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Distance, Globalization, and International Trade

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Abstract

For a long time globalization could be seen everywhere but in gravity estimates. We offer evidence how globalization affects manufacturing trade over the period 1986-2006 and show that, on average, the effect of distance has fallen whereas the effects of proximity and regional trade agreements have increased over time. We also document substantial cross-country heterogeneity in the extent to which distance elasticities have changed. Countries in the middle of the per-capita income distribution have seen the steepest fall in distance coefficients. At the same time, distance as a trade friction has not lost its bite for a number of low income countries, which may jeopardize their integration into global markets. We present suggestive evidence that the heterogeneous change in distance elasticities is related to secular shifts in the composition of exports.

JEL-Codes: F130, F140, F160.

Keywords: distance puzzle, missing globalization, structural gravity, poor countries.

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Highlights

- We offer solutions to the 'distance puzzle' and the 'missing globalization puzzle' in trade.
- On average, the effect of distance on trade fell by 10% between 1986 and 2006.
- The effects of globalization on trade vary widely across the 69 nations in our sample.
- The relationship between the gains from globalization and income is U-shaped.
- Globalization benefitted middle income countries the most.

1 Introduction and Motivation

Economists are in agreement that physical distance is the most robust proxy for international trade costs, cf. Anderson and van Wincoop (2004) and Head and Mayer (2014), and there is hardly any empirical trade model that does not obtain economically strong and statistically significant negative estimates of the effects of distance on bilateral trade. Yet, there has been a long debate—which is still ongoing—about the fact that the estimates of the effects of distance in empirical gravity equations fail to capture the effects of globalization and remain constant over time. The latter has been dubbed the 'Distance Puzzle' in international trade.[1] Coe et al. (2002) generalize this result to define the 'Missing Globalization Puzzle' as "the failure of declining trade-related costs to be reflected in estimates of the standard gravity model of bilateral trade" (p.1). Many economic studies have attempted to resolve the 'distance puzzle' with mixed success.[2]

The contribution of this paper is threefold. First, we extend the methods of Yotov (2012) to more comprehensively account for intra-national trade costs, and we offer robust evidence that on average the effect of distance on international trade has indeed fallen over time. Second, we demonstrate that our methods apply more broadly to capture the impact of globalization through changes in the effects of other standard gravity variables such as contiguity and regional trade agreements (RTAs). Thus, we contribute to the so-called 'missing globalization puzzle'. Finally, we allow for estimates of the effects of distance on trade to vary at the individual country level. In so doing, we obtain the novel finding that the effects of globalization have been uneven, favoring middle income countries the most and seemingly bypassing some of the poorest nations in our sample.

Relying on the properties of the structural gravity model, Yotov (2012) argues that the 'distance puzzle' is resolved when the effects of distance on international trade are measured relative to the effects of distance on *intra-national* trade.[3] A potential drawback of Yotov's analysis is that he uses distance as the only proxy for intra-national trade costs. We overcome this issue by employing a rich

[1] Disdier and Head (2008) perform meta-analysis with a rich data set of 1,467 distance estimates to conclude that "the estimated negative impact of distance on trade rose around the middle of the century and has remained persistently high since then. This result holds even after controlling for many important differences in samples and methods" (p.37).

[2] The distance puzzle has been of significant interest to researchers. See Buch et al. (2004), Carrère and Schiff (2005), Brun et al. (2005), Boulhol and de Serres (2010), Lin and Sim (2012), Yotov (2012) Carrère et al. (2013) and Larch et al. (2016).

[3] Yotov (2012) recognizes that since the structural gravity system is homogeneous of degree zero, it can only identify relative trade costs. Thus, studies that use only international trade data cannot resolve the distance puzzle because the effects of globalization on some international pairs are estimated relative to the effects of globalization on other international pairs. Yotov's simple solution to the 'distance puzzle' is to measure the effects of distance on international pairs relative to the effects of distance on internal trade.

set of country-specific fixed effects for internal trade, which not only allow for and absorb the country-specific effects of intra-national distance but also account for any other determinants of intra-national trade including 'home bias' effects. Employing a sample covering aggregate manufacturing trade for 69 countries over the period 1986-2006, we resolve the 'distance puzzle' and find that the effect of distance on trade has fallen, on average, by nearly 10% (-9.34%) during the period of investigation.[4]

While distance is arguably the most robust proxy for international trade costs, it is quite possible that the effects of globalization may travel through other channels as well. For example, new manufactured products (never exported before) may first be exported to adjacent countries. Similarly, global value chains may first be established regionally, thereby reinforcing trade with neighboring countries. This intuition suggests that the effects of globalization should also be reflected in increasing estimates of the effects of contiguous borders in gravity estimations. Turning to trade policy, over the past quarter century the world has witnessed a proliferation of regional trade agreements, which have become deeper and more comprehensive in nature. Accordingly, one would expect to obtain an increasing estimate of the effect of RTAs in gravity estimations.

Motivated by these intuitive hypotheses, we allow for time-varying effects of all gravity variables in our main specifications. Two findings stand out. First, consistent with the 'missing globalization puzzle' argument of Coe et al. (2002), we obtain (positive but) *decreasing* estimates of the effects of both contiguity and RTAs in our baseline specification that only employs international trade flows. However, these results are reversed, i.e. estimates on contiguity and RTAs are *increasing* over time in line with our expectations, once the effects of contiguity and RTAs are measured relative to intra-national trade flows.

We capitalize on our methods to allow for heterogeneous effects of globalization on trade across the countries in our sample. Our main findings characterize the cross-country heterogeneity with which globalization has affected countries' international trade. First, countries in the middle of the global per-capita income distribution have benefitted the most from globalization, whereas economies at either end of the income distribution have not benefitted from globalization to the same extent. Second, there are also interesting differences within groups. Within high income countries, distance elasticities of OECD members have fallen twice as much as those of other high-income non-OECD

[4]An important feature and an advantage of our data set is that it includes data on international and intra-national trade flows that are consistent with each other. This is ensured by employing *gross* production value data in order to construct intra-national trade as the difference between production and total exports. Availability of *gross* production value data predetermined our focus on aggregate manufacturing and the time coverage of our sample.

economies. This is consistent with trends such as production fragmentation, from which the oil-exporting economies, albeit rich, are more insulated than OECD economies. At the opposite end, there is substantial heterogeneity amongst low income countries too. Whilst China—formally a low income country—is recording the largest fall in distance elasticity in the entire sample, globalization has largely bypassed the poorest economies such as Malawi, Niger, Senegal or Nepal. Overall, the finding that on average globalization has had a positive effect on the countries in our sample is encouraging. At the same time, this average effect hides substantial cross-country heterogeneity; in particular, the finding that geographic distance as a trade friction has not lost its bite for a number of low income countries, thereby jeopardizing their international integration, may be a cause for concern.

We also present preliminary evidence of the forces that could potentially be at the heart of the observed differential response of countries at different income levels. Specifically, we find a significant negative relationship at the country level between the fall in distance elasticity and (i) the ratio of air-to-rail transportation as a proxy for the shift towards higher value-to-weight goods in a country's export bundle; (ii) the structure of merchandise exports; (iii) the value of high-tech/ICT goods in export bundles; and (iv) inward investment flows. These findings provide strong suggestive evidence that the changes in estimated distance gravity coefficients that we obtain are indeed reflecting economic globalization effects.

2 Theoretical Background and Empirical Strategy

The effects of bilateral distance on international trade are traditionally estimated with the empirical gravity equation, which has established itself as the workhorse framework in international trade. Deriving structural gravity is beyond the scope of this paper.[5] For our purposes it is sufficient to summarize the gravity equation of trade in its most general form:

$$X_{ij,t} = G_t \frac{\pi_{i,t}\chi_{j,t}}{T_{ij,t}}, \quad \forall i, j. \tag{1}$$

Here $X_{ij,t}$ denotes exports from source i to destination j at time t; $T_{ij,t}$ denotes all bilateral frictions between i and j, which may include transportation costs, trade policies, etc.; $\pi_{i,t}$ and $\chi_{j,t}$ capture all possible exporter and importer characteristics, respectively, e.g. country size and multilateral resistance terms of Anderson and van Wincoop (2003); Finally, G_t is a gravity constant whose structural interpretation is as a function of the value of output in the world at each time t.

[5] We refer the reader to Anderson (2011), Costinot and Rodríguez-Clare (2014), and Larch and Yotov (2016) for recent surveys of the theoretical gravity literature.

Three simple steps translate equation (1) into an estimating specification: (i) use standard gravity variables, including the logarithm of bilateral distance ($\ln DIST_{ij}$) and indicators for contiguous borders ($CNTG_{ij}$), common language ($LANG_{ij}$), colonial ties ($CLNY_{ij}$), and regional trade agreements (RTA_{ij}) to proxy for bilateral trade costs;[6] (ii) add an error term; and (iii) estimate gravity with the Poisson Pseudo-Maximum-Likelihood (PPML) estimator:[7]

$$X_{ij,t} = \exp[\beta_1 \ln DIST_{ij} + \beta_2 CNTG_{ij} + \beta_3 LANG_{ij} + \beta_4 CLNY_{ij} + \beta_5 RTA_{ij} + \pi_{i,t} + \chi_{j,t}] + \epsilon_{ij,t}, \qquad (2)$$

Following the recommendations of Brun et al. (2005) and Piermartini and Yotov (2016) we will estimate equation (2) with panel data, using exporter-time and importer-time fixed effects in order to control for any possible characteristics on the exporter and importer side that may influence bilateral trade.[8] The panel approach will enable us to trace the evolution of estimated effects of distance and any other gravity variables of interest within the same econometric specification.

3 Data

Our sample covers aggregate manufacturing for 69 countries over the period 1986-2006.[9] The dimensions of the data set were predetermined by the availability of intra-national trade flows, which are crucial for the analysis in this study.[10] Following the standard procedure to recover domestic sales as apparent consumption, intra-national trade flows for each country are constructed as the difference between total production and total exports. Importantly, in order to ensure consistency between international trade flows and intra-national trade flows, *gross* production values are used to construct intra-national trade. This predetermined the time coverage of the sample and our focus on aggregate manufacturing, for which we have access to production data in *gross* values. Three sources are used to construct the gross-value production data: the United Nations UNIDO INDSTAT database, the CEPII TradeProd database, and the World Bank Trade Production and Protection database.

[6] Anderson and van Wincoop (2004) offer a thorough survey of trade costs and their relation to gravity.

[7] Santos Silva and Tenreyro (2006) advocate the use of PPML because it successfully accounts for heteroskedasticity in trade data. An additional advantage is that PPML estimates gravity in multiplicative form. This enables researchers to take advantage of the information contained in the zero trade flows, which is thrown away with OLS. Our results are robust to employing the OLS estimator instead.

[8] Piermartini and Yotov (2016) discuss the main challenges with the estimation of structural gravity models and make best practice recommendations for gravity estimations. We also refer the reader to Head and Mayer (2014) and Baldwin and Taglioni (2006) for excellent surveys and insightful discussions related to gravity estimations. Yotov et al. (2016) provide estimation codes and data for a series of gravity specifications.

[9] The countries in our sample are listed in Table 2.

[10] The data on intra-national trade was constructed by Thomas Zylkin and come from Baier et al. (2016).

The main source for international trade data, which are used to obtain total exports that are needed for the construction of internal trade as well as bilateral exports, is the United Nations COMTRADE database. The CEPII TradeProd data set is used to fill some missing observations from COMTRADE. All standard gravity variables including distance, contiguous borders, common language, and colonial ties are from the CEPII Distances database. An important advantage of the CEPII database is that the same population weighted-average methods are used to construct consistent measures of intra-national and international distance, cf. Mayer and Zignago (2006).

Finally, information on the correlates of economic globalization, used below in Figure 2, are taken from the World Development Indicators. The respective data series are (i) the ratio of air freight transport to railways goods transports, both in million ton-km (top left panel); (ii) exports of manufactures as a share of merchandise exports (top right); (iii) the value of high-technology exports in current USD (bottom left); and (iv) net inflows of foreign direct investment as a share of GDP (bottom right).

4 A Simple Solution to the 'Missing Globalization Puzzle'

Recognizing that the structural gravity model of trade can only ever identify relative trade costs, Yotov (2012) demonstrates that the 'distance puzzle' is resolved when the effects of distance on international trade are estimated relative to the effects of distance on internal trade. Yotov's idea is straightforwardly implemented by adding intra-national flows to the sample of international trade flows. A potential drawback of the approach taken in Yotov (2012) is that he only considers intra-national distance to proxy for all possible internal trade costs. Furthermore, Yotov does not allow for the effects of other standard gravity variables—which may also capture globalization effects—to vary over time.

In this paper we improve on Yotov's methods in two ways. First, we employ country-specific dummies for intra-national trade, thereby offering a more flexible and comprehensive treatment of intra-national trade costs. The idea is that these fixed effects will absorb not only internal distance but also any other country-specific characteristics, including 'home bias', that may affect intra-national trade. Second, in addition to studying the evolution of the effects of distance over time, we also allow for time-varying effects of all other gravity variables that are commonly used in the literature. The idea behind this adjustment is that it will enable us to see a more comprehensive picture of potential globalization effects.

Our departing point is a standard gravity estimating equation, based on (2), which allows for time-varying effects of the gravity variables and is estimated on international trade data only:

$$X_{ij,t} = \exp\left[\sum_{T=1986}^{2006} \beta_1^T \ln DIST\_T_{ij} + \sum_{T=1986}^{2006} \beta_2^T CNTG\_T_{ij} + \sum_{T=1986}^{2006} \beta_3^T LANG\_T_{ij}\right] \times \exp\left[\sum_{T=1986}^{2006} \beta_4^T CLNY\_T_{ij} + \sum_{T=1986}^{2006} \beta_5^T RTA\_T_{ij,t} + \pi_{i,t} + \chi_{j,t}\right] + \epsilon_{ij,t}, \qquad \forall i \neq j \tag{3}$$

The 'distance puzzle' will be present in our estimates so long as the estimates of the effects of distance in each year, $\hat{\beta}_1^T$, were to increase in absolute value or to remain constant over time. In addition, we can trace the evolution of estimates of other gravity variables from specification (3) to test more broadly for the presence of globalization effects.[11] For expositional simplicity, we will focus on three time intervals within our panel, though our findings are robust to using more frequent intervals.[12]

Estimates from column (1) of Table 1 establish the presence of the 'distance puzzle' and the 'missing globalization puzzle' in our sample. Specifically, a comparison between the estimates of the coefficients on ln_DIST_1986 and ln_DIST_2006 reveals that the negative impact of distance on international trade increased by about 11 percent during the period of investigation. This result is consistent with the meta analysis estimates of Disdier and Head (2008) on the 'distance puzzle.' In addition, we also find that the estimated effects of contiguous borders, common language, and regional trade agreements have all fallen significantly over time, despite expectations to the contrary as globalization and deeper integration should have resulted in larger estimates of the effects on these covariates.[13] These results are consistent with the definition of the 'missing globalization puzzle' as "the failure of declining trade-related costs to be reflected in estimates of the standard gravity model of bilateral trade" (p.1, Coe et al. (2002)).

By contrast, the coefficients in column (2) of Table 1 are obtained by estimating the effects of

[11] It is important to emphasize that many of the effects of globalization are country-specific. For example, Anderson and Yotov (2010) demonstrate that specialization forces play an important role in shaping globalization patterns in the world through the general equilibrium multilateral resistance indexes. We believe that this channel is important and we control for such forces with the exporter-time and importer-time fixed effects in our specification. Accordingly, the objective of the current paper is to demonstrate that there are additional, partial equilibrium globalization forces, which the gravity literature struggled to account for.

[12] As discussed in the data section, our data cover the period 1986-2006. In the main analysis, we will follow the evolution of estimates on the gravity variables in 1986, 1996, and 2006. In sensitivity experiments, we confirm our main results with 4-year intervals.

[13] We do not obtain significant estimates of the effects of colonial ties. A possible explanation is that the importance of colonial ties as a driver of trade has waned in recent years.

Table 1: A Simple Solution to the Missing Globalization Puzzle

	(1) Puzzle Present	(2) Puzzle Resolved
ln_DIST_1986	-0.696	-0.783
	(0.048)**	(0.035)**
ln_DIST_1996	-0.599	-0.730
	(0.040)**	(0.034)**
ln_DIST_2006	-0.775	-0.694
	(0.034)**	(0.033)**
CNTG_1986	0.506	0.312
	(0.095)**	(0.101)**
CNTG_1996	0.497	0.378
	(0.091)**	(0.083)**
CNTG_2006	0.328	0.416
	(0.079)**	(0.080)**
LANG_1986	0.285	0.294
	(0.079)**	(0.097)**
LANG_1996	0.259	0.315
	(0.081)**	(0.080)**
LANG_2006	0.168	0.120
	(0.082)*	(0.083)
CLNY_1986	0.007	0.004
	(0.099)	(0.114)
CLNY_1996	-0.046	-0.107
	(0.112)	(0.113)
CLNY_2006	-0.075	-0.050
	(0.112)	(0.118)
RTA_1986	0.652	0.418
	(0.126)**	(0.078)**
RTA_1996	0.682	0.420
	(0.079)**	(0.069)**
RTA_2006	0.308	0.452
	(0.065)**	(0.066)**
N	14076	14283

Notes: The dependent variable is nominal trade. All estimates are obtained with the PPML estimator and exporter-time and importer-time fixed effects whose estimates are omitted for brevity. The estimates in column (1) are obtained with international data only. The estimates in column (2) are obtained with intra-national trade flows and country-specific dummies for intra-national trade. Standard errors are clustered by country pair and are reported in parentheses $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$. See text for further details.

distance and globalization on international trade relative to the corresponding effects on intra-national trade. This is done with two simple adjustments to specification (3). First, the estimating sample now includes intra-national trade flows.[14] Second, we use country-specific dummies for intra-national trade, thereby offering a flexible and comprehensive treatment of intra-national trade costs including home-bias preferences.

[14]The values for all standard gravity variables are set to zero for the observations that correspond to intra-national trade. The results are robust to using values for internal distance and to set all dummy variables to equal to one for intra-national trade.

Three main findings stand out. First, proper measurement of distance elasticities as being relative to internal frictions leads to a smoother, monotonic decline in estimated coefficients from -0.78^{***} in 1986 to -0.69^{***} in 2006, a fall by 11.3%. Second, we obtain a significant increase in the effect of contiguity from 0.31^{***} in 1986 to 0.42^{***} in 2006. One potential explanation for this result is that newly manufactured products that were never exported before may first be exported to nearby countries. Another, not mutually exclusive explanation could be the emergence of regional (rather than global) supply-chain trade, cf. Baldwin (2012).[15] Finally, we see the estimated effects of RTAs in column (2) increase over time as well, from 0.42^{***} in 1986 to 0.45^{***} in 2006. We believe that this result is consistent with the proliferation of RTAs and ever more substantive provisions therein. In sum, comparisons between the estimates from columns (1) and (2) of Table 1 suggest that the theoretically consistent treatment of distance and globalization effects in gravity equations as being relative to internal frictions leads to solutions of both the 'distance' and the 'missing globalization' puzzles in international trade.

5 On the Uneven Effects of Globalization

In this section we characterize in greater detail the relationship between distance effects and the unfolding of globalization at the country level. The fall in the distance elasticities over time, as documented in Table 1, presumably reflects falling communication costs, technological advances and other globalization forces that have led to distance being less of a friction than it used to be. However, it is likely that these forces have not penetrated countries uniformly, cf. Brun et al. (2005) and Carrère et al. (2013). Our goal in this section is to test this argument by allowing for heterogeneous distance effects across countries in our sample with a view to establishing which (groups of) countries benefitted the most from globalization.

First, we obtain country-specific estimates of the changes in the effects of distance. Percentage changes in the distance estimates over the period 1986-2006 for each country in our sample are reported in columns (2), (5), and (8) of Table 2 (standard errors for corresponding percentage changes in columns 3, 6, and 9). The underlying distance estimates are obtained from a gravity specification with time-varying standard gravity variables, exporter-time, importer-time fixed effects, and country fixed effects for intra-national trade. All but two of the underlying country-specific and time-varying distance effects that we obtain are negative. The two exceptions, for which we obtain positive though

[15] We thank an anonymous referee for pointing to this intuition.

not statistically different from zero distance estimates, are Sri Lanka and Macao. This explains the unrealistically high percentage change reported for Macao in Table 2 as in that case the denominator is close to zero.

Table 2: On the Uneven Effects of Globalization on Trade: Country-specific Estimates

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Country Name	$\%\Delta DIST$	Std.Err.	Country Name	$\%\Delta DIST$	Std.Err.	Country Name	$\%\Delta DIST$	Std.Err.
Argentina	-22.5	2.4	Greece	3.8	2.3	Malaysia	-6.2	6.3
Australia	-0.4	1.0	Hong Kong	3.5	8.1	Niger	2.7	9.0
Austria	-17.7	1.8	Hungary	-24.1	1.5	Nigeria	-5.2	4.4
Belgium	-20.4	2.1	Indonesia	-3.9	3.7	Netherlands	-11.5	1.8
Bulgaria	-26.8	2.5	India	-22.2	5.5	Norway	-1.0	1.8
Bolivia	0.4	2.9	Ireland	-19.9	3.0	Nepal	9.1	6.3
Brazil	-8.6	0.8	Iran	4.4	4.1	Panama	-20.0	23.3
Canada	-9.2	1.4	Iceland	-0.3	1.7	Philippines	-25.9	4.9
Switzerland	-14.4	3.5	Israel	-31.7	18.8	Poland	-29.4	1.9
Chile	-11.5	5.8	Italy	1.3	1.9	Portugal	-5.3	2.5
China	-50.2	11.8	Jordan	9.8	22.3	Qatar	-20.7	7.8
Cameroon	3.6	3.5	Japan	-3.5	2.5	Romania	-22.2	1.9
Colombia	-11.6	2.0	Kenya	-4.5	2.6	Senegal	-0.1	4.7
Costa Rica	-40.6	12.2	Korea	-8.3	7.7	Singapore	5.9	2.8
Cyprus	-8.5	4.9	Kuwait	23	20.9	Sweden	0.1	1.3
Germany	-15.4	1.8	Sri Lanka	-24.7	18.7	Thailand	-30.4	4.6
Denmark	-1.8	1.8	Macao	-641.7	6805.0	Trinidad&Tobago	1.0	3.2
Ecuador	-0.6	2.7	Morocco	-5.8	2.4	Tunisia	-10.3	2.8
Egypt	-14.9	3.5	Mexico	-11.5	0.9	Turkey	-12.7	2.1
Spain	-12.3	1.6	Malta	-22.6	9.1	Tanzania	-10.0	4.7
Finland	-6.6	1.5	Myanmar	15.2	6.4	Uruguay	-2.6	3.9
France	-10.4	1.8	Mauritius	-2.3	5.2	United States	-5.0	1.3
UK	-9.5	1.7	Malawi	-1.4	5.4	South Africa	0.4	1.7

Notes: This table reports country-specific estimates of the percentage changes in the effects of distance on trade over the period 1986-2006. The underlying distance estimates are obtained from a gravity specification with standard gravity variables, exporter-time, importer-time fixed effects, and country fixed effects for international trade. Standard errors are obtained with the Delta method. See text for further details.

The country-specific estimates of percentage changes in distance effects on trade confirm that globalization is indeed present in the gravity estimates. This is suggested by the fact that we obtain negative percentage changes for 78% of the countries in our sample (54 of the 69), and more than two-thirds of them are statistically significant. Only two of the percentage changes that we obtain are positive and marginally statistically significant estimate. In addition, we find that the effects of globalization are quite heterogeneous across the countries in our sample. The strongest impact of globalization has been felt in some Asian economies including China (-50%), Thailand (-30%) and the Philippines (-26%) and in some countries of Central and Eastern Europe including Poland (-29%), Bulgaria (-27%) and Hungary (-24%). All of the most developed and richest economies in our sample exhibit intermediate changes of distance effects. Finally, the five countries at the bottom of the distribution include Kuwait, Myanmar, Jordan, Nepal, and Singapore. The associated estimates for these economies are relatively small and positive. Overall, relative to distance elasticities' initial

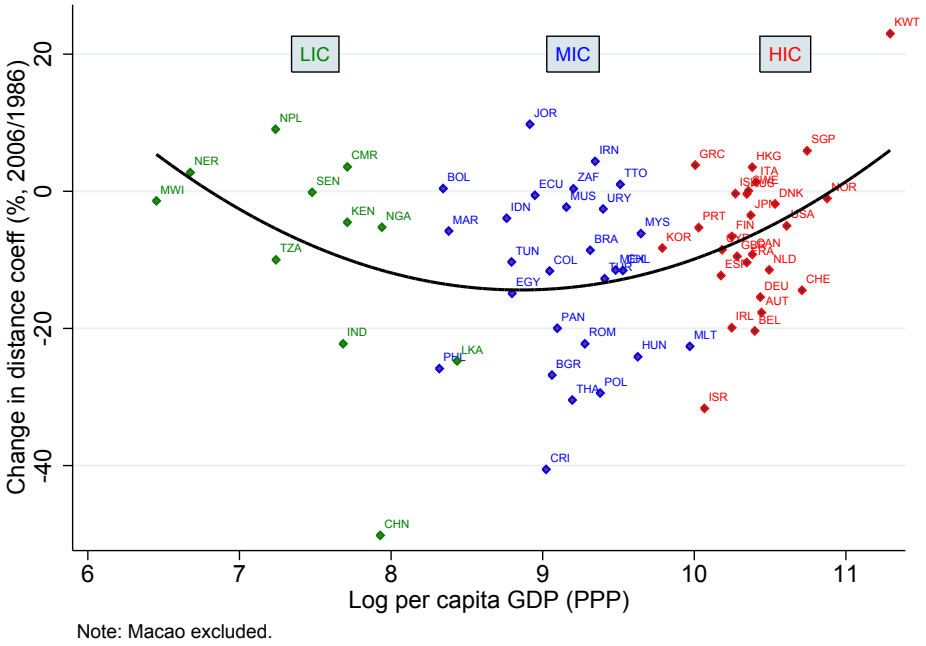
values in 1986, we find that most countries benefitted from globalization; however, the effects vary widely across the countries in our sample. Of particular note is the finding that there is no pattern of convergence visible over the 20 years under consideration. The next step is an attempt to characterize the differential effect across countries in greater detail.

A natural first step is to plot individual changes in distance elasticities against an indicator of economic development such as per capita income (Figure 1). Distinguishing three broad income groups, marked in different color, suggests a U-shaped relationship between the gains from globalization (in terms of 'flatter' geography) and per capita income. Specifically, we find that for "Middle Income Countries" (MIC) the effect of distance as a trade friction has fallen the most (-12.5% on average). In contrast, the decrease in distance estimates for both "Low Income Countries" (LIC) and "High Income Countries" (HIC) is only about half as large (-7.3% and -7.0%, respectively). Within the latter group, high income *OECD members* saw their distance elasticity fall by -8%, about as much as LICs on average, whilst the effect for *non-OECD* HICs was markedly lower (-4.3%). The sample of high-income non-OECD countries consists of either small economies with idiosyncratic economic structures (Cyprus, Macao, Hong Kong or Singapore) or oil-rich Gulf countries (Kuwait, Qatar). The muted effect of globalization on those countries's trade flows is thus not surprising.

Another interesting observation is the quite pronounced negative relation within low income countries: Whilst China has been making bigger advances than any other country in the sample, hardly any globalization effect is at work amongst the poorest economies. Hence, from the point of view of trade as a conduit for development, one (possibly alarming) implication of this result is that the poorest nations have ostensibly not been able to take full advantage of recent developments in trade-facilitating technology and communications.

An intriguing question is what could possibly have spurred the differential impact of globalization across countries at different stages of development. Since in this paper we capture globalization forces as lowering distance-induced trade costs more than proportionally for international trade, a conjecture involving compositional change of the export basket comes to mind. Specifically, the pattern evident in Figure 1 could reflect the fact that over the two decades under consideration, middle income countries (and also China) were most successful in changing the composition of their exports towards goods for which distance is relatively less of a friction, e.g. higher value-to-weight manufactures as opposed to agricultural produce. Whilst this is certainly not the only conceivable

Figure 1: Globalization and per capita income, 1996



Note: Macao excluded.

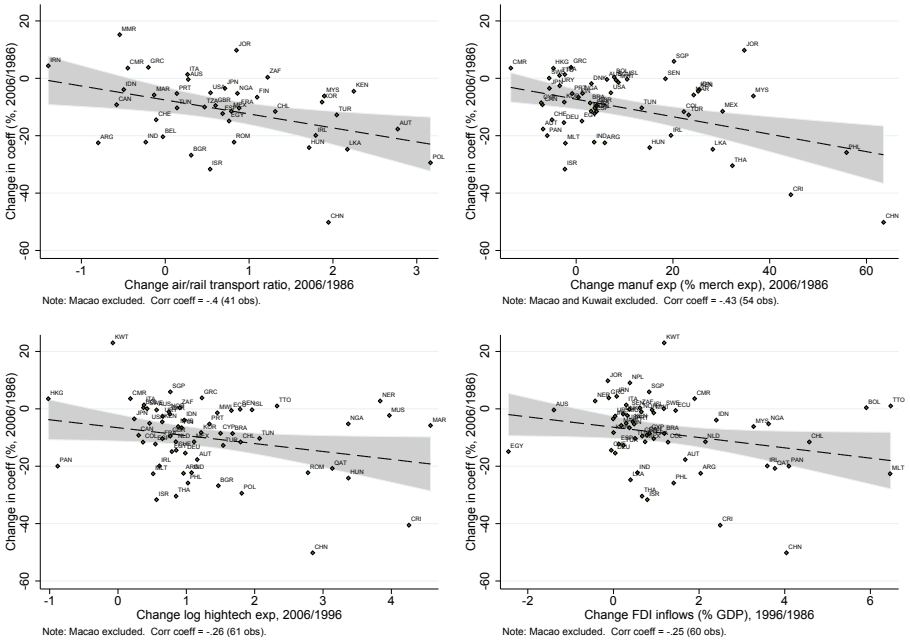
Notes: This graph is constructed using the World Bank's income classification as of 1996, the midpoint of our analysis. At that time the official threshold for LIC stood at $785 GNI per capita (Atlas methodology); the bracket for MIC was [$786, $9,645], and above $9,645 countries were classified as HIC.

explanation, we conclude this section by offering some reduced-form evidence that would be consistent with this process.

Figure 2 correlates the estimated fall in distance elasticities at the individual country level with changes in variables that reflect the evolution of trade and other forces of globalization. The top left panel in Figure 2 focuses on the revealed long-term shift in transportation modes. The change in the ratio of air-to-rail transportation is taken here as a proxy for the shift towards a larger share in transportation of higher value-to-weight goods. The negative correlation is clearly visible (correlation coefficient of 0.40), consistent with the conjecture that the "uneven effect of globalization" is reflecting differential compositional changes in countries' export bundles. Specifically, the distance coefficients fell the most for those countries that changed the composition of their exports faster towards higher value-to-weight goods, which are less sensitive to distance.

The top right panel of Figure 2 shows the extent to which, over time, countries have moved into exporting manufactures (as a share of overall merchandise exports); the estimated correlation coefficient is 0.43. Not surprisingly, the economy that has performed this transition most rapidly is China,

Figure 2: Correlates of Uneven Globalization



along with other economies such as Philippines, Thailand or Malaysia that are commonly associated with an export-led growth model. Again, the assumption here is that distance would constitute less of a barrier to manufactures compared to shipping non-manufacturing exports (agriculture, base metals or the like). The bottom left panel pursues this aspect further by depicting a measure of technological change, showing that distance coefficients have fallen the most for those countries which over time exported more and more high-tech/ICT goods. Finally, structural change in middle and low income countries is often facilitated by foreign direct investment (FDI) from abroad, especially when such investment is motivated by exploiting local factor cost advantages ('export-platform FDI'). Hence, the bottom right panel relates an economy's diminished distance elasticity to the size of foreign capital inflows over the initial decade 1986-96. Notwithstanding a fair amount of variation (correlation coefficient of 0.25), the picture is not inconsistent with the possibility that the technological and compositional change in exports may in part have been facilitated by FDI.

In combination, the four panels in Figure 2 confirm that the estimated changes in gravity distance elasticities are indeed reflecting globalization effects that affect how and what countries are trading. In particular, one driving force appears to be a shift towards more sophisticated goods whose exports are less sensitive to distance frictions. Yet with the notable exception of China, low income countries

as a group were markedly less transformative in that regard than middle income countries, raising the prospect of further decoupling the poorest nations from the dynamics (and gains) of globalization.

6 Conclusion

We offer robust evidence that, on average, the effect of distance on international trade has fallen over time, possibly reflecting the impact of new technologies or production fragmentation, commonly associated with 'globalization.' Yet we find that the effects of globalization over the period 1986-2006 are quite heterogeneous across the 69 countries in our sample. Specifically, our estimates reveal a U-shaped relationship between per capita income and the effects of globalization. On a positive note, our results suggest that on average globalization has had a positive effect without harming any particular country. However, our findings also imply that geographic distance as a trade friction has not lost its bite for a number of low income countries. This 'decoupling' may jeopardize their integration into global markets and, eventually, may contribute to widening income differences between richer and poorer economies. We find this result interesting but also potentially alarming. The evidence presented in this paper calls for more research to better understand the effects of globalization on trade and cross-country income inequality.

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