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Pulp mill Fiction: a conflict to solve the "distance puzzle"

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"There is very little that we economists fully understand about global trade but there is one thing that we do know—commerce declines dramatically with the distance. It is not a small world." (Leamer, 2007)

Geographic distance certainly matters for international trade. According to Berthelon and Freund (2004), over half of the world trade is between countries that are less than 3000km apart. It is very well documented in the literature of empirical international trade that distance has a negative impact on bilateral trade. But this effect is large and persistent in time, which conflicts with the fact that transport costs have declined over the past 50 years[1]. This is known as the "distance-elasticity puzzle": the distance elasticities that we estimate are too large to represent just transport costs. So the question remains: What is the true impact of geographic distance on bilateral trade?

I will show that unbiased and realistic estimates of the distance effect can be obtained by exploiting a unique conflict between Argentina and Uruguay that allows me to identify changes in distance between the countries.

Introduction

There is a vast collection of papers that estimate the effect of geographic distance on bilateral trade in a gravity equation context. In their Meta-Analysis, Disdier and Head (2008) compile and examine 1467 distance effects from over a hundred papers. They introduce the "distance-elasticity puzzle" by showing that all those estimated distance elasticities are very concentrated around the -0.91 mean effect. In their own words, "On average, a 10% increase in distance lowers bilateral trade by about 9%." Subsequent research has tried to solve the puzzle by employing different estimation methods, like non-linear estimation or panel-data techniques.[2] However, even when they find smaller distance effects, all papers suffer from either a vague (and thus hard to interpret) distance variable or an incorrect econometric specification.

The first issue has to do with how we measure distance and how we interpret the distance elasticity. Data on trade by transport modes is rare, so almost all studies use aggregate data. But is an extra km by land equivalent to an extra km by sea or air? Substantial work on the matter by Hummels indicates the answer is no; transport costs

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1. This is mainly due to technological advance, like the container revolution.

2. Some examples are Coe, Subramanian and Tamirisa (2007), Feyrer (2009), Larch et al (2012), and Yotov (2012).

are very mode-specific. Moreover, the most frequently used distance measures are not based on real trade routes which makes the resulting distance coefficient very hard to interpret. The second issue arises due to the existence of bilateral trade costs that are unobservable and thus excluded from the estimation. This implies that their effects on bilateral trade will be picked up by those bilateral measures that are indeed included in the empirical model, such as distance, thus biasing upwards (inflating) all coefficients.

Ideally, we would like to measure the real (i.e. trading routes) distance between two countries and then separate them apart. By doing this, we would be able to compute the impact of an extra km in distance on their trade without suffering from the problems mentioned above. The idea behind this is that nothing except for the distance would change, so the distance coefficient obtained would be unbiased. Usually, geographic distances between countries do not change. However, in rare occasions an episode between two or more countries (typically a conflict) can produce an exogenous shock to distance that acts as if countries were being separated.

A conflict to solve the puzzle

I take advantage of the 'Pulp Mill Conflict', which took place in South America, to estimate the causal relationship between distance and bilateral trade. The conflict started by the end of 2006 when the government of Uruguay granted Botnia, a Finnish firm, permission to build a pulp mill in the city of Fray Bentos on the Uruguay River (shared by Argentina and Uruguay). Since the pulp mill industry is the world's third largest industrial polluter to air, land, and water, the residents on the Argentinian side of the river began to protest. To get media attention they blocked the main bridge, which provides the shortest land routes between Uruguay's capital city (Montevideo) and several other Latin American capital cities, for over three years. Thus, alternative routes had to be used to get to Montevideo. This rare shock introduces a time-variation in the distance, which allows me to identify its effect on bilateral trade.
In particular, I use the following equation to estimate the distance elasticity for all MERCOSUR countries for 2002-2010:

$$\ln(x_{ijt}) = \alpha + \delta_{ij} + \delta_{it} + \delta_{jt} + \beta_3 \ln(dist_{ijt}) + \varepsilon_{ijt}$$

where x_{ijt} are exports by land from country i to country j at time t, δ_{it} and δ_{jt} exporter-time and importer-time fixed effects (that represent trade costs of countries i and j with the rest of their trading partners), δ_{ij} are bilateral pair fixed effects (that represent time-invariant bilateral trade costs, like whether they share a border or speak the same language), and $dist_{ijt}$ is the shortest real land route between the two countries.

Note: the data I use is dissagregated by transport mode, so I am able to estimate the effects of this land-separation on trade by land.

The results

Estimation results can be seen in the table below. Column (1) shows my main finding: *the distance effect is cut in half compared to the mean one in the literature.* The elasticity obtained when exploiting the Pulp Mill Conflict to generate time variation in the distance variable is -0.56 and statistically significant. This means that a 10% increase in geographic distance between two countries generates a 5.6% decrease in their bilateral trade. While still economically meaningful, this number is substantially below the 9.1% average in the literature. Columns (2) to (4) just show that results do not change when the sample is enlarged to include more product levels (SITC 3 digits, 4 digits, and 5 digits).

For comparison purposes, I also estimate the typical distance effect as done in the literature. For this I use great circle distances as the time-invariant distance measure and, following the literature, include several different controls to account for the bilateral trade costs. These are variables indicating whether the country pairs share a language, a border, a common legal origin, signed a trade agreement or where the same colony. Column (5) shows that the distance elasticity that this yields is -1, very close to the mean effect in the literature, and statistically significant.

Table 1. Estimation Results

	(1)	(2)	(3)	(4)	(5)
ln (Distance)	-0.564***	-0.468**	-0.655***	-0.539***	-1.095***
	(0.209)	(0.194)	(0.119)	(0.0947)	(0.0520)
Observations	19,343	54,837	139,919	232,134	35,452

Conclusion

This brief shows that plausible (smaller) estimates of the distance elasticity can be obtained when the econometric model is correctly specified and estimated. In my study I exploit a natural experiment between Argentina and Uruguay to generate time-variation in the distance variable and therefore employ bilateral pair fixed effects to correctly account for all other bilateral trade costs. Moreover, I depart from the traditional 'great circle distances' towards a real and more accurate measure of distances between countries and use data disaggregated by transport mode that allows me to see the effects on trade by land only. Therefore, we can think that the resulting distance estimates are unbiased and a better representation of transport costs than the others in the literature.

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