theta_1}^{pre} > {\theta_1}^{post}$; $(\theta_2, \theta_3)^{pre} < (\theta_2, \theta_3)^{post}$

Table I summarises our testable hypotheses and the expected signs of coefficients. First, we validate the gravity equation model (H1). Then, we test the three categories of trade-enhancing factors: culture (H2.1), institutions (H2.2) and geography (H2.3). Finally, we assume that the national sentiment has resurrected since the great financial crisis and we compare trade-influencing factors before and after 2008. We expect that institutional factors weaken with the increase of nationalism (H3.2) and by contrast, cultural and geographical factors become more important (H3.1 and H3.3).

3 Data and Descriptive Statistics

Our dataset is an unbalanced panel with 399,225 annual observations covering 226 importing countries and 231 exporting countries over the period 1988 to 2015. Zero bilateral trade flows are not included.[2] Country-level bilateral exports in U.S. dollars come from the United Nations International Trade Statistics Database. The other data come from CEPII.

Table II: Descriptive statistics

PERIOD	**Whole: 1988-2015 (399,225 obs.)**		**Pre-Crisis: 1988-2008 (226,163 obs.)**		**Post-Crisis: 2009-2015 (133,062 obs.)**	
Variable	**Mean** ***St.Dev.***	**Min** ***Max***	**Mean** ***St.Dev.***	**Min** ***Max***	**Mean** ***St.Dev.***	**Min** ***Max***
X_{ijt}	561	0[(a)]	443	0[(a)]	799	0[(a)]
	5,355	*409,979*	*4,195*	*353,783*	*7,123*	*409,979*
Y_{it}	496,473	15	424,159	15	641,123	127
	1,532,492	*18,036,648*	*1,310,728*	*14,718,600*	*1,891,666*	*18,036,648*
Y_{jt}	381,222	9	309,899	9	523,889	27
	1,382,560	*18,036,648*	*1,161,670*	*14,718,600*	*1,733,527*	*18,036,648*
$DISTANCE_{ij}$	7156	60	7155	60	7157	60
	4435	*19811*	*4458*	*19811*	*4388*	*19811*
$LANGUAGE_{ij}$	0.156	0	0.157	0	0.153	0
	0.362	*1*	*0.364*	*1*	*0.36*	*1*
$COLONY_{ij}$	0.0897	0	0.0874	0	0.0942	0
	0.286	*1*	*0.282*	*1*	*0.292*	*1*
$RELIGION_{ij}$	0.175	0	0.177	0	0.171	0
	0.253	*0.994*	*0.254*	*0.994*	*0.25*	*0.994*
$BORDER_{ij}$	0.0247	0	0.0252	0	0.0238	0
	0.155	*1*	*0.157*	*1*	*0.152*	*1*
$MONEY_{ijt}$	0.0169	0	0.0145	0	0.0218	0
	0.129	*1*	*0.119*	*1*	*0.146*	*1*
RTA_{ijt}	0.143	0	0.115	0	0.199	0
	0.35	*1*	*0.319*	*1*	*0.399*	*1*
$LANDLOCK_{ij}$	0.283	0	0.273	0	0.304	0
	0.451	*1*	*0.445*	*1*	*0.46*	*1*
$LATITIDE_{ij}$	29.2	0	29.2	0	29.1	0
	21.8	*108*	*21.9*	*108*	*21.6*	*108*
LONMDij	64.5	0	64.9	0	63.8	0
	54.8	*354*	*55.3*	*354*	*53.9*	*354*

Note: (a) = 0.000001. For each variable, the first and second number of each column report respectively the value for the first and second (in *Italic*) statistics indicated in the column title.

[2] Zero trade flows are mainly from very small or problematic countries for which we have incomplete data. Consequently, these records would be automatically dropped in any case from the sample due to missing values in some determinant variables. This selection bias prevents us from a deeper analysis of zero trade flows.

We estimate the gravity equation model over the period 1988-2015, the pre-crisis period 1988-2008, and the post-crisis period 2009-2015. Table II presents descriptive statistics. The pre-crisis period is more than three times longer than the post-crisis period. The overall average amount of bilateral exports is 561 million dollars, with a range spanning from one thousand to 410 billion dollars. Exporter countries have higher GDP than importer ones revealing an important role of manufacturing in international trade. The poorest country, Benin, has a GDP close to 9 million dollars whereas the GDP of the richest country, the US, is 18 trillion dollars. The distance between partner countries ranges from 60 to 19,811 km.

The average amount of bilateral exports is 356 million dollars higher after the crisis than before it, but it is also associated with higher volatility. The average GDP is twice bigger in post-crisis period for both importing countries (from 424 to 641 billion dollars) and exporting countries (from 310 to 524 billion dollars). Cultural affinities among trade partners are relatively frequent: 15.6 percent speak the same language, 8 percent had a colonial relationship in the past, and 17.5 percent share the same religion. The colonial relationship is the only cultural factor that has strengthened after 2008.

Institutional factors are also important: over the whole period, 2.5 percent of country pairs share a land border, 1.7 percent use a common money, and 14.3 percent are members of the same RTA. Statistics by sub-periods show a 50% increase in the number of country pairs sharing the same money and the same RTA after 2008. It is mainly due to EU countries adopting euro later, i.e. Slovakia (2009), Estonia (2011), Latvia (2014) and Lithuania (2015). Trade among the same RTA has increased by 8.5 percent.

Moving to geographical factors, the average distance between trade partners is 7,156 km, i.e. more than the distance between London and Washington (5,897 km) or New Delhi (6,711 km), but less than the distance between London and Beijing (8,142 km) or Los Angeles (8,755.19 km). The average longitude difference (64.5 degrees) is more than twice the average latitude difference (29.2 degrees), and 71.7% of trade flows is between countries with access to oceans suggesting a big impediment to trade for land-locked countries. However, also trade between land-locked countries increased after 2008.

4 Main Empirical Findings

Table III presents our main results. Poisson-family estimators such as Poisson or Pseudo-Poisson Maximum Likelihood estimators do not converge even when we weaken or relax convergence criteria.[3] Consequently, we run the base gravity equation model with cultural, institutional and geographical affinities by sub-samples using OLS with cluster correction to reduce potential pair serial correlation, and country-pair FE and RE with robust standard errors to correct for potential heteroscedasticity. It could arise from multilateral resistance, i.e. the barriers which each country faces in its trade with all its trading partners. Exports, incomes and distance are expressed in logarithms. As zero trade flows are not included, the transformation does not reduce (and affect) our sample.

As expected for a gravity equation model, R-squared is high: independent variables explain 73 percent of the bilateral trade. However, this figure is much lower under FE. Incomes and distance have the expected signs confirming H1 and H2. The overall F-test and specific F-tests for multilateral resistance (i.e. both exporter and importer country dummies) are statistically significant under all models and reject the null hypothesis.

[3] This issue is well known in the empirical GE literature in particular after controlling for multilateral resistance. Note that Poisson-family estimators do not have theoretical foundations (see Santo Silva and Tenreyro 2006).

Table III: Empirical Results

Period	Whole	Whole	Whole	Pre-Crisis	Pre-Crisis	Pre-Crisis	Post-Crisis	Post-Crisis	Post-Crisis
Estimator	OLS+CL	FE+Cluster	RE+Cluster	OLS+CL	FE+Cluster	RE+Cluster	OLS+CL	FE+Cluster	RE+Cluster
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
lnY_{it}	0.578***	0.633***	0.630***	0.479***	0.494***	0.493***	0.225**	0.243***	0.244***
lnY_{jt}	0.580***	0.663***	0.656***	0.508***	0.591***	0.582***	0.446***	0.523***	0.514***
$lnDISTANCE_{ij}$	-1.720***		-1.760***	-1.671***		-1.734***	-1.816***		-1.855***
$RELIGION_{ij}$	0.482***		0.533***	0.512***		0.557***	0.442***		0.502***
$LANGUAGE_{ij}$	0.706***		0.742***	0.687***		0.694***	0.758***		0.801***
$COLONY_{ij}$	0.752***		0.686***	0.729***		0.695***	0.782***		0.794***
$BORDER_{ij}$	0.553***		0.888***	0.555***		0.832***	0.544***		0.722***
$MONEY_{ijt}$	0.0957	-0.0169	0.0154	0.239*	-0.0579*	0.0252	-0.126**	0.198***	0.0918
RTA_{ijt}	0.470***	0.0919***	0.135***	0.519***	0.178***	0.243***	0.406***	0.0864***	0.231***
$LANDLOCK_{ij}$	-0.813***		-0.763***	-0.791***		-0.743***	-.0872***		-0.908***
$LATITUDE_{ij}$	0.00592***		0.00112	0.00632***		0.00270***	0.00523***		0.00222*
$LONGITUDE_{ij}$	0.00146***		0.00196***	0.00130***		0.00199***	0.00168***		0.00142**
Constant	-1.664**	-17.16***	-3.489***	4.857		-11.02***	16.56***	-5.984***	8.171***
Observations	399,225	399,225	399,225	266,163	266,163	266,163	133,062	133,062	133,062
Number of country pairs		16,640	16,640		15,701	15,701		15,041	15,041
R-square	0.736	0.505	0.731	0.74	0.499	0.734	0.744	0.486	0.742
F Test Statistics	215.3	145	126,275	1124	110.6	$2.10*10^6$	100.4	46.21	85,432
Prob F Test > F	0	0	0	0	0	0	0	0	0
Mult. Resistance (D_i=D_j=0)	215.3	35.52	16522	1124	31.18	13,870	100.4	30.99	14,454
Prob Mult. Resistance > F	0	0	0	0	0	0	0	0	0
LR Test Statistics	131,550	56,282	64,603	81,421	40,341	46,578	(b)	26,302	30,239
Prob LR Test > chi2	0	0	0	0	0	0	(b)	0	0
BPLM Test Statistics	-	-	699,903	-	-	(a)	-	-	101,655
Prob BPLM Test > chi2	-	-	0	-	-	(a)	-	-	0
Hausman Test Statistics	-	-	6,389	-	-	1,050	-	-	13,871
Prob Hausman Test > chi2	-	-	0	-	-	0	-	-	0

NOTES: Clustered standard error under OLS, robust standard errors under FE and RE. Hausman test does not fully meet the assumptions although we forced the test to produce a result using robust standard errors. LR test under RE is based on a maximum likelihood estimator. (a) BPLM test does not work (probably due to one cluster with only one observation). (b) LR test does not work. ***p<0.01, **p<0.05, *p<0.10, #p<0.15

The OLS estimate over the whole period (column 1) corroborates H2.1, H2.2. and H2.3 in line with the previous literature. Both culture and institutions promote bilateral trade. In particular, we find a larger impact of cultural factors than institutional ones except for the *BORDER* coefficient (0.553) larger than the *RELIGION* coefficient (0.482). Among institutional factors, being a member of an RTA (0.470) has a slightly smaller impact than sharing the same religion whereas *MONEY* is not significant. Geographical factors are all very significant and economically relevant. The distance elasticity is 1.72, being land-locked almost offsets all the institutional factors together, and there is more trade between differently climate-endowed countries (0.00592) than resource-endowed ones (0.00146). But the economic relevance of the endowments is relatively small.

The FE estimator produces results consistent with the OLS estimate (column 2). LR test rejects the null hypothesis of no country pair effects and supports FE against OLS. However, we cannot estimate the effects of time-invariant drivers of trade flows under FE due to the collinearity with country pairs (Kabir et al. 2017). As R-squared reduces significantly and our analysis includes many time-invariant variables, we apply RE estimator. Our choice ignores the result of the Hausman test (1978) in favour to FE estimator because the test fails to meet its statistical assumptions, and we rely on the BPLM test (1980) that rejects the null hypothesis of zero country pair variance. The BPLM test supports indirectly country pair RE. The RE estimate of column 3 corroborates the OLS estimate of column 1 with two exceptions: *BORDER* coefficient is 60% larger, and RTA coefficient is 29% smaller.

After the financial crisis, the impact of incomes on trade lowers whereas distance elasticity increases from 1.734 to 1.855 (cfr. columns 6 and 8). This is in line with H3.3 and unveils a deglobalization process at work: the negative effect of a physical distance on bilateral exports raised around 13 percent after the crisis. Climatic differences create more trade than differences in natural resources (*LONGITUDE* coefficients are positive and smaller than *LATITUDE* coefficients).[4] But their impact is similar before and after the crisis. Differently, landlocked countries trade significantly less after the financial crisis, thus further corroborating H3.3.

The crisis increased the positive effect of cultural factors on trade except for religion: when uncertainty increases, trade partners rely on whom they understand and know better because they speak the same language and have common roots. On the contrary, institutional factors weaken after 2008. *BORDER* and RTA coefficients reduce whereas *MONEY* coefficient becomes unstable through estimators. These results support both H3.2 and H3.2.

In sum, countries reacted to the great financial crisis shrinking globalization into regionalization and implicitly relying on RTAs and currency areas. But the crisis undermined also these international institutions reducing their ability to promote trade after 2008. In this process, landlocked countries were much more penalized than other countries. It shows clearly that when a crisis weakens institutional factors, geographical impediments to trade become much more important whereas cultural factors overcompensate the smaller benefit of institutions. Hence, paradoxically, the substitution effect between institutional and cultural factors is efficient even if it is dominated by trade reduction due to geographical factors.

5 Conclusion

This paper examines the impact of different factors on international trade before and after the financial crisis. We estimate a gravity equation model with 12 different trade-enhancing factors grouped into cultural, institutional, and geographical factors. Cultural affinities had a larger impact on trade after the financial crisis whereas institutional similarities are only

[4] Cultural variables capture historical patterns. However, geography could have contributed to shape culture.

having a minor change or becoming unstable through sub-periods. Geography is the strongest limit to integration with distance being the biggest impediment to trade and land-locked countries trading considerably less than other countries in particular after the crisis. Once distance is taken into account, climate differences create more trade than the difference in natural resources endowment. This is in line with the recent literature on North-South trade.

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