Networks and the disappearance of the intranational home bias

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Abstract

Previous studies have shown that, not only countries, but also regions have a preference to trade within their administrative borders. Using unique trade flows data, we also find a large home bias in Spanish intranational trade. However, we show that this home bias tend to disappear once we take into account the higher density of social and business networks within regions than between regions. We also find that the home bias does not disappear if intranational trade flows are measured in quantity rather than value. This fact might explain why previous studies on other European countries still find an intranational home bias, even when network effects are taken into account.

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1. Introduction

In a seminal paper, McCallum (1995) showed that Canadian provinces trade 22 times more with themselves than with US states. This enormous border effect shocked scholars, especially considering that the US and Canada are highly integrated countries. Some years after McCallum's finding, surprisingly, authors found that the preference to trade with oneself was not confined to country borders, but also occurred at the regional level. Wolf (2000) estimated that US states trade as average 200% more within their administrative borders than with other states. In a later work, Hillberry and Hummels (2003) reduced the state border effect to 55%; in any case, the intranational home bias remained very large.

What explains this large intranational home bias? Hillberry and Hummels (2008) argue that the intranational home bias might be an artefact of geographical aggregation. They show that there is a highly non-linear relationship between shipments and distance. At the beginning, there is a sharp reduction in value with distance; however, once a distance threshold is achieved, the negative effect vanishes. In the presence of non-linearity, the choice of the sub-national unit plays a critical role when estimating the border effect. If the sub-national unit is very large (e.g. a US state), data will not be able to capture the sharp reduction in trade that happens at short distances. In this situation, a large border effect is needed to account for the larger trade flows that happen within states. Hillberry and Hummels (2008) show that the intranational home bias shrinks when geographically smaller sub-national units are used for the empirical analysis.[1]

Other authors argue that information barriers may also explain the existence of an intranational home bias. For example, in order to sell their products, firms should gather information about potential customers and their preferences. They also need to gather information about the most suitable ways to distribute the product, and the level of competition in the market. Moreover, firms wish to know whether a potential customer will honor the payments. The gathering of this information will be cheaper the richer the network of the firm. If firms' managers and other personnel have a large number of links with other professionals, friends or relatives, they will be able to tap on a wider set of information sources. The networking with other managers and professionals will be further facilitated if firms are part of a business group. As firms have a larger number of social and business links

[1] Llano et al. (2011) show that non-linearity between distance and trade may also lead to artificially larger country-level border effects.

in the region where they are located, they will face lower information costs when dealing with local partners, facilitating intra-regional trade flows.[2]

The few empirical studies analyzing intranational trade flows confirm that networks contribute to explain the home bias effect.[3] For example, Millimet and Osang (2007) show that US states' border effect is substantially reduced, although not eliminated, when differences in social networks across states are taken into account. Using geographically more disaggregated sub-national units, Combes et al. (2005) also find that social and business networks reduce substantially the intranational home bias in France. However, as in the previous case, a non-negligible intranational home bias remains.

The aim of this paper is to provide new evidence on whether social and business networks can explain the intranational home bias, using Spain as a case study. To perform this analysis, we use a unique database on trade flows, measured both in value and quantity, between highly geographically disaggregated Spanish sub-national units (provinces - NUTS III). We combine trade flows data with data on the density of social and business networks. Our empirical analysis shows that, even when we use highly geographically disaggregated sub-national units, there is a large home bias in Spanish intranational trade. However, contrary to previous studies, we find that in almost all estimations the home bias disappears once we control for the links established by migrants and business groups. We also show that the home bias remains if trade flows are measured in quantity instead of value. To explain this result, we show that traded quantities drop faster with distance than traded values. In the case of quantity, provinces might still represent a too large geographical unit to capture the full non-linearity between distance and trade, leading to an artificial border effect. This result might explain why previous studies, such as Combes et al. (2005), which combine highly geographically disaggregated sub-national units and quantity-based trade flows, still find a sizable intranational home bias after controlling for network effects.

The article is organized as follows. The next section presents the data and offers some descriptive analyses. Section 3 comments the results of the econometric analyses. Section 4 presents the main conclusions of the paper.

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[2] Turrini and van Ypersele (2010) find that judicial asymmetries across regions might also contribute to intranational home bias.

[3] With respect to international trade, there is ample evidence showing that migrant communities, ethnic ties and business groups facilitate trade between countries (Gould, 1994; Rauch and Trindade, 2002).

2. Data and descriptive statistics

Data on trade flows between Spanish provinces, measured in value and quantity, comes from the C-intereg database (Llano et al., 2010).[4] We proxy social networks by the number of occupied persons born in a Spanish province that live in another Spanish province. This data comes from the Spanish Statistical Institute (INE) Census of Population 2001. Data on business networks are computed from SABI for year 2006. This dataset, produced by the private firm Bureau van Dijk, offers data on the accounts and balance sheets of Spanish firms. Following the norm established by the Spanish General Accounting Plan we consider that two firms belong to the same business-group if the same shareholder has at least a 20% participation in both firms, and the shareholder is the primary shareholder in both firms. We identify the firms that belong to the same group in the origin and destination province. For each business group we multiply the firms in the origin province by the firms in the destination province to proxy for total number of firm-links. Then we aggregate each business group's firm-links to get the final origin-destination firm-link figure. Finally, we proxy transport costs by the time spend by a truck (in minutes) to travel from one Spanish province to another province (Gutierrez-Puebla et al., 2007). This time is calculated through a procedure that takes into account, among other factors, the orography, slope and width of the road and speed limits. To calculate distance between and within provinces, Spain is segmented in 815 geographical zones, and the time spent by a truck between every pair of bilateral zones is calculated. Intra or inter-provincial final distance is calculated as a population weighted average of the bilateral distances that belong to the aggregate distance we want to estimate. As distance data are based on truck-transport, we exclude from the sample the Spanish insular provinces, and the two autonomous cities located in the African continent, leaving us 47 peninsular provinces.

Table 1 presents the average values for trade flows, social networks and business networks between Spanish provinces and within Spanish provinces. A representative Spanish province trades 120 million € with another Spanish province, moving 263,000 tones. The value and the volume of trade are much larger within a province than between provinces. The ratio of intra-province to inter-province trade is 18 for value and 78 for quantity. This difference suggests that the quantity of trade falls faster at short distances than the value of trade. With respect to social networks there are on average 1,601 workers that were born in

[4] The database excludes transit trade flows. In a previous version of the paper we use another database, the Permanent Survey of Road Transport, to measure trade flows in quantities, which does include transit flows. The results are very similar to the ones using C-intereg. Results available on request.

one Spanish province and live in another Spanish province. In contrast, there are on average 229,651 workers that live in the province they were born. With respect to business networks, there are on average 194 plant-links between two distinct Spanish provinces. The number of plant-links within the same province is much larger: 3,004. These figures point out that both social and business networks exhibit a much higher density level within a province than across provinces; in the next section, we analyze whether these differences lead to larger trade flows within provinces than between provinces.

[Table 1 around here]

To analyze whether provinces are a sufficiently geographically disaggregated sub-national units to capture the non-linearity between trade and distance, we use a kernel regression estimator to provide a nonparametric estimate of the relationship between these variables. Figure 1 presents the relationship between trade value and distance (left), and trade quantity and distance (right).[5] We can observe that there is a clear non-linear relationship between trade and distance: at the beginning there is a sharp reduction in the value and quantity of trade when distance is increased; however, for trips longer than 200 minutes, distance no longer seems to influence the quantity and value of trade. To compare whether non-linearity is larger for quantity than for value, we normalize quantity and value figures, and estimate two new kernel regressions. As shown in Figure 2, quantity drops sharper at short distances than value. As we show in the next section, this difference might explain why some studies still find a sizable home bias, even when they control for the network effect.

[Figure 1 around here]

[Figure 2 around here]

[5] We use the Gaussian kernel estimator in STATA, calculated on n=100 points, and allowing the estimator to calculate the optimal bandwidth.

3. Results of the econometric analyses

To analyze whether social and business networks can explain the intranational home bias, we estimate the following gravity equation:

$$X_{ij} = \beta_0 d_{ij} + \beta_1 d_{ij}^{\ 2} + \beta_2 C_{ij} + \beta_3 \ln(mig_{ij}) + \beta_4 \ln(mig_{ji}) + \beta_5 \ln(firm_{ij}) + \beta_6 Border + \beta_i + \beta_j \qquad (1)$$

where X_{ij} is the amount of exports (in value or quantity) between province *i* and province *j*. To capture non-linearity, distance (d_{ij}) and the square of distance (d_{ij}^2) are introduced in the regression equation. mig_{ij} is the number of workers born in province *i* that live in province *j* (emigrants), mig_{ji} the number of workers born in province *j* that live in province *i* (immigrants), $firm_{ij}$ is the number of plant-links between province *i* and province *j*, and *Border* is a dummy variable that takes the value of 1 if *i* and *j* are the same province and zero otherwise. Equation (1) also includes a dummy variable C_{ij} that takes the value of one if province *i* and province *j* are adjacent, and zero otherwise. We include this variable to control for shipments that might occur between municipalities that are close to each other, but located in different provinces. Due to these short-distances shipments, our distance measure might overvalue the real distance travelled by goods for adjacent provinces trade flows. The adjacency dummy variable controls for this possibility.[6] Finally, to control for omitted variables, equation (1) includes origin-province (β_i) and destination-province (β_j) fixed-effects. To control for endogeneity, we use trade flows data for the year 2007 and lagged values for social networks (year 2001) and business networks (year 2006). In addition, network variables are stocks rather than flows.

[Table 2 around here]

Table 2 presents the results of the estimating equation (1) using OLS. We estimate the equation with trade measured in value (columns 1-4) and in quantity (columns 5-8). To determine the relative contribution of networks and our novel distance measure to the reduction of the intranational home bias, first we estimate the regressions with a standard

[6] Note that we should distinguish between intra-province and adjacent province trade, because the scope of short-term distances shipments is much larger within a province than between adjacent provinces. Moreover, as argued in this paper, the province dummy might capture the higher density of networks that exist within a province.

great-circle distance measure, and then with our novel time-distance measure.[7] We can see that in all estimations, distance has a negative coefficient and the square of distance has a positive coefficient, confirming the non-linear relationship between trade flows and distance. In all estimations the adjacency coefficient is positive, pointing out to an overvaluation of distance for adjacent provinces trade flows. When trade is measured in value terms, network variables are not included, and distance is the great-circle one (column 1), we find a large home bias for Spanish intranational trade. According to the OLS result, a Spanish province trades 3.71 [=exp(1.31)] times more with itself than with another Spanish province. When social and business network variables are included (column 2), we find that both immigrants and business networks exhibit a very large trade-creation effect, reducing the border coefficient from 1.31 to 0.65. In contrast with Combes et al. (2005), emigrants do not seem to have any effect on trade across provinces. When we use our novel time-distance measure (Columns 3 and 4), we also observe a large drop in the border coefficient when network variables are included; moreover, the province border coefficient, although positive (0.49), becomes statistically not significant. Comparing coefficients in columns 3 and 4, we can see that the combined effect of social and business networks reduce the province border by 59% (exp(0.49-1.37)-1). Migrant workers play a larger role than business workers in the reduction of the province border coefficient: 52% vs 21%, a result which is in line with Combes et al. (2005).[8] Our results point out that the presence of larger networks at the province level explains to a large extent why provinces have a strong preference to trade within their borders. The more accurate distance measure also contributes to the reduction of the province border effect when networks variables are included in the model.

When the dependent variable is measured in quantity and network variables are not included (columns 5 and 7), the province border coefficients increase substantially. The estimations also confirm that the non-linearity between distance and trade is much larger when flows are measured in quantity than value. When network variables are introduced, there is a large reduction in the border coefficient, both for great-circle distance and time distance. However, contrary to the previous case, both border coefficients remain statistically

[7] To calculate inter-provincial and intra-provincial great-circle distances, first, we estimate the great circle distance between every pair of Spanish municipalities with, at least, 20,000 citizens. Then, we calculate the origin and destination population weighted average of the bilateral great-circle distances that belong to the aggregate distance we want to estimate.

[8] To calculate these percentages we estimate a regression including migrant workers as the only network variable, and another regression including business groups as the only network variables. We compare the province-border coefficients obtained in these regression with the border coefficient reported in Column (4).

significant. This result might explain why previous studies, such as Combes et al. (2005), that use quantity measures and highly geographically disaggregated sub-national units for the analysis, still find a sizable intranational home bias, even when they control for network effects. As in the previous estimation, migrant workers play a larger role than business networks in explaining the reduction in the border coefficient. Moreover, we can observe that in the estimations with quantity emigrants have a trade-creating effect. We also find that the province border coefficient estimated with time-distance is lower than the one estimated with great-circle distance, when network variables are included in the regression.

As robustness check, we re-estimate all regressions with a Poisson Pseudo-Maximum Likelihood model (Santos-Silva and Tenreyro, 2006). We also observe a large reduction in the province border coefficient when network variables are introduced in the regression. When trade is measured in value the province border coefficient is not statistically significant when distance is great-circle, but it is statistically significant, by a small margin, when we use time distance. When trade is measured in quantity both province border coefficients are positive and statistically significant. [9]

4. Conclusions

We find a large home bias in Spain using data on intranational trade flows measured in value and quantity. We show that the home bias almost disappears once we take into account the higher density of social and business networks within Spanish provinces. But the home bias remains if trade is measured in quantity rather than value. As quantity drops faster than value at short distances, provinces may still be too large geographically to capture the full non-linearity between quantity and trade, leading to an artificially higher intranational home bias. This result might also explain why previous studies, using quantity and highly geographically disaggregated sub-national units, still find a sizable intranational home bias, even when networks effects are taken into account.

References

Combes, P.P., Lafourcade, M. and Mayer, T. (2005). "The trade-creating effects of business and social networks: evidence from France", *Journal of International Economics*, **66**, 1, 1-29

[9] Results are also robust to using a 50% control threshold to determine that two firms belong to the same business-group. Results available on request.

Gutiérrez-Puebla,J., García-Palomares, J.C. and Condeço, A. (2007). "META: Modelo español de tarifación de carreteras. Meta Project", unpublished manuscript.

Gould, D.M. (1994). "Immigrant Links to the Home Country: Empirical Implications for the U.S. Bilateral Trade Flows", *Review of Economics and Statistics*, **76**, 2, 302-316.

Hillberry, R. and Hummels, D. (2003). "Intranational Home Bias: Some Explanations", *The Review of Economics and Statistics,* **85**, 4, 1089-1092

Hillberry, R. and Hummels, D. (2008). "Trade responses to geographic frictions: A decomposition using micro-data", *European Economic Review*, **52**, 3, 527-550.

Llano, C., Esteban, A., Pulido, A. and Pérez, J. (2010), "Opening the Interregional Trade Black Box: The C-intereg Database for the Spanish Economy (1995-2005)", *International Regional Science Review*, **33***,* 3, 302-337.

Llano, C., Minondo, A. and Requena, F. (2011). "Is the border effect an artefact of geographical aggregation?", *The World Economy*, **34**, 10, 1771-1787.

McCallum, J. (1995). "National Borders Matter: Canada-U.S. Regional Trade Patterns", *American Economic Review*, **85**, 3, 615-623.

Millimet, D.L. and Osang, T. (2007). "Do state borders matter for U.S. intranational trade? The role of history and internal migration", *Canadian Journal of Economics*, **40**, 1, 93-126.

Rauch, J.E, and Trindade, V. (2002). "Ethnic Chinese Networks in International Trade", *The Review of Economics and Statistics*, **84**, 1, 116-130.

Santos-Silva, J. and Tenreyro, S. (2006). "The log of gravity", *Review of Economics and Statistics*, **88**, 4, 641-658.

Turrini, A. and van Ypersele, T. (2010). "Traders, courts, and the border effect puzzle", *Regional Science and Urban Economics*, **40**, 2-3, 81-91.

Wolf, H.C. (2000). "Intranational home bias in trade", *Review of Economics and Statistics*, **82**, 4, 555-563.

Figure 1. Kernel regression: Value and quantity of intranational flows on distance, year 2007

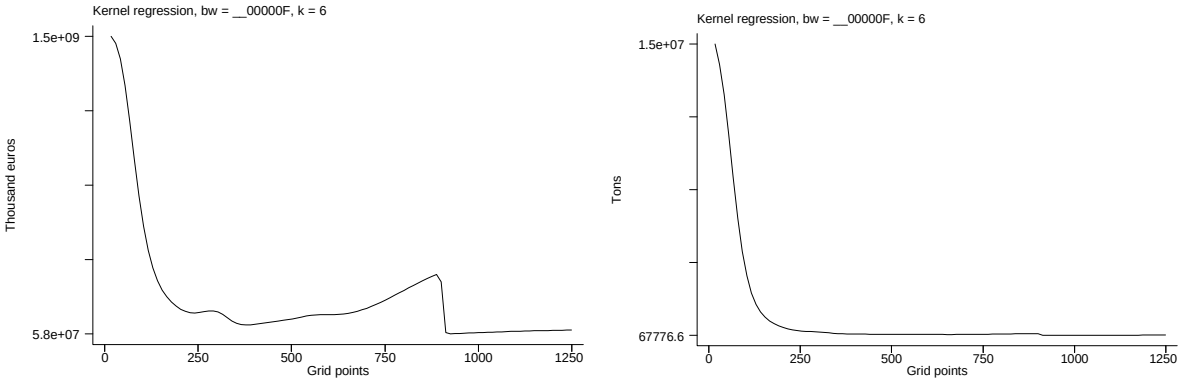

Figure 2. Kernel regression: normalized value and quantity of intranational flows on distance, year 2007

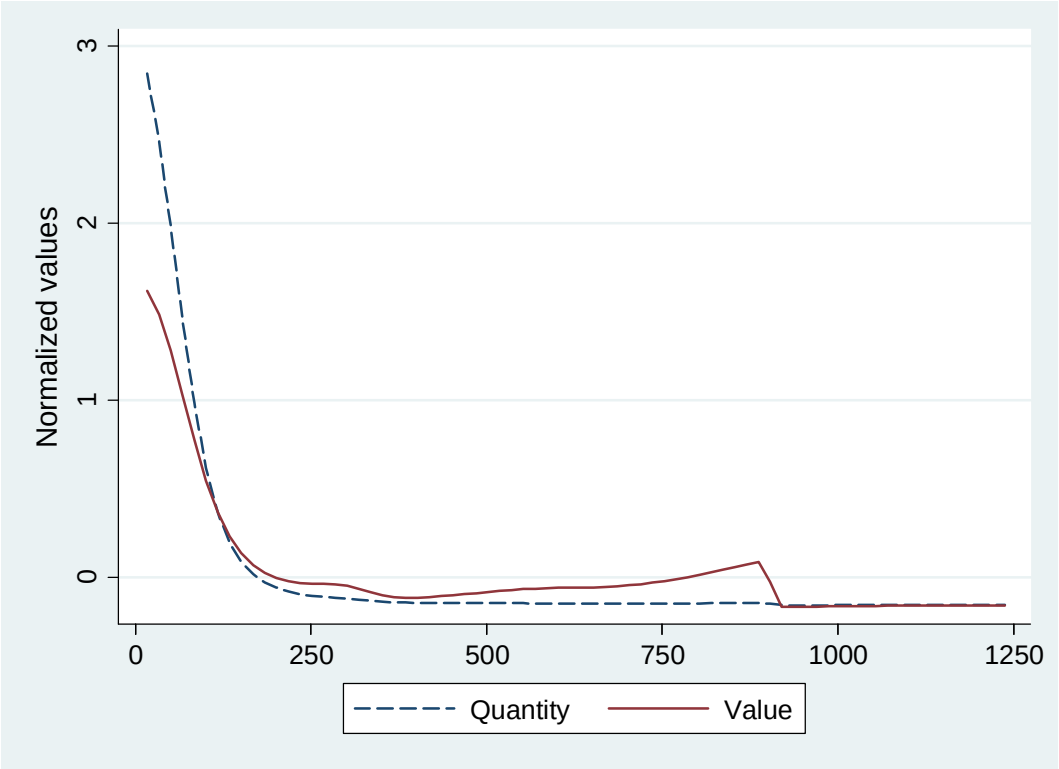

Table 1. Average values for intranational trade and social and business networks

	Across provinces		Within a province	
	Exports in value	Exports in quantity	Exports in value	Exports in quantity
Average	120	263	2,094	20,528
Standard deviation	276	731	3,772	20,705
	Migrants	Plant-links	Migrants	Plant-links
Average	1,601	194	229,651	3,004
Standard deviation	4,655	991	2,793,235	10,070

Note: data on bilateral trade flows in 2007 comes from C-Intereg database (value: million €; quantity: thousand tones). Data on migrant workers in 2001 comes from the Spanish Statistical Institute. Data on business networks in 2006 is calculated by the authors using data from SABI.

Table 2. Social and business networks and intranational home bias. Estimation method OLS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable	Log (Value exports)	Log (Value exports)	Log (Value exports)	Log (Value exports)	Log (Quantity exports)	Log (Quantity exports)	Log (Quantity exports)	Log (Quantity exports)
Border province	1.31	0.65	1.37	0.49	2.06	0.69	2.12	0.56
	(0.17)***	(0.33)*	(0.16)***	(0.32)	(0.15)***	(0.27)***	(0.13)***	(0.26)***
Great-circle	-6.16	-5.11			-9.87	-7.80		
distance	(0.71)***	(0.81)***			(0.57)***	(0.65)***		
Great-circle	3.55	2.77			6.35	4.79		
distance square	(0.73)***	(0.79)***			(0.58)***	(0.63)***		
Time distance			-4.37	-3.50			-7.25	-5.75
			(0.44)***	(0.50)***			(0.37)***	(0.41)***
Time distance			1.98	1.55			3.48	2.73
square			(0.26)***	(0.28)***			(0.21)***	(0.23)***
Adjacency	0.72	0.61	0.90	0.73	1.06	0.69	1.27	0.97
	(0.11)***	(0.12)***	(0.10)***	(0.11)***	(0.09)***	(0.27)***	(0.08)***	(0.09)***
Immigrants		0.27		0.30		0.20		0.21
		(0.09)***		(0.09)***		(0.07)***		(0.07)***
Emigrants		-0.13		-0.10		0.12		0.14
		(0.09)		(0.09)		(0.07)*		(0.07)**
Business groups		0.12		0.15		0.21		0.24
		(0.05)**		(0.05)***		(0.04)***		(0.04)***
R-squared	0.61	0.62	0.61	0.61	0.76	0.77	0.76	0.77
Observations	1814	1814	1814	1814	1814	1814	1814	1814

Note: Regressions include origin and destination province fixed effects. Heteroskedastic-robust standard deviations in parentheses. ***, **, * statistically significant at 1%, 5% and 10% respectively.

Table 3. Social and business networks and intranational home bias. Estimation method PPML

Dependent variable	(1) Log (Value exports)	(2) Log (Value exports)	(3) Log (Value exports)	(4) Log (Value exports)	(5) Log (Quantity exports)	(6) Log (Quantity exports)	(7) Log (Quantity exports)	(8) Log (Quantity exports)
Border province	0.88	0.12	0.87	0.32	2.04	0.44	1.82	0.84
	(0.10)***	(0.19)	(0.08)***	(0.19)*	(0.09)***	(0.16)***	(0.06)***	(0.15)***
Great-circle	-3.78	-2.38			-6.68	-3.63		
distance	(0.70)***	(0.68)***			(0.97)***	(0.76)***		
Great-circle	1.83	0.89			3.12	0.82		
distance square	(0.72)***	(0.69)			(1.05)***	(0.80)		
Time distance			-3.82	-2.71			-8.27	-5.92
			(0.41)***	(0.43)**			(0.40)***	(0.40)***
Time distance			1.71	1.17			3.96	2.74
square			(0.23)***	(0.24)***			(0.23)***	(0.23)***
Adjacency	0.48	0.25	0.42	0.28	0.84	0.44	0.60	0.44
	(0.10)***	(0.10)**	(0.08)***	(0.09)***	(0.11)***	(0.16)***	(0.07)***	(0.07)***
Immigrants		0.20		0.17		0.27		0.18
		(0.06)***		(0.06)***		(0.06)***		(0.06)***
Emigrants		-0.05		-0.07		0.07		0.00
		(0.06)		(0.06)		(0.06)		(0.06)
Business groups		0.31		0.27		0.46		0.39
		(0.04)***		(0.04)***		(0.03)***		(0.03)***
Observations	2066	2066	2066	2066	2066	2066	2066	2066

Note: Regressions include origin and destination province fixed effects. Heteroskedastic-robust standard deviations in parentheses. ***, ** statistically significant at 1% and 5% , respectively.