Cross-border mergers and acquisitions and inter-urban gravity

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16 November 2020

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November 16, 2020

Abstract

Cross-border mergers and acquisitions (M&As) have grown rapidly in recent years and are a major part of foreign direct investment (FDI). However, M&A distribution is highly skewed, with most of the activity concentrated in certain countries and even in certain cities. Only a handful of cities account for most M&As. Unlike many previous studies that have relied on a gravity model approach using the bilateral volume of FDI, this study examines the determinants of cross-border M&As by applying an FDI gravity model to inter-city investment flows in the world. The empirical results, which are based on panel data of M&A flows across 44 major cities in the world from 2010 to 2017, show that besides the basic attributes used in conventional gravity models, such as market size and distance between origin city and destination city, urban-specific attributes such as the agglomeration of the world's top-ranked firms and the number of foreign residents have a statistically significant explanatory power for inward M&As.

Keywords: Gravity model, M&As, border effects, inter-city investment, agglomeration
JEL *Classification*s: F14, F21, F23, R12

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* The author is grateful to the participants at the ETSG 2019 Conference in Bern and seminar participants at Aoyama Gakuin University and the University of Hawaii for their helpful comments and suggestions. This work was supported by research grants from the Institute of Economic Research, Aoyama Gakuin University, Japan Society for the Promotion of Science (JSPS) KAKENHI Grant Number 20K01634, and Nomura Foundation for Social Science.
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1. Introduction

Over the last decade, cross-border mergers and acquisitions (M&As) have seen a sharp increase in activity. According to UNCTAD (2019), the value of net cross-border M&As has reached 62% of foreign direct investment (FDI) inflows. Most of them are concentrated in developed countries, accounting for 84% of the global total. This study asserts that such flows are concentrated only in a handful of cities. Table 1 shows the proportion of the top 1%, 5%, and 10% of the target cities to the total value of inward M&As in the country. From the table, it can be seen that the value of M&As is concentrated in certain cities in a country. In China, France, and Japan, the top 1% of cities account for more than half of the total, and the top 10% account for approximately 90% of the total. Such significant bias toward particular cities can also be seen in France, Germany, Japan, the United Kingdom, and the United States.

[Insert Table 1 here]

Conventionally, we rely on a gravity equation using bilateral transactions to explain international trade and FDI. However, the concentration of M&As in specific cities raises doubt about the validity of this traditional approach based on bilateral transactions. Firms may make investment decisions by considering the attributes of the target city rather than the target country, and the distance from the origin city to the target city rather than the distance between the capitals. The factors that cause M&As to be concentrated in some cities have not yet been elucidated. To explore the city-specific attributes that attract inward M&As, unlike many

previous studies using a gravity model for bilateral FDI,[1] this study examines the determinants of cross-border M&As by applying a gravity model to inter-city M&As across the world.

This paper contributes to the literature by empirically showing how the gravity model for bilateral FDI fits inter-city M&As. The gravity model is estimated using data collected from 44 cities in the world for city-level attributes. To the best of my knowledge, this study is the first attempt to estimate a gravity model for cross-border M&As at the city level. It examines whether a gravity model for bilateral FDI also explains inter-city M&A volumes with plausible signs of basic gravity variables such as market size and geographical distance. Further, this study answers the question, which urban attributes attract M&As? One possible explanation for why such trade is so much more concentrated in specific cities is the benefits from agglomeration.[2] The agglomeration of foreign-invested firms in destination cities likely generates a Marshallian externality that arises from the pooling of specialized workers and the sharing of intermediate input and knowledge (Fujita and Thisse, 1996). As Duranton and Puga (2004) pointed out, the externality from agglomeration is one of the important factors for a firm's location choice. Thus, the agglomeration of foreign-invested firms is likely to be an

[1] See Brainard (1997), Markusen and Maskus (2002), Portes and Rey 2005, Bénassy-Quéré et al. (2005), Bergstrand and Egger (2007), Kleinert and Toubal (2010), Blonigen and Piger (2014), Román et al. (2016), and Hoshi, Kiyota, 2019. Head and Mayer (2015) provide a literature review with regard to the Gravity Model of FDI. With respect to cross-border M&As, Hyun and Kim (2010) examine the determinants of bilateral M&As using gravity model.

[2] For example, Head et al. (1995) provide evidence that vertical supplier-assembler relationship attracts subsequent FDI by using Japanese multinational enterprises. A meta-analysis of the effect of agglomeration economies on FDI location by Jones (2017) shows that agglomeration economies have a positive impact on FDI location.

attractive city attribute that triggers subsequent M&As. This study sheds light on the role of the agglomeration of foreign-invested firms in target cities in M&As across major cities. Another contribution of this study is to present evidence of border effects on M&As by dealing with both intra-national and cross-border transactions. As noted by Jones et al. (2018), little is known about border costs in terms of FDI compared to international trade. The present study examines as to whether border effects still remain in the M&A flow across cities.

The remainder of this paper is organized as follows: Section 2 elaborates on the gravity equation for inter-city M&As and the variables to be used in the estimation, Section 3 explains the data used in the estimation of the gravity model, Section 4 presents the estimation results of the gravity model, and Section 5 highlights conclusions drawn from the investigation.

2. Application of the gravity model to cross-border M&As

Head and Ries (2008) developed a gravity model to examine the determinants of FDI. They theoretically derived the gravity model for FDI, based on an idea from an inspection game between the headquarters of a multinational enterprise and a subsidiary. They specify the costs and benefits of controlling a remote overseas subsidiary. The model assumes that managers at the headquarters are required to monitor the managers at the overseas subsidiary to exert effort and therefore, maximize the value of the subsidiary. Monitoring costs are assumed to increase with the bilateral geographical distance between the headquarters and the subsidiary. In addition, bilateral FDI is assumed to be proportional to the country's size. From this theoretical

consideration, they derived a gravity model that includes origin country- and target country-specific factors and bilateral distance. This existing framework is useful when considering an extension to an intercity-level analysis of cross-border M&As. As panel data are used in the estimation of this study, the gravity model for FDI is modified to include the time dimension. A gravity model for explaining inter-city M&As from origin city *i* to target city *j* in year *t* MA_{ijt} is expressed as follows:

$$MA_{ijt} = \exp\left(\mathbf{O}_{it}^{'}\alpha + \mathbf{T}_{jt}^{'}\beta + \mathbf{D}_{ijt}\theta\right)\varepsilon_{ijt} \qquad (1)$$

where $\mathbf{O}_{it}^{'}$ is the vector of time-variant origin city-year specific factors, $\mathbf{T}_{jt}^{'}$ is the vector of time-variant target city-year specific factors, $\mathbf{D}_{ijt}$ is the vector of origin-target city pair characteristics, and ε_{ijt} is the disturbance term.

With respect to the time-varying origin- and target-city-year specific variables, this study uses population size (Pop_{it}, Pop_{jt}) and per capita GDP ($Pcgdp_{it}, Pcgdp_{jt}$) following Hoshi and Kiyota (2019). In addition to these size variables, some unique characteristics that would influence M&A decisions are added to the model. For example, for tax avoidance, M&A decisions may be sensitive to the level of the corporate tax rate in both the origin and the target cities. If firms make investment decisions to avoid taxes, there would be more M&As in cities with low corporate tax than in cities with high corporate tax. The agglomeration of foreign-

invested firms that are considered to generate the Marshallian externality is also likely to affect inward M&As. If the knowledge-based capital required for business activities in the host city is embodied in existing foreign-invested firms or foreign workers, it is expected that externality from the agglomeration of foreign-invested firms or workers will result in a decrease in costs for firms located in the agglomerated city owing to shared resources and knowledge. Therefore, such benefits from agglomeration may act as a further incentive for subsequent firms to invest. In the estimation, the corporate tax rates in both the origin and the target cities (Tax_{it}, Tax_{jt}), and proxy variables indicate the agglomeration of foreign-invested firms in a target city (Agg_{jt}). At the national level, the institutional barrier is likely to impede inward M&As, so the level of restriction on foreign direct investment in the host country (RFI_{jt}) is also added to the model.

The $\mathbf{D}_{ijt}$ vector consists of a pair of time-variant and time-invariant characteristics as follows:

$$\mathbf{D}_{ijt} = \{Dist_{ij}, CBRD_{ij}, COMCUR_{ij}, LANG_{ij}, CLNY_{ij}, Sister_{ijt}, RTA_{ijt}\} \quad (2)$$

where $Dist_{ij}$ is the geographical distance between origin city i and target city j. As recommended by Heid et al. (2017), the gravity model of this study covers both intra-national and cross-border flows. Therefore, the dependent variable includes M&As targeting their own cities (and other cities in the same country if the sampled country has multiple cities). The cross-

border dummy $CBRD_{ij}$ is added to control the difference between intra-national and cross-border M&As. $COMCUR_{ij}$, $LANG_{ij}$, and $CLNY_{ij}$ are dummy variables that take the value 1 when origin city *i* and target city *j* share a common currency, a common language, and a colonial relationship, respectively. These two variables are likely to be appropriate proxies for factors that facilitate monitoring, as addressed by Head and Ries (2008). As a time-variant pair specific factor, it is expected that impediments to an M&A between the two cities are mitigated by the strengthening of the friendship and cooperation between the two cities. To uncover this factor, this study investigates the existence of sister cities and friendship cooperation agreements across the 44 cities and constructs a dummy variable $Sister_{ijt}$that takes the value 1 when an agreement is in force. To take into account regional trade agreements (RTAs) at the national level, a dummy variable RTA_{ijt} takes the value 1 if a city pair belongs to the same RTA. As a result, the empirical specification is as follows:

$$MA_{ijt} = \exp\big(\alpha_1 Pop_{it} + \alpha_2 Pcgdp_{it} + \alpha_3 Tax_{it} + \beta_1 Pop_{jt} + \beta_2 Pcgdp_{jt} + \beta_3 Tax_{jt} + \beta_4 Agg_{jt} + \beta_5 RFI_{jt} + \theta_1 \ln Dist_{ij} + \theta_2 CBRD_{ij} + \theta_3 Sister_{ijt} + \theta_4 COMCUR_{ij} + \theta_5 LANG_{ij} + \theta_6 CLNY_{ij} + \theta_7 RTA_{ijt}\big)\varepsilon_{ijt} \quad (3)$$

The gravity model is estimated by the pseudo-Poisson maximum likelihood (PPML) estimation proposed by Santos Silva and Tenreyro (2006). The advantage of the PPML

estimator is that it accounts for heteroskedasticity and allows zero M&A observations. Since there remains a concern about omitted variable bias, a model that includes the origin city-year fixed effects and target city-year fixed effects instead of the explicit time-varying city characteristics is also employed. This specification is expressed as follows:

$$MA_{ijt} = \exp\left(\boldsymbol{\lambda}_{it}^{'} + \boldsymbol{\pi}_{it}^{'} + \theta_1 \ln Dist_{ij} + \theta_2 CBRD_{ij} + \theta_3 COMCUR + \theta_4 LANG_{ij} + \theta_5 CLNY_{ij} + \theta_6 Sister_{ijt} + \theta_7 RTA_{ijt} + \gamma_1 CBRD_{ij} \times Agg_{jt}\right)\varepsilon_{ijt} \quad (4)$$

where $\boldsymbol{\lambda}_{it}^{'}$ denotes the set of time-varying origin city-year fixed effects, and $\boldsymbol{\pi}_{it}^{'}$ indicates the set of time-varying target city-year fixed effects. The interaction term of the cross-border dummy and city characteristics enables us to examine the possible differences in the effects of city attributes on M&As between intra-national and cross-border, even when the model includes both the city-year and target city-year fixed effects. In this study, cross terms for variables of interest are introduced, and the effects of urban attributes are examined.

3. Data

This study uses inter-city M&A volumes data of 44 cities across 32 countries/regions obtained from *Zephyr*, the database of M&A transactions provided by Bureau van Dijk (BvD). M&A volume data are available for the years 2010–2017, including own-city M&As as well as other domestic cities M&As. M&A volume can be decomposed into intensive margins measured by

average volumes per M&A deals and extensive margins by the number of M&A deals expressed as, $MA_{ijt} = N_{ijt} \times \frac{MA_{ijt}}{N_{ijt}}$ where N_{ijt} is the number of M&A deals from city i to j. The gravity models specified in Eqs. (3) and (4) are estimated for both the intensive margins and extensive margins as well as the volume.

City selection depends on the availability of data on the attributes of the city such as population size, per capita GDP, and proxies for the agglomeration of foreign-invested firms. The characteristics at the city level were collected from the Global Power City Index (GPCI) Yearbook published by the Institute of Urban Strategies, The Mori Memorial Foundation, for the period 2010–2017. The GPCI Yearbook collects a variety of statistics from the 44 cities to evaluate and rank them.[3] In addition to the basic gravity variables such as population size (Pop_{it}, Pop_{jt}) and per capita GDP ($Pcgdp_{it}, Pcgdp_{jt}$), proxy variables of agglomeration in the form of the level of corporate tax rates (Tax_{it}, Tax_{jt}), the number of the world's top 300 companies (Agg_Firms_{jt}) and the number of foreign residents ($Agg\_Foreigners_{jt}$) were collected from the dataset. A list of the 44 cities is shown in Table 2, together with the average volume of inward and outward M&A flows per year over the study period. The number of sampled cities increased over time, from 35 in 2010–2011 to 40 in 2012–2015. Two more cities were added in 2016 and 2017, respectively. Hence, the sample size of inter-city M&As for the

[3] The three criteria for city selection (Institute of Urban Strategies, 2018)) are: 1. Top-ten cities in existing influential city rankings; 2. Major cities of countries found in the top ten of existing influential international competitiveness rankings; 3. Cities that do not meet the above criteria but were deemed appropriate for inclusion by the GPCI Executive Committee. However, some cities match one or more of the above criteria but are not evaluated in the GPCI as necessary data are not available.

8 years is (35×35×2) + (40×40×4) + (42×42) + (44×44) = 12,550 at the maximum. The annual volume of M&As can be divided into intra-national and cross-border. In most of the sampled cities, intra-national inward M&As are more dominant than cross-border inward M&As, suggesting the existence of border effects. This observation is also consistent with the finding of 'home bias' in an investigation by Mayer et al. (2010), which analyzes the determinants of French firms' choices of affiliate location.

[Insert Table 2 here]

The geographical distance between origin city *i* and target city *j* ($Dist_{ij}$) was obtained from the *world distance calculator* website. The city-pair dummy variable indicating sister city or friendship cooperation agreements ($Sister_{ijt}$) was constructed by surveying the homepages of each city on the internet. Regarding country-pair characteristics, following Head and Ries (2008), this study employs directional dummy variables for colonial relationships to indicate M&As to a former colony from its colonizer ($ToCLNY_{ij}$) and M&As from a colony to its colonizer ($FromCLNY_{ij}$). These are obtained from the Centre d'Etudes Prospectives et d'Informations Internationales as well as other country-pair characteristics, including the common currency dummy ($COMCUR_{ij}$), common language dummy ($LANG_{ij}$), and RTA dummy (RTA_{ijt}). To consider the impact of country-level FDI regulation in the target city (RFI_{jt}), the total FDI regulatory restrictiveness index (RRI), which measures statutory

restrictions on FDI, was collected from the OECD. Table 3 shows the descriptive statistics of the variables.

[Insert Table 3 here]

4. Estimation results

4.1 Base results

Table 4 shows the basic results from the pooling estimation for Eq. (3). The results show the estimated coefficients from PPML and robust standard errors clustered at the city pair in brackets to account for the correlation within a city pair. All estimations include year fixed effects, although the results are suppressed. Columns (1)–(5) report the results for the intensive margin measured as the average volume per M&A deals. Columns (6)–(10) show the results for the extensive margin as the number of M&A deals, and columns (11)–(15) indicate the results for the volume of M&A deals. As PPML is a non-linear model, the sum of the coefficients of both margins is not equal to the coefficients for the volume. All the models include the market sizes of both the origin and target city, and the distance between them. As shown in the results of empirical studies on the bilateral gravity model, the economic sizes of both cities have a positive impact on M&As between cities, while the geographical distance between the two cities is, as expected, significantly and negatively associated with inter-city M&As. This result is always consistent, even when considering other covariates.

[Insert Table 4 here]

Columns (2), (7), and (12) show the results of the model with the border dummy variable that takes the value of 1 when the target city is located in a foreign country. As for the volume of M&A deals in column (12), the coefficient of the border dummy is significantly negative, indicating that cross-border M&As would be approximately one-third of intra-national M&As ($\exp[-1.159]$=0.314), holding other factors constant. This result is consistent with the results in Table 1, which show that, in most cities, the average volume of intra-national M&As is significantly larger than that of cross-border M&As. As demonstrated by the gravity model of trade, border effects are still noticeable even if the effects of distance are controlled. In addition, the results from the decomposition of M&A volume into the intensive margin and the extensive margin indicate that such a border effect is found only for the extensive margin.

The result in column (3) shows that other time-varying city and city pair characteristics are not associated with inter-city M&As. The exception is $Agg_Firms_{jt}$the number of the world's top 300 companies introduced into the model as a proxy for the agglomeration of foreign-invested firms in the target city. The agglomeration has a statistically significant and positive impact on the volume of M&A and mainly on the extensive margin, while the coefficient of another measurement for agglomeration, i.e., that of foreign residents, $Agg\_Foreigners_{jt}$ is not statistically significant.

Regarding corporate tax rates, since this study only covers major cities in the world, cities and regions known for being tax havens are not included in the analysis. The

insignificance of the tax rate in the target city may be due to the lack of variation in the sample. As a city-pair attribute, this study examines the possible positive effect of twin/sister cities or cooperation agreements on inter-city M&A volume. However, contrary to expectations, the coefficient of the sister city dummy variable is not statistically significant. Originally, the conclusion of sister city agreements may have been intended for cultural exchange rather than strengthening economic ties, but in some cases, they mutually exchange investment promotion delegates. The results of this study show that investment in two cities does not necessarily accelerate even if the official connection between cities is strengthened; instead, investment is increased in cities without such bureaucratic connections.

Columns (4)–(5), (9)–(10), and (14)–(15) show the results from the model where country pair-level variables are added as well as city-level variables. Although the signs of the common currency dummy and common language dummy are not statistically significant, those of the colonial relationship dummy and RTA dummy, being intuitively plausible (only for the volume and the extensive margin), are statistically significant and positive. Even if country-pair level variables are introduced into the model, they do not change the significance of city-level variables.

4.2 Alternative specification

This study also examines the equation in which dummy variables for the city-year origin and the target city year are introduced in place of explicit variables. Table 5 shows the

results from the model with time-varying city fixed effects. Remarkably, the coefficient of the border dummy variable is still significant at the 1% level, even after the time-varying city fixed effects are introduced into the model. As shown in Eq. (4), introducing interacted terms of time-varying city attributes and the border dummy leads to an alternative specification that examines the heterogenous effect of city characteristics between intra-national and cross-border. Columns (1), (6), and (11) in Table 5 show the results of the interaction between the border dummy and the number of the world's top 300 firms ($CBRD_{ij} \times Agg\_Firms_{jt}$), which are compatible with the results in Table 4, showing a statistically significant positive effect on the extensive margin and the volume. As an alternative measurement, the model with the interaction term of border dummy and the number of foreign residents ($CBRD_{ij} \times Agg\_Foreigners_{jt}$) is also estimated, and its coefficient turns out to be statistically significant and positive, as reported in columns (2), (7), and (12). These results support the assertion that the concentration of foreign-invested companies and foreign workers has the effect of further promoting subsequent cross-border inward M&As. In addition to the variables of interest, the effects of other factors, such as tax rates and regulations, were also examined. With respect to the tax impacts ($CBRD_{ij} \times \ln Tax_{it}, CBRD_{ij} \times \ln Tax_{jt}$) shown in columns (13) and (14), as for the volume, no statistically significant impact is detected for both the origin and the target cities. In contrast, statistically significant impacts are found for both intensive and extensive margins. Specifically, for the extensive margins, there is a positive impact from the tax rate in the origin city, as shown in

column (8). This result is consistent with the observation that high tax rates induce outward investment in tax avoidance. Regarding the tax rate in the target city, the sign of the coefficient differs between the intensive margin and the extensive margin, as shown in columns (4) and (9). The negative effect of tax rates in the target city consistent with expectations is observed for intensive margins. A high tax rate in the target city has the effect of lowering average volumes per M&A deals and increasing the number of deals, but does not affect the total volume. As shown in column (15), country-level investment regulation ($CBRD_{ij} \times RFI_{jt}$), which is measured by the total FDI RRI, is found to be negatively associated with inter-city M&As, and the impact is concentrated in the extensive margin as shown in column (10). A higher RRI reflecting foreign capital regulation at the country level is likely to inhibit M&A decisions. As a robustness check, time-invariant city-pair fixed effects are introduced to the gravity equation. The endogeneity can be eliminated by the fixed-effect model under the assumption that unobserved city-pair specific effects are time-invariant. The results indicate that the main results still hold, even after unobserved origin-target city-pair effects are controlled.

[Insert Table 5 here]

4.3 Goodness of fit for the gravity model by inter-city data

Unlike previous studies, this study succeeds in obtaining results consistent with the conventional gravity model, even when using inter-city data. The fit of the gravity model is often examined by comparing the predicted and actual values. Here, we discuss the goodness

of fit using the estimation results. Figures 1 and 2 show the goodness of fit based on the results from Eq. (3) (i.e., column 14 in Table 4) for 2010 and 2017. The vertical axis shows the average value of the inward M&A volume of the target city, and the horizontal axis shows the predicted value as a logarithmic value. A 45-degree line is also shown on the table, with the upper side representing "outperform" and the lower side, "underperform." Most of them tend to gather around the 45-degree line, but some cities are scattered from there. Comparing 2010 and 2017, it seems that 2017 is more likely to show dissipation, suggesting that the gap between winners and losers is widening, but there are some cities in which inward M&A was successfully increased during this period, perhaps because the policy to promote inward investment was successful. For example, Geneva, Cairo, Fukuoka, and Copenhagen (especially Copenhagen) moved down from the 45-degree line in 2010, but all of them except Fukuoka showed significant improvement through 2017.

[Insert Figures 1 and 2 here]

In addition to the results of considering the effects of explicit variables, the model that also controls unobservable factors gives almost perfect predictions. Figure 3 shows the relationship between the predicted value and the actual value based on the result obtained from the model introducing the city-year fixed effects. The sampled cities coincide with the 45-

degree line. These results show that urban-level M&A flows can be estimated by the gravity model, as has been shown in conventional gravity analyses by bilateral data.

5. Conclusion

With regard to the determinants of FDI, many previous studies relied on bilateral data to utilize gravity models. Unlike the existing literature, this study uses disaggregated M&A data at the city level for the years 2010–2017 to examine whether the gravity model can explain inter-city M&As around the world. The empirical strategy builds on the framework of the gravity model for bilateral FDI and empirically examines the effect of city-level attributes. The study focuses on the role of the border effect and the agglomeration of foreign-invested firms.

The estimation results from the PPML reveal that the gravity model fits well for even the inter-city data. Although the range of cities covered in the study is very limited, the evidence that the gravity model is applicable even between cities reveals the untapped potential of gravity models. The study also examines the border effect that differentiates intra-national and cross-border M&As. The value of cross-border M&As has nearly quadrupled in the last ten years (UNCTAD, 2019) but the results of this study show that border effects are still substantial.

As for city attributes, this study sheds light on the role of the agglomeration of foreign-invested firms in target cities in M&As across major cities. It is found that the agglomeration is positively associated with the volume of inward M&As and mainly with the extensive margin. The sharing of resources and knowledge through pools of foreign-invested firms and foreign

workers agglomerated in the target cities will benefit subsequent investors. From the results, it is concluded that the agglomeration of foreign firms or workers has a positive impact on inward M&As. Policy debates have highlighted the importance of promoting inward investment to spur economic growth. The results of this study show that the agglomeration of global firms has a cyclical effect that leads to subsequent inward investment, suggesting that agglomeration promotes investment concentration in specific cities.

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Figure 1. Goodness of fit for gravity with explicit variables (2010)

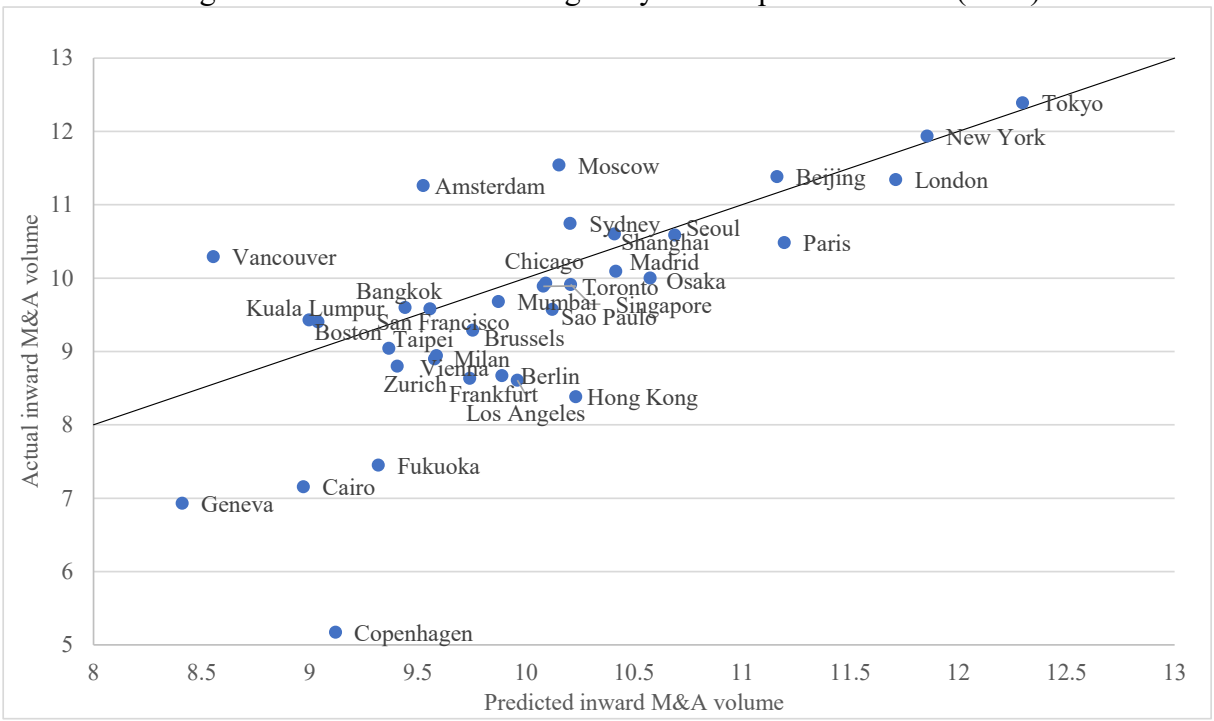

Figure 2. Goodness of fit for gravity with explicit variables (2017)

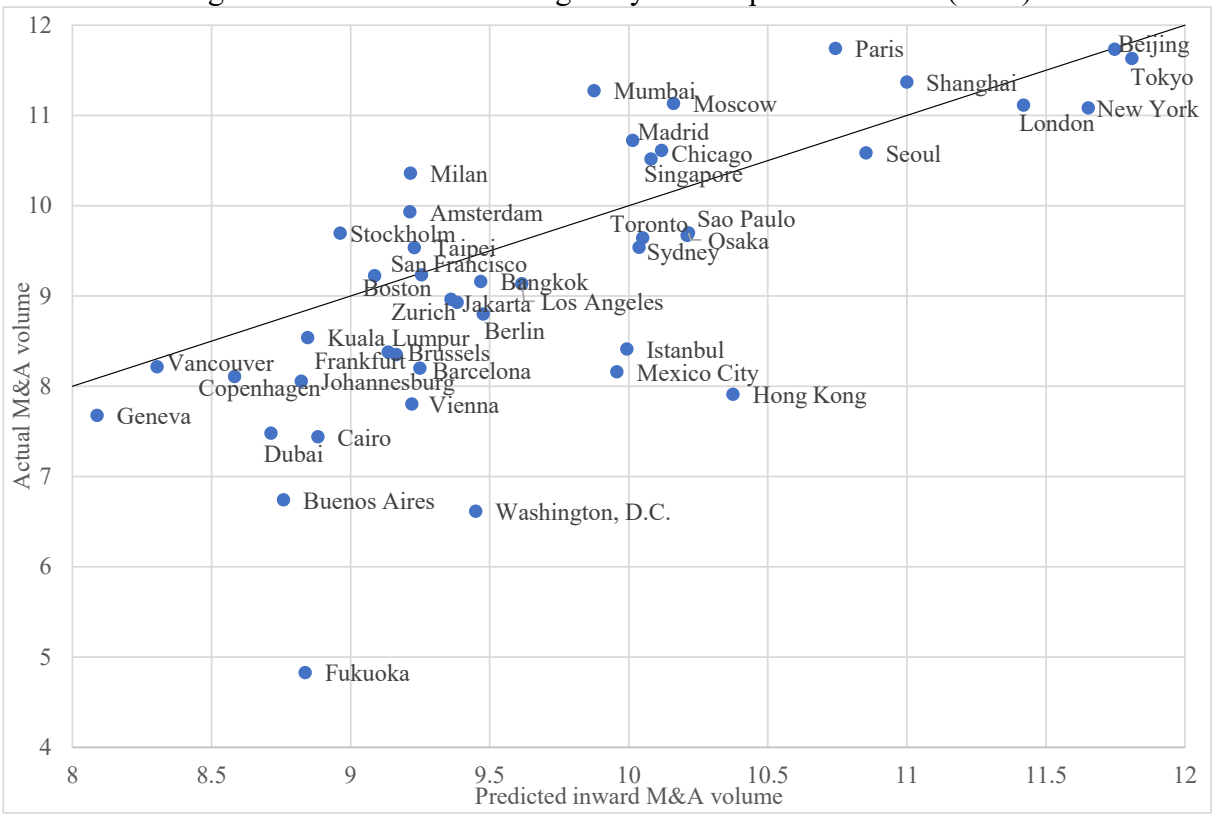

Figure 3. Goodness of fit for gravity with city-year fixed effects

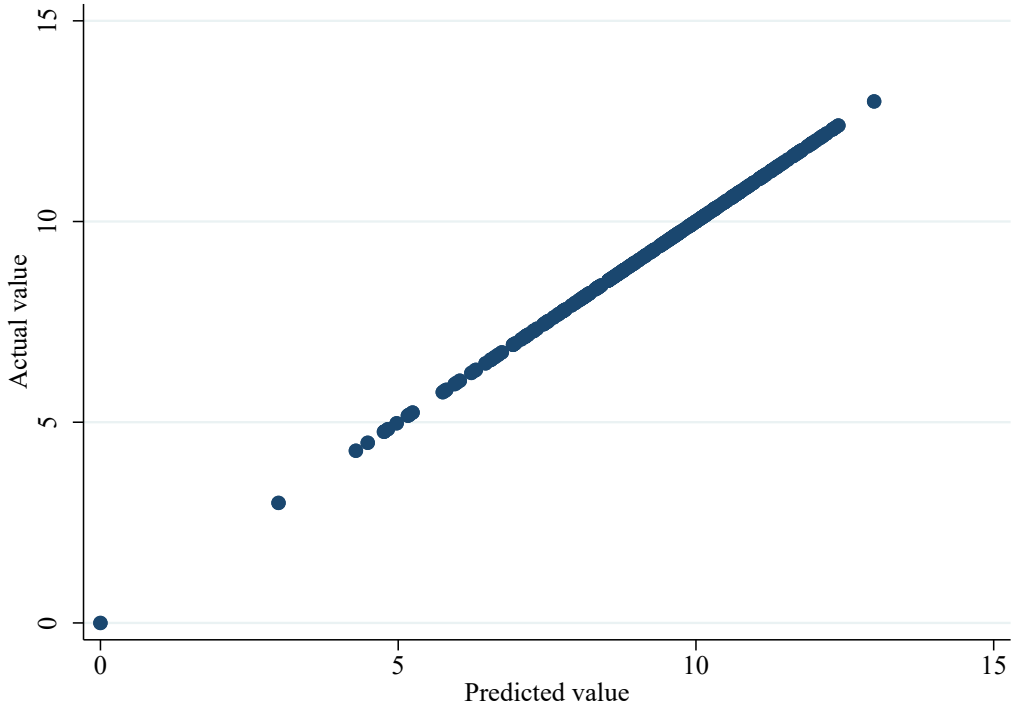

Table 1. Share of M&A volumes for top recipient cities in 2017

Country	Top 1%	Top 5%	Top 10%
China	66.5%	82.5%	88.8%
France	55.6%	77.1%	88.6%
Germany	25.4%	57.8%	72.6%
Japan	60.8%	86.5%	92.9%
UK	46.7%	68.1%	81.8%
US	38.6%	75.0%	85.6%

Source: Author's computation based on the *Zephyr* database by BvD.

Table 2. Sampled cities and the annual average volume of M&As (USD million)

		Inward M&A		Outward M&A	
City	Availability	Intra-national	Cross-border	Intra-national	Cross-border
Amsterdam	2010-2017	5125	21294	5510	32555
Bangkok	2010-2017	3438	1066	3738	1666
Barcelona	2012-2017	3742	1500	924	839
Beijing	2010-2017	51631	15505	68244	17546
Berlin	2010-2017	1583	2932	1406	1300
Boston	2010-2017	6816	1348	23830	10654
Brussels	2010-2017	2523	3925	2532	18574
Buenos Aires	2017	2475	1381	2473	566
Cairo	2010-2017	230	1452	356	197
Chicago	2010-2017	20942	6605	40123	7009
Copenhagen	2010-2017	717	294	534	317
Dubai	2017	1025	1125	791	1982
Frankfurt	2010-2017	1435	1719	2451	2535
Fukuoka	2010-2017	549	78	310	34
Geneva	2010-2017	312	702	197	1052
Hong Kong	2010-2017	5443	2276	811	7154
Istanbul	2012-2017	1416	2521	1247	382
Jakarta	2016-2017	4233	3959	4504	688
Johannesburg	2016-2017	1856	447	879	1234
Kuala Lumpur	2010-2017	3585	2044	3830	1004
London	2010-2017	27957	46343	47081	66447
Los Angeles	2010-2017	5024	1758	8764	8788
Madrid	2010-2017	14155	17537	19999	9622
Mexico City	2012-2017	5648	1813	5130	1946
Milan	2010-2017	6489	13091	8567	2075
Moscow	2010-2017	34619	21172	41436	10506
Mumbai	2010-2017	12500	5907	14475	761
New York	2010-2017	92644	16201	120077	63677
Osaka	2010-2017	8970	2004	5621	3869
Paris	2010-2017	16548	16165	21326	35728
San Francisco	2010-2017	23773	2368	19044	6603
Sao Paulo	2010-2017	16213	5090	17454	1405
Seoul	2010-2017	25452	5287	27738	3422
Shanghai	2010-2017	31503	7652	33884	3542
Singapore	2010-2017	7849	7193	7828	28896
Stockholm	2012-2017	3237	5024	4923	4931
Sydney	2010-2017	14210	8354	15584	7570
Taipei	2010-2017	5327	818	6865	3005
Tokyo	2010-2017	64618	8052	74541	42758
Toronto	2010-2017	10546	4404	11974	19909
Vancouver	2010-2017	4171	4433	3704	1842
Vienna	2010-2017	963	2173	1525	1087
Washington, D.C.	2012-2017	2246	1235	11700	4519
Zurich	2010-2017	1814	3532	2432	12312

Table 3. Descriptive statistics

Variable	Description	Obs	Mean	Std. Dev.	Min	Max
MA_{ijt}	M&A flow (Ten thousand USD)	12,550	34580	312830	0	12900000
$\ln Pop_{it}$	Origin city's population (log, 1000)	12,550	7.98	1.18	5.25	10.10
$\ln Pcgdp_{it}$	Origin city's per capita GDP (log, USD)	12,550	10.62	0.91	7.41	12.13
$\ln Pop_{jt}$	Target city's population (log, 1000)	12,550	7.98	1.18	5.25	10.10
$\ln Pcgdp_{jt}$	Target city's per capita GDP (log, USD)	12,550	10.62	0.91	7.41	12.13
$\ln Dist_{ij}$	Distance btw origin and target city (log, km)	12,550	8.39	1.66	0	9.89
$CBRD_{ij}$	Cross-border dummy	12,550	0.95	0.22	0	1
$Sister_{ijt}$	Sister city pair dummy	12,550	0.13	0.33	0	1
$\ln Tax_{it}$	Tax rate in origin city (log, %)	12,550	3.29	0.66	-6.91	3.82
$\ln Tax_{jt}$	Tax rate in target city (log, %)	12,550	3.29	0.66	-6.91	3.82
Agg_Firms_{jt}	The N of top 300 firms in target city	12,550	1.11	0.91	0	4.08
$Agg\_Foreigners_{jt}$	The N of foreign residents in target city	11,158	12.25	1.06	10.07	14.72
$COMCUR_{ij}$	Common currency dummy	12,550	0.09	0.29	0	1
$LANG_{ij}$	Common language dummy	12,550	0.19	0.39	0	1
$ToCLNY_{ij}$	To colony dummy	12,550	0.03	0.16	0	1
$FromCLNY_{ij}$	From colony dummy	12,550	0.03	0.16	0	1
RTA_{ijt}	RTA dummy	12,550	0.29	0.45	0	1
RFI_{jt}	Total FDI Regulatory Restrictiveness Index	11,242	0.11	0.09	0.02	0.43

Table 4. Base results from the gravity model for inter-city M&As

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	Intensive margin: average volume per M&A deals					Extensive margin: the number of M&A deals					Volume of M&A deals				
City-level variables															
$\ln Dist_{ij}$	-0.201***	-0.422*	-0.411*	-0.227	-0.236	-0.508***	-0.305***	-0.299***	-0.274***	-0.279***	-0.493***	-0.368***	-0.376***	-0.347***	-0.362***
	[0.0280]	[0.230]	[0.236]	[0.155]	[0.151]	[0.0199]	[0.0342]	[0.0308]	[0.0310]	[0.0357]	[0.0181]	[0.0498]	[0.0508]	[0.0380]	[0.0425]
$CBRD_{ij}$		2.101	2.111	0.677	0.335		-1.919***	-1.943***	-2.411***	-2.413***		-1.159**	-1.008*	-1.370***	-1.347**
		[2.013]	[2.103]	[0.815]	[0.685]		[0.282]	[0.266]	[0.381]	[0.428]		[0.493]	[0.532]	[0.497]	[0.583]
$\ln Pop_{it}$	0.328**	0.369***	0.399***	0.450***	0.367***	0.752***	0.731***	0.706***	0.738***	0.776***	0.610***	0.605***	0.571***	0.610***	0.618***
	[0.142]	[0.109]	[0.111]	[0.113]	[0.120]	[0.110]	[0.103]	[0.0872]	[0.0927]	[0.102]	[0.143]	[0.138]	[0.131]	[0.132]	[0.145]
$\ln Pcgdp_{it}$	0.634***	0.677***	0.463	0.518**	0.464***	0.479***	0.481***	0.0781	0.0516	0.571***	0.703***	0.696***	0.292*	0.328**	0.633***
	[0.194]	[0.235]	[0.285]	[0.259]	[0.120]	[0.109]	[0.103]	[0.129]	[0.116]	[0.149]	[0.141]	[0.138]	[0.151]	[0.163]	[0.150]
$\ln Pop_{jt}$	0.764***	0.789***	0.809***	0.814***	0.673***	0.798***	0.790***	0.783***	0.852***	1.056***	0.762***	0.762***	0.649***	0.678***	0.708***
	[0.0960]	[0.0938]	[0.106]	[0.127]	[0.182]	[0.130]	[0.125]	[0.0950]	[0.114]	[0.132]	[0.125]	[0.122]	[0.133]	[0.169]	[0.209]
$\ln Pcgdp_{jt}$	0.475*	0.504**	0.285	0.36	0.359*	0.217*	0.18	-0.187	-0.21	0.494**	0.421***	0.397***	0.0153	0.0177	0.428
	[0.247]	[0.256]	[0.355]	[0.349]	[0.206]	[0.114]	[0.112]	[0.117]	[0.149]	[0.241]	[0.134]	[0.140]	[0.147]	[0.203]	[0.266]
$Sister_{ijt}$			-0.501	-0.397	-0.298			-0.242	-0.221	-0.149			-0.464*	-0.451*	-0.417
			[0.361]	[0.336]	[0.403]			[0.254]	[0.217]	[0.216]			[0.265]	[0.263]	[0.275]
$\ln Tax_{it}$			0.0139	0.0763	0.842			-0.0548	-0.0335	-0.0901			0.549	0.923	1.256
			[0.221]	[0.447]	[1.056]			[0.0646]	[0.100]	[0.0772]			[0.413]	[0.697]	[0.784]
$\ln Tax_{jt}$			-0.0922	-1.147	-1.152			-0.0641	-0.468	-0.849**			-0.102	-0.717	-0.76
			[0.116]	[0.799]	[0.783]			[0.0729]	[0.348]	[0.423]			[0.139]	[0.770]	[0.845]
Agg_Firms_{jt}			0.288	0.267				0.463***	0.510***				0.453***	0.427***	
			[0.223]	[0.176]				[0.108]	[0.0997]				[0.0735]	[0.0736]	
$Agg\_Foreigners_{jt}$					0.313					-0.0955					0.0662
					[0.211]					[0.114]					[0.108]
Country-level variables															
$COMCUR_{ij}$				-0.0692	-0.0663				-0.305	-0.331				-0.0902	-0.0527
				[0.528]	[0.549]				[0.281]	[0.289]				[0.463]	[0.476]
$LANG_{ij}$				0.599*	0.0694				0.479**	0.351				0.453	0.145
				[0.354]	[0.378]				[0.227]	[0.248]				[0.290]	[0.350]
$ToCLNY_{ij}$				-0.0487	0.161				0.775**	0.788**				0.431	0.537
				[0.377]	[0.395]				[0.305]	[0.319]				[0.410]	[0.415]
$FromCLNY_{ij}$				0.376	0.241				1.461***	1.579***				1.188***	1.248***
				[0.462]	[0.576]				[0.318]	[0.329]				[0.335]	[0.365]
RTA_{ijt}				0.836***	0.596**				0.683***	0.722***				0.778**	0.709*
				[0.266]	[0.255]				[0.202]	[0.228]				[0.362]	[0.374]
RFI_{jt}				0.052	-1.392				0.118	1.799*				-0.127	0.292
				[1.695]	[1.413]				[0.983]	[0.997]				[0.725]	[0.984]
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-11.01***	-12.47***	-9.045*	-7.900**	-10.64***	-16.52***	-15.89***	-8.717***	-8.266***	-19.17***	-9.822***	-9.460***	-2.829	-3.266	-11.61***
	[3.144]	[4.129]	[5.421]	[3.811]	[3.846]	[3.144]	[3.207]	[2.640]	[3.181]	[3.978]	[2.020]	[2.043]	[1.816]	[2.194]	[2.561]
Observations	12,550	12,550	12,550	11,242	10,040	12550	12550	12550	11242	10040	12550	12550	12550	11242	10040
R-squared	0.003	0.007	0.008	0.016	0.03	0.669	0.673	0.765	0.796	0.724	0.586	0.587	0.635	0.641	0.61
Log Likelihood	-1.64E+08	-1.61E+08	-1.60E+08	-1.44E+08	-1.16E+08	-39045	-36423	-33842	-28406	-28058	-4.78E+08	-4.7E+08	-4.41E+08	-3.94E+08	-3.6E+08

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors clustered within city pairs are in brackets.

Table 5. Results from the model with the time-varying origin and target city fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	Intensive margin: average volume per M&A deals					Extensive margin: the number of M&A deals					Volume of M&A deals				
City-level variables															
$\ln Dist_{ij}$	-0.169***	-0.235***	-0.173***	-0.199***	-0.160***	-0.236***	-0.249***	-0.225***	-0.225***	-0.223***	-0.330***	-0.361***	-0.324***	-0.326***	-0.319***
	[0.0440]	[0.0518]	[0.0486]	[0.0537]	[0.0473]	[0.0169]	[0.0236]	[0.0152]	[0.0136]	[0.0136]	[0.0212]	[0.0274]	[0.0214]	[0.0223]	[0.0195]
$CBRD_{ij}$	-1.469***	-10.39***	2.659	8.934**	-1.786***	-2.901***	-11.92***	-7.211***	-9.627***	-1.193***	-2.963***	-14.90***	-3.127**	-0.841	-1.899***
	[0.563]	[3.155]	[2.301]	[3.929]	[0.659]	[0.296]	[1.415]	[2.058]	[1.823]	[0.328]	[0.664]	[2.088]	[1.578]	[2.273]	[0.691]
$Sister_{ijt}$	-0.487**	-0.365	-0.435*	-0.435*	-0.507**	-0.25	-0.128	-0.151	-0.16	-0.0427	-0.603***	-0.516***	-0.476**	-0.448**	-0.398*
	[0.236]	[0.251]	[0.246]	[0.250]	[0.246]	[0.212]	[0.193]	[0.202]	[0.206]	[0.167]	[0.204]	[0.197]	[0.215]	[0.210]	[0.220]
$CBRD_{ij} \times Agg\_Firms_{jt}$	0.31					0.343***					0.338***				
	[0.242]					[0.0898]					[0.127]				
$CBRD_{ij} \times Agg\_Foreigners_{jt}$		0.784***					0.750***					1.016***			
		[0.243]					[0.110]					[0.146]			
$CBRD_{ij} \times \ln Tax_{it}$			-1.073					1.382**					0.172		
			[0.653]					[0.603]					[0.416]		
$CBRD_{ij} \times \ln Tax_{jt}$				-2.844**					2.123***					-0.501	
				[1.146]					[0.523]					[0.765]	
$CBRD_{ij} \times RFI_{jt}$					5.330*					-12.51***					-7.860***
					[2.772]					[1.472]					[2.382]
Country-level variables															
$COMCUR_{ij}$	-0.816*	-0.34	-0.861*	-0.873*	-0.776*	0.228	0.257	0.116	0.214	-0.376	-0.598	-0.122	-0.628	-0.598	-0.946*
	[0.472]	[0.422]	[0.459]	[0.460]	[0.457]	[0.193]	[0.185]	[0.206]	[0.196]	[0.236]	[0.549]	[0.426]	[0.547]	[0.529]	[0.529]
$LANG_{ij}$	0.0567	-0.359	0.0353	0.0583	-0.097	0.472**	-0.0105	0.384*	0.491**	0.812***	0.169	-0.338	0.0815	0.0797	0.231
	[0.280]	[0.278]	[0.272]	[0.264]	[0.286]	[0.208]	[0.222]	[0.210]	[0.198]	[0.234]	[0.262]	[0.232]	[0.255]	[0.258]	[0.253]
$ToCLNY_{ij}$	0.655	0.612	0.692	0.674	0.923*	0.761**	0.614	0.784**	0.765**	0.375	0.998**	0.68	1.098**	1.119**	0.890*
	[0.455]	[0.466]	[0.444]	[0.434]	[0.488]	[0.383]	[0.390]	[0.375]	[0.327]	[0.389]	[0.504]	[0.418]	[0.504]	[0.522]	[0.505]
$FromCLNY_{ij}$	0.321	0.328	0.363	0.375	0.501	1.223***	0.926***	1.347***	1.255***	0.658**	0.928***	0.642**	0.999***	1.022***	0.687**
	[0.444]	[0.419]	[0.450]	[0.458]	[0.454]	[0.311]	[0.304]	[0.304]	[0.301]	[0.294]	[0.331]	[0.316]	[0.346]	[0.343]	[0.331]
RTA_{ijt}	1.305***	0.869***	1.301***	1.219***	1.522***	0.791***	0.600***	0.852***	0.811***	0.534***	1.034***	0.619***	1.065***	1.044***	0.947***
	[0.292]	[0.263]	[0.279]	[0.261]	[0.291]	[0.148]	[0.149]	[0.145]	[0.139]	[0.145]	[0.241]	[0.208]	[0.248]	[0.232]	[0.261]
Observations	12550	11158	12550	12550	11242	12550	11158	12550	12550	11242	12550	11158	12550	12550	11242
Log Likelihood	-1.23E+08	-98100000	-1.23E+08	-1.21E+08	-1.15E+08	-20400	-17638	-20399	-20031	-18151	-3.16E+08	-2.57E+08	-3.18E+08	-3.18E+08	-2.92E+08

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors clustered within city pairs are in brackets.