RIETI Discussion Paper Series 19-E-011

Geography and Realty Prices: Evidence from International Transaction-Level Data

MIYAKAWA, Daisuke
Hitotsubashi University

SHIMIZU, Chihiro
Nihon University

UESUGI, Iichiro
RIETI

RIETI
Research Institute of Economy, Trade & Industry, IAA

The Research Institute of Economy, Trade and Industry
https://www.rieti.go.jp/en/

RIETI Discussion Paper Series 19-E-011
February 2019

Geography and Realty Prices: Evidence from International Transaction-Level Data[1]

Daisuke MIYAKAWA
Hitotsubashi University
Chihiro SHIMIZU
Nihon University
Iichiro UESUGI
Hitotsubashi University and RIETI

Abstract

In this paper, we examine the role of international capital flows in real estate prices by quantifying the relationship between conditions in the location of residence or registration of investors or investment firms and the prices they pay for their realty investments as well as the spillover effect of such capital flows on property prices in the host countries of their investments. Using a unique dataset accounting for about 30,000 realty investment transactions in Australia, Canada, France, Hong Kong, Japan, the Netherlands, the United Kingdom, and the United States, we find the following. First, foreign investors pay significantly higher prices than domestic investors, even after taking a wide variety of controls into account. Second, the larger the buyers' experience with realty investments in the host countries, the smaller the over-payment tendency. These results indicate that foreign investors are overcharged when they are less informed about the property market and that the extent to which they are overcharged decreases with the more investment experience they have. Third, we did not find any significant spillover effects from overpaying by foreign investors to real estate prices in host countries. This finding is consistent with a group of extant studies employing aggregate-level data to examine the link between international capital flows and real estate prices.

Keywords: Realty prices; Transaction data; Geographic location; Spillover effects
JEL classification: D83, F21, G12, R30

[1]This research was conducted as a part of the Project "Study Group on Corporate Finance and Firm Dynamics" undertaken at Research Institute of Economy, Trade and Industry (RIETI). It is also part of the work supported by JSPS KAKEN Grant (S) 25220502. We thank Bob White, Jim Sempere, Yiqin Wang, Doug Murphy, Willem Vlaming, and Yogeeta Chatoredussy of the RCA for kindly providing the data on international real estate transactions and for their valuable comments. We would also like to thank Makoto Yano, Hiroshi Ohashi, Masayuki Morikawa, Takatoshi Ito, Andrew Rose, Li Jing, Masaki Mori, Yasuhiro Nakagami, Mathias Hoffman, Wataru Ohta, Jiro Yoshida, Michio Suzuki, Naoki Wakamori, Daniel Janusz Marszalec, Seung-Gyu Sim, Tetsuji Okazaki, Kentaro Nakajima, Naohito Abe, Kiyohiko Nishimura, Paul Schreyer, Dan McMillen, Seow Eng Ong, and Christian Hilber as well as participants of the NBER-EASE, RIETI-Hitotsubashi conferences, the JEA annual meeting, and seminars at Osaka University and the University of Tokyo, for their valuable comments.

1. Introduction

Given that real estate is one of the major investment objects in international financial market, a large body of literature has attempted to examine the impact of international capital flows on realty prices. The interaction between international capital flows and real estate markets has become even more relevant in the age of a "global saving glut," in which a large influx of capital from emerging economies has lowered long-term interest rates and contributed to a run-up in asset prices (Bernanke 2005). In recent years, many pieces of anecdotal evidence suggest that foreign investors are the central cause of local property booms.[1] Also, a considerable number of studies have examined the argument that global imbalances in financial flows have resulted in massive fluctuations in asset prices, above all in real estate prices. On the one hand, Jordà et al. (2014) argue that a change in monetary policy in one country can potentially generate large fluctuations in realty prices in other countries through changes in international capital flows. On the other hand, Favilukis et al. (2013) have expressed doubt that changes in international capital flows lead to large fluctuations in realty prices.

All of these pieces of evidence point to the importance of geography when we examine the real estate market. As demonstrated by Coval and Moskowitz (2001), who focus on the distance between fund managers and portfolio companies in the stock market, geography matters in the asset market in general since the physical distance between investors and assets is one of the major determinants of asset returns. It matters even more when investors and assets are geographically separated by national borders.

However, there has been a paucity of studies that employ disaggregated data and examine the role of geographical distances between investors and real estate properties, especially when they are separated by national borders.[2] This is presumably due to a lack of international transaction-level data on realty investment, which are needed for a precise analysis of international financial flows and their impact on property prices. As a result, it is not sufficiently clear whether the pattern of prices paid by foreign and domestic real estate investors differs and how any potential differences in pricing patterns affect real estate markets.

Against this background, the present study employs a unique transaction-level dataset on real estate properties and seeks to investigate how geography plays a role in the real estate market. It does so by focusing on the case when investors and properties are separated by national borders.

[1] See, for example, articles such as "Hot in the City," *The Economist*, April 2, 2016.
[2] A notable exception is the study by Badarinza and Ramadorai (2016).

Specifically, in this study, we conduct the following three analyses. First, we identify the country where each of the investors in the market is located and examine how realty prices paid for by foreign investors differ from those paid by domestic investors. The estimations control for a comprehensive list of property characteristics (such as location, type, size, and age) and transaction characteristics (such as the geographical location of the buyer and the seller, and the type of buyer and seller), so that we can exclude potential confounding factors affecting the price paid by investors.

Second, we consider the possibility that the informational disadvantage associated with investing over a longer distance and across borders diminishes as international investors learn about local real estate markets through so-called "learning by investing" (see, e.g., Sorensen 2008, Gompers et al. 2008). Such learning by investing may be particularly important in the case of real estate investment, since the extent of information asymmetry between buyers and sellers is substantial.

Third, after examining whether foreign investors indeed pay over the odds and, finding that this is the case, we investigate whether this has any effect on property prices in the neighborhood. For the analysis, we employ information on the timing and geographical location of each property sale to test if the prices paid by domestic investors for properties in the vicinity of a property purchased by a foreign investor are significantly higher after the purchase by the foreign investor. Regarding prices paid by local investors before the purchase by the foreign investor as control observations and prices paid by local investors after the purchase by the foreign investor as treatment observations, we compare the two sets of prices to explicitly test whether any causal impact from foreign property purchases on local real estate market can be observed.

The novelty of this study is at least threefold. First, this study is the first to explicitly examine differences in the behavior of foreign and domestic investors in the realty market. Second, this study is also the first to focus on international investors' real estate experience and examine how this experience alleviates the information asymmetry over time. Third, this study is the first to explicitly study the causal effect of foreign real estate investment on local markets. Our dataset providing information on both the precise geographical location and timing of each transaction allows us to address this identification challenge.

The main findings of our analysis can be summarized as follows. First, we find that foreign investors pay substantially higher prices than domestic investors, even after taking a wide variety of controls into account. Second, this price difference becomes smaller the greater buyers' investment

exposure in a host country. These results are fairly robust even when we limit the sample to repeated sales observations allowing us to control for unobserved property characteristics such as quality. Taken together, these results indicate that foreign investors tend to pay inflated prices when they are less informed about the local realty market. Third, however, we did not find any significant spillover effects from foreign investors paying over the odds on local real estate prices. This finding is consistent with a group of extant studies employing aggregate data suggesting that the impact of international capital flows on real estate markets is limited (e.g., Favilukis et al. 2013).

The remainder of this study is organized as follows. In Section 2, we briefly survey the related literature that provides the theoretical underpinnings of our empirical analysis. Next, in Section 3, we explain the data and our empirical framework. In Section 4, we then present and discuss the empirical results on realty prices paid by foreign and domestic investors and on spillover effects. Section 5 concludes and considers questions for future research.

2. Related Literature and Theoretical Underpinnings

In this section, we first provide a brief survey of studies on the impact of international capital flows on local realty prices. We then survey the literature examining how the information asymmetry resulting from the geographical distribution of investors affects realty prices of various types. Finally, we present the related literature on price spillovers in the real estate market.

A considerable number of studies quantitatively examine the determinants of real estate prices, including the role of international capital flows. For instance, using aggregate-level data on 43 countries from 1978 to 2008, Aizenman and Jinjarak (2009) show that there is a positive association between countries' current account deficits, which reflect capital inflows, and increases in real estate prices. Similarly, Justiniano et al. (2014), using a quantitative equilibrium model, suggest that international capital flows accounted for a sizable portion of the increase in U.S. house prices before the 2008 financial crisis. On the other hand, Favilukis et al. (2013), also focusing on U.S. house prices, argue that international capital flows at most played a minor role. Ferrero (2015) argues that domestic factors such as lower collateral requirements rather than foreign factors including current account deficits facilitate access to external funds and drive up housing prices.

These studies have yet to reach a decisive conclusion regarding the extent of the impact of a country's current account deficit and resulting capital inflows on the local realty market. Also, a

country's current account deficit means that capital can flow into the country in a variety of forms, such as the purchase of riskless sovereign bonds, securities issued by private companies, and real estate properties. Therefore, simply establishing causality between capital inflows and realty prices does not necessarily indicate that foreign buyers purchase a substantial amount of local real estate properties in the market. This issue needs to be addressed using more disaggregated data.

As for studies examining the impact of information asymmetry caused by the geographical distribution of buyers and properties in the realty market, these mostly focus on buyer-property distances within a country.[3] Based on the theoretical discussion in Kurlat (2016), Kurlat and Stroebel (2015), for example, use data on realty transactions for Los Angeles County in the United States and analyze the determinants of changes in realty prices. They find that the physical characteristics of both the property itself and nearby properties as well as information asymmetry about these characteristics between insiders (i.e., residents in the area) and outsiders determine realty prices. Specifically, they find that price increases are smaller the larger the share of informed sellers and the less informed buyers are. Based on this finding, they conclude that information asymmetry is an important determinant of realty prices. In a similar vein, using realty transaction data for the United States, Garmaise and Moskowitz (2004) find that the geographical distances between buyers and properties are shorter the greater the information asymmetry faced by buyers. They further find that the median distance between buyers and properties is short (i.e., 47 km) and the distance between buyers and properties is shorter the greater the dispersion of realty prices, although the latter finding is less pronounced the older properties are. In sum, they show that information asymmetry associated with the geographical distance between buyers and properties is an important determinant of changes in property prices. However, one important shortcoming of the abovementioned studies is that they examine the impact of distance-induced information asymmetry when buyers and properties are located in different countries.

Note that there exist several types of mechanisms which reduce the extent of information asymmetry in the market. One of them emphasizes the role of experience. Gompers et al. (2008) focus on the behavior of venture capital investors and find that it is experienced rather than inexperienced investors that respond quickly to positive information in the market. Similarly, Sorensen (2008), also

[3] There are studies that examine the effect of distance-induced information asymmetry on asset markets other than real estate. Coval and Moskowitz (2001), for instance, focus on the stock market and show that the geographical distance between the fund manager and companies in their portfolios matters for performance.

focusing on venture capitalists, posits a dynamic model of "learning by investing" and arrives at empirical findings consistent with his theory.

One of the few studies examining the role of distance when buyers and properties are separated by borders is that by Badarinza and Ramadorai (2015), who focus on the specific circumstances when shocks in foreign countries are transmitted to the local realty market. Employing realty transaction information for London, they show that an exogenous shock in a home country (i.e., outside of UK) affects the realty prices in spatially limited areas in London where many people born in the home country reside. This result, which they label the "safe haven effect," indicates that certain types of shocks in foreign countries can be transmitted to the local realty market. Based on this study, we directly identify transactions made by foreign investors and contrast them with transactions by domestic investors using data on multiple host countries rather than one.

However, none of the above studies employing transaction level data and examining the impact of distance-induced information asymmetry on realty prices analyze the spillovers of price shocks on other properties or the comovement of prices across real estate properties. An examination of such spillovers or the comovement of prices is important for evaluating the aggregate impact of investments by outside buyers, especially those from foreign countries. While there are no such study that directly address this issue (to the best knowledge of the authors), Autor et al. (2014) focus on the abolishment of rent control in Cambridge, Boston, and examine spillovers of realty prices from previously-rent controlled properties on properties that were not subject to rent controls.

Given the abovementioned studies, we will focus on the behavior of realty investors that are located in foreign countries in order to disentangle the mechanism of an influx of foreign capital affecting domestic real estate market. These foreign buyers are faced with information asymmetry caused by geographical distance from local real estate properties, but their investment experience in the local market may substantially reduce such asymmetry. Further, we will examine the existence of spillover effects of such foreign realty investment on the prices paid in other realty transactions in the neighborhood. Combining the results of these analyses, we are able to evaluate the role of foreign investors in the realty market during the period that includes the years of a "global saving glut."

3. Data and Empirical Approach

3.1. Data overview

The data used for this study are transaction-level data for the period from 2005 to 2015. We obtain the data from Real Capital Analytics Inc. (RCA), one of the largest data vendors specializing in real estate investments. The data provided by RCA reflect institutional investment activities and cover relatively large investment transactions, involving real estate properties worth in excess of about US$ 1 million. The original data cover 71,000 realty transactions in Australia, Canada, France, Hong Kong, Japan, the Netherlands, the United Kingdom, and the United States. Although the data cover properties in a large number of cities (namely, 1,223 cities), a large part of the observations are concentrated in the major cities of eight economies, namely, Amsterdam (Netherlands); Chicago, Los Angeles, New York, and San Francisco (United States); Tokyo and Osaka (Japan); Paris (France); London (United Kingdom); Sydney (Australia); Toronto and Vancouver (Canada); and Hong Kong (Hong Kong). This means that the data we use are mainly for large investments in major cities.

The data contain various types of information regarding the investment transactions. Information included concerns the property involved in the transaction, namely, the price in US$, the floor area of the building in square feet, and the land area in acres. For the analysis, we use the natural logarithm of these variables (*LN_PriceUSD*, *LN_Floor*, and *LN_Land*). The data also contain the age of each structure (*Age*) as well as its type. Properties are classified into the following types: apartment, development site, hotel, industrial, office, other, retail, and seniors housing and care facility. Given this classification, we use eight dummy variables (*Property type*) to represent the property type, with seniors housing and care facilities serving as the reference group.

In addition, the dataset contains a wide range of transaction-related information. This includes the country in which the property is located (*Property country*), the country in which the buyer is located (*Buyer country*), and the country in which the seller is located (*Seller country*). In our empirical analysis, we control for these characteristics by including eight dummy variables for *Property country* and up to 102 dummy variables for *Buyer country* and *Seller country*.[4]

The data further contain information on the type of buyer investors and the type of seller investors of a property. Buyer and seller investors are classified into various categories (see Tables 1(d) and (e)) and we construct dummy variables to represent them. The *Buyer/Seller investor type* variables capture the detailed characteristics of investment funds (e.g., corporate,

[4] In the original dataset, we have information on up to three buyers and sellers for each transaction. We use the information on buyers and sellers listed at the top if there are multiple buyers or sellers. Note, however, that in most of the transactions in the dataset there are only one buyer and one seller.

developer/owner/operator, investment manager, or REIT). We construct dummy variables for these investor types in order to represent differences in the funding environment they face.

Table 1 provides an overview of our data, which consists of observations for 28,893 transactions. Note that the number of observations reduces from the original 71,000 to fewer than 30,000 due to the lack of information on some variables. Panel (a) shows the distribution of properties by type. As can be seen, apartments make up the largest share of properties in the database, followed by offices, industrial sites, and retail properties. Panel (b) shows the distribution by year of transaction. The figures indicate that there was a substantial reduction around 2008 and 2009 due to the global financial crisis. Panel (c) shows the distribution by country where properties are located. The United States makes up the largest shares, followed by Japan and Australia. The numbers for several countries – such as France and the UK – are much smaller than one would expect given the size of their economies. This is presumably due to missing information for several variables used in the analysis. Panels (d) and (e) show the distributions by buyer and seller investor type. In both panels, REITs make up the largest share, followed by equity funds, corporates, and investment managers.

We use *Property country* and *Buyer country* to construct a dummy variable, *ForeignBuyer*, that equals one if the two countries differ and zero otherwise. We hypothesize that information asymmetry is likely to be greater in the case of *ForeignBuyer*=1, which, in turn, is likely to lead to higher transaction prices (or possibly lower returns) than in the case of *ForeignBuyer*=0 (i.e., domestic buyer). Further, in order to take buyers' investment experience in a particular country into account, we calculate the cumulative amount of investment of all buyers located in country A in real estate in country B. This pairwise variable is measured for the period up to month *t*-1. Although we could compute this variable for each buyer, we choose to construct the variable at the country level. This choice reflects our assumption based on Badarinza and Ramadorai's (2015) finding that there is information sharing among buyers in one country. Since this variable monotonically increases over the observation period, following Gompers et al. (2008), we standardize it to construct a variable, *CUMINV*, by dividing it by the cumulative total sum of investment of all buyers in country A in *all* host countries measured up to month *t*-1. Table 2 provides summary statistics for our variables.

3.2. Empirical framework

Using our transaction-level data, we examine how buyers' characteristics (in particular

ForeignBuyer, *CUMINV*, and the interaction term of these two variables) as well as other transaction-specific factors affect the transaction price employing the following linear regression model:

$$LN\_PriceUSD_{i,p,b,s,t} = \alpha + \beta_1 ForeignBuyer_{i,p,b} + \beta_2 CUMINV_{p,b,t} + \beta_3 ForeignBuyer_{i,p,b} \times CUMINV_{p,b,t} + \boldsymbol{X}_{it}\boldsymbol{\gamma} + \eta_p^1 + \eta_b^2 + \eta_s^3 + \eta_t^4 + \varepsilon_{i,t} \quad (1)$$

The variable on the left-hand side of the equation is the natural logarithm of the transaction price of property *i* in country *p* sold by a seller in country *s* to a buyer in country *b* at time *t* (measured monthly). On the right-hand side of the equation, $\boldsymbol{X}_{it}$ represents property characteristics such as the size, age (time-variant) and type of the property, which are important determinants of the price of a property. $ForeignBuyer_{i,p,b}$ is a dummy variable that equals one if country *p* and country *b* are different. $CUMINV_{p,b,t}$ is the standardized cumulative investment amount from country *b* in country *p* for the period up to the month preceding *t*. We include the interaction term $ForeignBuyer_{i,p,b} \times CUMINV_{p,b,t}$ to test for the possibility that the impact associated with $ForeignBuyer_{i,p,b}$ varies with $CUMINV_{p,b,t}$. The four variables $\{\eta_p^1, \eta_b^2, \eta_s^3, \eta_t^4\}$ respectively represent country fixed-effects for the country in which the property is located, country fixed-effects for the country in which the buyer is located, country fixed-effects for the country in which the seller located, and time fixed effects.

As another main specification, we also estimate the following equation:

$$LN\_PriceUSD_{i,p,b,s,t} = \alpha + \beta_1 ForeignBuyer_{i,p,b} + \beta_3 ForeignBuyer_{i,p,b} \times CUMINV_{p,b,t} + \boldsymbol{X}_{it}\boldsymbol{\gamma} + \eta_{t,p}^1 + \eta_{t,b}^2 + \eta_{t,s}^3 + \varepsilon_{i,t} \quad (2)$$

In this specification, the time-invariant country effects are replaced with time-variant country effects, i.e., we replace $\{\eta_p^1, \eta_b^2, \eta_s^3\}$ with $\{\eta_{t,p}^1, \eta_{t,b}^2, \eta_{t,s}^3\}$. In this model, some variables reflect changes in macroeconomic conditions in host/buyer/seller countries including their output, employment, and exchange rates, while other variables such as buyer/seller investor types show how different types of investors react to macroeconomic shocks during the observation period. Note that we exclude the variable $CUMINV_{p,b,t}$, which is also time-variant, from the equation in order to avoid

possible collinearity with other variables.

While we include a fair number of property characteristics that likely affect transaction prices, it is still possible that there may be omitted variables. If, for example, we have failed to include an important property characteristic that affects $LN\_PriceUSD_{i,p,b,s,t}$ and is correlated with $ForeignBuyer_{i,p,b}$, the coefficient β_1 will suffer from endogeneity bias. One characteristic that might affect property prices and that we have not controlled for is detailed information on the location of a property (such as the street). To examine this possibility, the six panels in Figure 1 depict the location of properties bought by foreign investors (marked by a star) and domestic investors (marked by a dot) in Los Angeles, Paris, Toronto, London, Tokyo, and Sydney as illustrative examples. As can be seen, there does not appear to be a substantial systemic difference in terms of the areas where foreign and domestic investors bought properties. We therefore do not include further location-related variables in the baseline estimations. However, we will implement several additional analyses that control for the potential heterogeneity of property locations in a more appropriate manner than in the baseline. We employ information on the latitude and longitude of each transacted property in order to calculate the geographical distances between properties purchased by domestic buyers and those purchased by foreign buyers. The first way in which we try to control for the potential heterogeneity of property locations is to match each property purchased by domestic buyers with a property purchased by foreign buyers and located closest to the property purchased by domestic buyers. We limit the sample to properties purchased by domestic buyers whose matched properties are located within a radius of certain distances. The second way in which we try to control for the potential heterogeneity of property locations is to employ the repeat-sales approach. We focus on properties that have been purchased by both domestic and foreign buyers at different times and compare the difference in transacted prices.[5]

4. Empirical Analysis

4.1. Baseline estimation

In this section, we present the results of the estimation of Equations (1) and (2). The results are displayed in Table 3, where columns (1) and (2) show the coefficient estimates for Equation (1) and columns (3) and (4) show the coefficient estimates for Equation (2). In each estimation, the most

[5] Note, however, that we are not able to capture changes in real estate values caused by depreciation and renovation using the repeat sales approach.

important coefficients are those on the foreign investor variable ($ForeignBuyer_{i,p,b}$), the cumulative investment amount of the buyer's country ($CUMINV_{p,b,t}$), and the interaction term of these two variables ($ForeignBuyer_{i,p,b} \times CUMINV_{p,b,t}$).

We start by considering the results in columns (1) and (2). In column (1), the coefficient on $ForeignBuyer_{i,p,b}$ is positive and significant, indicating that purchase prices are higher when the buyer is foreign (i.e., $\beta_1 > 0$). In Column (2), when we add $CUMINV_{p,b,t}$ and $ForeignBuyer_{i,p,b} \times CUMINV_{p,b,t}$ to the estimation, the coefficients on $ForeignBuyer_{i,p,b}$ and $CUMINV_{p,b,t}$ are both positive and significant, while the coefficient on $ForeignBuyer_{i,p,b} \times CUMINV_{p,b,t}$ is negative and significant. These coefficient estimates indicate that foreign investors pay higher prices (i.e., $\beta_1 > 0$), but that the extent to which foreign investors pay higher prices diminishes the larger the cumulative investment from country *b* in country *p* (i.e., $\beta_3 < 0$).

The estimation results further imply that a country's cumulative investment has a positive impact on purchase prices when the investment is domestic (i.e., $\beta_2 > 0$) but the opposite impact when the investment is in another country (i.e., $\beta_3 < 0$ and $|\beta_3| > |\beta_2|$). This differential impact of $INVACC_{p,b,t}$ depending on whether the investment is at home or abroad suggests that the variable may be capturing different things in the case of domestic and foreign investment. While in our analysis we assume that the variable represents foreign buyers' investment experience in a country, in the case of domestic investment it might be a proxy for strong demand for property. That is, domestic buyers are already well informed about the domestic property market, so that the variable does not capture investment knowledge and experience; instead, the link between greater cumulative investment and property prices means that the property market is heating up.

The coefficients for the remaining variables employed in the estimations in columns (1) and (2) are generally as expected. Purchase prices are higher the larger the floor area of the property structure (*LN_Floor*), the younger the structure (*Age*), and the larger investment from countries other than the country of the buyer is (*INV_OTHER*). Note, however, that the size of the land of the property (*LN_Land*) has a negative impact on price once the size of the floor area is controlled for.

Next, let us turn to the estimation results based on Equation (2), which are shown in columns (3) and (4). In column (3), the coefficient on $ForeignBuyer_{i,p,b}$ is positive but insignificant. Meanwhile, in column (4), where we add the $ForeignBuyer_{i,p,b} \times CUMINV_{p,b,t}$ variable, we find that the coefficient on $ForeignBuyer_{i,p,b}$ remains positive and significant, while the coefficient on

$ForeignBuyer_{i,p,b} \times CUMINV_{p,b,t}$ is negative and significant. These coefficients indicate that foreign investors pay higher purchase prices (i.e., $\beta_1 > 0$) and that the extent to which foreign investors pay higher prices diminishes the larger the cumulative investment from country *b* in country *p* (i.e., $\beta_3 < 0$). The coefficients of the remaining variables are qualitatively similar to those in columns (1) and (2).

We evaluate the varying impact of buyers' being from foreign countries on transaction prices according to the different values of $CUMINV_{p,b,t}$ and show the results in Figure 2. The figure shows the level of $CUMINV_{p,b,t}$ along the horizontal axis, the marginal impact of $ForeignBuyer_{i,p,b}$ conditional on the level of $CUMINV_{p,b,t}$ on the purchase price along the vertical axis, and the 95% confidence interval (dashed lines). The estimated coefficients for $ForeignBuyer_{i,p,b}$ (0.409) and $ForeignBuyer_{i,p,b} \times CUMINV_{p,b,t}$ (-0.798) indicate that the conditional marginal impact of $ForeignBuyer_{i,p,b}$ slopes downward as $CUMINV_{p,b,t}$ increases. The figure shows that the point estimate of the conditional marginal impact of $ForeignBuyer_{i,p,b}$ is positive for $CUMINV_{p,b,t}$ of 0.51 or less. Given that, as shown in the summary statistics in Table 2, the mean and standard deviation of $CUMINV_{p,b,t}$ are 0.78 and 0.18, respectively, this means that only in a relatively minor share of purchases by foreign investors do they pay a higher price than domestic investors would. This implies that paying over the odds by foreign buyers is limited to a small proportion of foreign buyers from countries with little exposure to the host country.

In addition to the link between $ForeignBuyer_{i,p,b}$ and property prices, the results in columns (3) and (4) allow us to examine the time-varying investment performance of each investor category. We focus on the results in column (4), since they are quite similar to those in column (3). We use the coefficients on *Buyer investor type*Year* and *Seller investor type*Year* dummies in the column in order to construct Figures 3 and 4. First, Figure 3 shows the difference between (i) coefficients on time-variant seller investor type dummies and (ii) coefficients on time-variant buyer investor type dummies. Specifically, the figure shows the differences for equity funds and pension funds. The estimated coefficients are taken from Table 3, column (4). We interpret these differences as the profit margin for each type of investor for each year. The figure shows a sharp decline in these margins right after the financial crisis. Interestingly, the extent of the drop is larger for equity funds than for pension funds, possibly reflecting the fact that debt turnover is more frequent among equity funds than pension funds and that they are more likely to fire-sell assets in their portfolio. Second, Figure 4 plots the

means and standard deviations of these margins for all types of investors. We see that investors such as equity funds and "finance" exhibit higher risk and return profiles, while pension funds show lower risk and return profiles.

4.2. Estimations controlling for geographical proximity and property fixed effects

In the baseline estimation in the previous subsection, we assumed that the heterogeneity in property prices across observations is explained by a number of factors, including the host, buyer, and seller countries, property characteristics, and the buyer type. However, it is still possible that our estimation did not adequately take geographical proximity between real estate properties into account, since the baseline estimation includes only country dummies for geographical information on real estate properties. In order to deal with this issue, we implement two additional estimations in this subsection: (1) We employ information on geographical proximity between properties and pair properties purchased by foreign and domestic investors. And (2), we focus on properties that were sold multiple times and apply the repeat-sales methodology.

We begin by controlling for geographical proximity by collecting information on real estate properties that are located close to each other. We take the following steps in order to pair properties purchased by domestic investors with properties in close proximity purchased by foreign investors. We start by measuring the geographical distances between all pairs of real estate properties using the latitude and longitude information on each real estate property. Then, for each property purchased by domestic investors, we match the properties that are purchased by foreign investors and located closest to the property purchased by domestic investors. In the process of this matching, we set a threshold for the maximum radius within which the matching is done. We employ a radius of 100m and of 500m. Finally, using these matched observations, we regress realty price on the set of explanatory variables employed in the baseline estimation.

As a result of this procedure, we drop from our observations a certain number of properties that were purchased by foreign (domestic) investors but located far from any of the properties purchased by domestic (foreign) investors. When we construct the dataset by limiting the sample to observation that satisfy the constraint of a 500m radius, the sample size drops to slightly above 20,000 observations. On the other hand, when we limit the sample using the constraint of a 100m radius, the sample size falls to about 5,400 observations.

The results of the matched sample estimation are presented in columns (1) and (2) of Table 4. The most important coefficients are again those on $ForeignBuyer_{i,p,b}$, $CUMINV_{p,b,t}$, and $ForeignBuyer_{i,p,b} \times CUMINV_{p,b,t}$. The coefficients on these variables are qualitatively the same as in the baseline estimation; that is, they are positive and significant for $ForeignBuyer_{i,p,b}$ and $CUMINV_{p,b,t}$ and negative and significant for the interaction term of the two. Somewhat surprisingly, the coefficient on $ForeignBuyer_{i,p,b}$ is substantially larger in column (2) than in column (1) even though the matched samples of properties purchased by domestic and foreign buyers are located close to each other.

Next, taking one step further, we employ the repeat-sales approach in order to more rigorously control for property fixed effects. Specifically, we identify real estate properties that are sold multiple times using the latitude and longitude information of each property. We further limit the sample of such repeat-sales properties to those that were purchased both by a domestic and a foreign investor at least once during the observation period. We end up with a sample of more than 4,500 properties, which we use for the estimation controlling for property fixed effects. Note that some of the property characteristics variables, such as *LN_Floor* and *LN_Land*, were dropped, since these variables are time-invariant within the repeat-sales sample.

The results are shown in columns (3) and (4) of Table 4. The coefficients in these estimations on $ForeignBuyer_{i,p,b}$, $CUMINV_{p,b,t}$, and $ForeignBuyer_{i,p,b} \times CUMINV_{p,b,t}$ are qualitatively the same as those in the baseline estimation. They are positive and significant for $ForeignBuyer_{i,p,b}$ and $CUMINV_{p,b,t}$ and negative and significant for the interaction terms. The only exception is the coefficient on $ForeignBuyer_{i,p,b}$ in column (3), which is positive but statistically insignificant. This result implies that, at least in this sample, the unconditional marginal impact associated with $ForeignBuyer_{i,p,b}$ is not statistically different from zero.

To summarize, we control for locational proximity and property-level fixed-effects in a more rigorous manner than in the baseline so as to correctly identify the impact of purchases by foreign investors. In both approaches, i.e., when limiting the sample to matched properties in close proximity and when employing the repeat-sales sample, we find that foreign investors pay significantly higher prices than domestic investors and that the extent to which foreign investors overpay is smaller the larger is the cumulative investment from the country of foreign buyers in the host country.[6]

[6] Given that the variable *CUMINV* might take a value close to one if investors headquartered in country A invest in country B for the first time, we carry out two robustness checks. The first is to exclude cases in which a country has

4.3. Subsample estimations

In this subsection, we examine how the estimation results in Table 3 are affected when we use different subsamples. First, we split the observation period into two subperiods. The results are presented in Table 5. The first two columns show the results when we split the period into the period through 2010 (column (1)) and after 2010 (column (2)), while the next two columns show the results for the subperiod through 2008 (column (3)) and after 2008 (column (4)). Overall, the coefficients are qualitatively the same as those in Table 3 with the exception of those in column (3), where all the coefficients on $ForeignBuyer_{i,p,b}$, $CUMINV_{p,b,t}$, and $Foreignbuyer_{i,p,b} \times CUMINV_{p,b,t}$ are statistically insignificant.[7] A notable feature in the results is that the impact associated with $ForeignBuyer_{i,p,b}$ is substantially larger in columns (2) and (4) than in columns (1) and (3). Given that the later periods were periods when real estate markets were recovering from the global financial crisis, this result shows that the importance of information asymmetry increased after the financial crisis. This result somewhat contradicts the widely held view that prices are more likely to be above fundamentals during boom periods.

Second, we split the sample based on the type of property purchased and present the results in Table 6. Specifically, we focus on the following five categories: apartments (column (1)), hotels (column (2)), industrial (column (3)), offices (column (4)), and retail (column (5)). Looking at the coefficients on $ForeignBuyer_{i,p,b}$, $CUMINV_{p,b,t}$, and $ForeignBuyer_{i,p,b} \times CUMINV_{p,b,t}$, we find that only for industrial and office properties do we obtain qualitatively similar results as in the baseline. In contrast, for the other types of properties including apartments, the signs on the coefficients of interest are consistent with our baseline results, but the coefficients are insignificant. The above results suggest that information asymmetry is more likely to be present in the case of types of property whose value is more difficult to measure (e.g., properties for business use) than in the case types of properties whose structures are standardized and whose values are relatively easy to measure (e.g., residential properties).

exposure to properties in only one country. In the second robustness check, instead of *CUMINV,* we use the log of the numerator of *CUMINV,* that is the cumulative investment from country A in country B (without normalizing by the total investment from country A). Both estimations provide results consistent with the baseline results.

[7] Note that these statistically insignificant coefficients for the period before 2008 may be due to the way *CUMINV* is constructed. In order to accurately measure a country's investment experience, which *CUMINV* seeks to gauge, information for a longer period than the subperiod through 2008 may be necessary.

4.4. Estimations with additional explanatory variables

In this subsection, we examine how the baseline results in Table 3 change when we introduce additional variables. In the baseline analysis, we employed dummies for the type of investor purchasing a property as well as buyer country-year dummies and property host country-year dummies without specifying the mechanisms how these dummies affect real estate prices. To be more specific about the mechanisms, we add two sets of variables in Equation (1). The first set concerns the buyer's views and objectives regarding the investment: whether the buyer regards the investment as low-risk and low-return (*Core=1*) or otherwise (*Core=0*), the buyer intends to increase the value of the property and regards the investment as medium-to-high risk and medium-to-high return (*ValueAdded=1*) or otherwise (*ValueAdded=0*), or the buyer intends to occupy the property him/herself (*Occ=1*) or otherwise (*Occ=0*). In our estimation, we drop *Occ* from the independent variables and include only *Core* and *ValueAdded* to measure the impact associated with *Core* and *ValueAdded*, using *Occ* as the baseline case.[8] The second set of variables measures the buyer's investment opportunities both in his/her home country (*Buyer_YoY_Return*) and in the host country (*Host_YoY_Return*). Note that the sample size decreases substantially, since these additional explanatory variables are available only for a limited number of observations. For example, we employ *Buyer_YoY_Return* constructed from the housing price index for a limited number of countries by the Federal Reserve Bank of Dallas.

Table 7 shows the results, which reveal a number of notable findings. First, the signs of the coefficients on $ForeignBuyer_{i,p,b}$, $CUMINV_{p,b,t}$, and $ForeignBuyer_{i,p,b} \times CUMINV_{p,b,t}$ are the same as those in the baseline results, although the coefficient on $CUMINV_{p,b,t}$ is statistically insignificant. Second, buyers' investment objective has a significant impact on the price they pay. It turns out that buyers that regard their investment as medium-to-high risk and expect medium-to-high returns end up paying the highest prices. Third, investment opportunities in buyers' home country, but not those in the host country, have a significant positive impact on the purchase prices. Buyers whose home country real estate market is booming may be less likely to be financially constrained and end up in paying over the odds for real estate overseas.

4.5. Testing for spillover effects

The results presented in Tables 3 to 7 have shown that foreign real estate buyers tend to pay

[8] The data contain "*Other*" as another category regarding buyers' purchase motive. Since we do not have more precise information on this category, we drop the observations for which "*Other* = 1."

higher prices than domestic buyers. Given that this result is obtained controlling for a wide range of property and investor characteristics, it seems possible that property purchases by foreign investors might lead to demand pressure in host country real estate markets. However, whether property purchases by foreign investors at inflated prices create sufficient pressure to have a wider impact on the local real estate market is an empirical matter. Specifically, it will depend on the number of investable properties in the local market and hence the elasticity of supply. In addition, if the markets in which foreign and domestic buyers invest are segmented, the higher prices paid by foreign buyers will not necessarily generate spillover effects on the wider property market.

Based on these considerations, we focus only on properties bought by domestic investors and how the prices paid by them are related to the prices of properties nearby purchased by foreign investors. Properties nearby are those within a 100m radius. In order to identify the causal impact of property purchases by foreign buyers, we distinguish properties bought by domestic investors into those bought before and after property purchases by foreign investors nearby. The former properties are then used as the control group, while the latter are the treatment group. If there are any causal spillover effects from the higher prices paid by foreign buyers on the prices paid by domestic buyers, we should see a statistically significant difference in the prices paid by the two different groups of domestic buyers.

Table 8 outlines the sample we use for this spillover test. Specifically, the table shows that among the 27,505 properties bought by domestic buyers, 23,406 do not have any properties bought by foreign investors nearby (i.e., within a radius of 100m).[9] The number of properties bought by domestic investors that do have a property or properties bought by foreign investors nearby is a total of 4,099. In 1,504 of these case, the domestic investor bought the property before the foreign investor(s), while in 2,101 cases, the domestic investor bought the property after the foreign investor(s). Meanwhile, in 494 cases, foreign buyers bought properties nearby both before and after the domestic buyer.

Using these 27,505 observations, we run the following estimation, which, in addition to various control variables, includes the following two dummy variables: $Placebo_{i,p,b}$, which takes a value of one if property *i* has a property nearby purchased by a foreign buyer *after* the property was

[9] To construct the table and the 1_spillover and 1_placebo variables, we do not set specific upper limits on the length of time between a purchase by a domestic buyer and a purchase by a foreign buyer. As a robustness check, we implement an alternative estimation in which the variables are constructed in a more restrictive manner, that is, the variables take a value of one only in the case there is less than a year between the purchases by domestic and foreign buyers. The results (not reported) are not substantially different from those in Table 9.

bought, and $Spillover_{i,p,b}$, which takes a value of one if property *i* has a property nearby purchased by a foreign buyer *before* the property was bought. Note that as we focus only on properties bought by domestic investors, we cannot include $ForeignBuyer_{i,p,b}$ and $CUMINV_{p,b,t}$ in the equation. If there are any spillover effects as a result of purchases by foreign buyers, we expect $\delta_1 > 0$ but δ_2=0, since purchases by foreign buyers after purchases by domestic buyers should not affect the price paid by domestic buyers. Thus, we estimate the following equation:

$$LN\_PriceUSD_{i,p,b,s,t} = \alpha + \delta_1 \mathbf{1}\_spillover_{i,p,b} + \delta_2 \mathbf{1}\_placebo_{i,p,b} + \delta_3 \mathbf{1}\_spillover_{i,p,b} \times 1\_placebo_{i,p,b} + \boldsymbol{X}_{it}\boldsymbol{\gamma} + \eta_p^1 + \eta_b^2 + \eta_s^3 + \eta_t^4 + \varepsilon_{i,t} \quad (3)$$

Table 9 presents the estimation results. We find that both δ_1 and δ_2 are greater than zero, indicating that domestic buyers tend to pay more for properties that are located close to properties purchased by foreign buyers than for properties that are not close properties purchased by foreign buyers. We also find that these coefficients are almost identical. This indicates that there exists no substantial difference in the premium paid by domestic buyers regardless of whether they purchased their property before or after the foreign buyer(s) purchased theirs. In sum, these results provide evidence for a selection effect in that prices are higher for properties purchased by foreign buyers, while we find no evidence for spillover effects.

5. Conclusion

In this study, we examined whether foreign real estate buyers pay higher prices than their domestic counterparts and, finding that this is the case, investigate whether this has any spillover effects in terms of driving up property prices. Using about 30,000 observations covering realty investment transactions in eight countries and controlling for a comprehensive list of property and transaction characteristics, we find the following. First, foreign investors pay substantially higher prices than domestic investors even after taking various controls into account. Second, this price difference is smaller the larger the cumulative aggregate real estate investment from the buyers' country in the host country. These results suggest that foreign investors tend to pay over the odds when they are less informed about local property markets and that the extent to which they overpay decreases

with buyers' investment experience, which, we assume, is represented by the cumulative investment. Third, despite the finding that foreign investors tend to pay over the odds, we did not find any evidence of significant spillover effects of foreign real estate investment on local real estate markets. The last result suggests that the supply of properties in host countries is fairly elastic and/or there is a certain degree of market segmentation between foreign and domestic property buyers.

Finally, we highlight potential avenues for future research. First, an important extension of this study is to examine if really no spillover effects can be observed under all circumstances and, if this is the case, to consider why. Second, another important research direction would be to examine investors' choice among multiple investment locations. We believe these potential extensions could provide further insights for a better understanding of the price implications of international real estate transactions.

References

Aizenman, J., and Y. Jinjarak (2009) "Current Account Patterns and National Real Estate Markets," *Journal of Urban Economics* 66(2): 75-89.

Autor, D., H. Palmer, J. Christopher, and P. A. Pathak (2014) "Housing Market Spillovers: Evidence from the End of Rent Control in Cambridge, Massachusetts," *Journal of Political Economy* 122(3): 661-717.

Badarinza, C., and T. Ramadorai (2015) "Home Away From Home? Foreign Demand and London House Prices," *mimeo*. Available online at: http://www.bde.es/f/webbde/INF/MenuHorizontal/SobreElBanco/Conferencias/2015/Archivos/27_1140B_BADARINZA_PAPER.pdf

Bernanke, B. (2005) "The Global Saving Glut and the U.S. Current Account Deficit," Remarks at the Homer Jones Lecture, St. Louis, MO.

Coval, J. D., and T. J. Moskowitz (2001) "The Geography of Investment: Informed Trading and Asset Prices," *Journal of Political Economy* 109(4): 811-841.

Favilukis J., D. Kohn, S. Ludvigson, and S. Van Nieuwerburgh (2013) "International Capital Flows and House Prices: Theory and Evidence," in E. L. Glaeser and T. Sinai (eds.), *Housing and the Financial Crisis*, NBER, Cambridge, MA, Chapter 6.

Ferrero A. (2014) "House Price Booms, Current Account Deficits, and Low Interest Rates," *Journal of Money, Credit, and Banking* 47(S1): 261-293.

Garmaise, M. J., and T. J. Moskowitz (2004) "Confronting Information Asymmetries: Evidence from Real Estate Markets," *Review of Financial Studies* 17(2): 405-437.

Gompers P., A. Kovner, J. Lerner, and D. Scharfstein (2008) "Venture Capital Investment Cycles: The Impact of Public Markets," *Journal of Financial Economics* 87(1): 1-23.

Hochberg, Y., A. Ljungqvist, and Y. Lu (2007) "Whom You Know Matters: Venture Capital Networks and Investment Performance," *Journal of Finance* 62(1): 251-301.

Jordà, Ò., M. Schularick, and A. M. Taylor (2014) "Betting the House," NBER Working Paper No. 20771.

Justiniano, A., G. Primiceri, and A. Tambalotti (2014) "The Effects of the Saving and Banking Glut on the U.S. Economy," *Journal of International Economics* 92(S1): S52-S67.

Kurlat, P. (2016) "Asset Markets with Heterogeneous Information," *Econometrics* 84(1): 33-85.

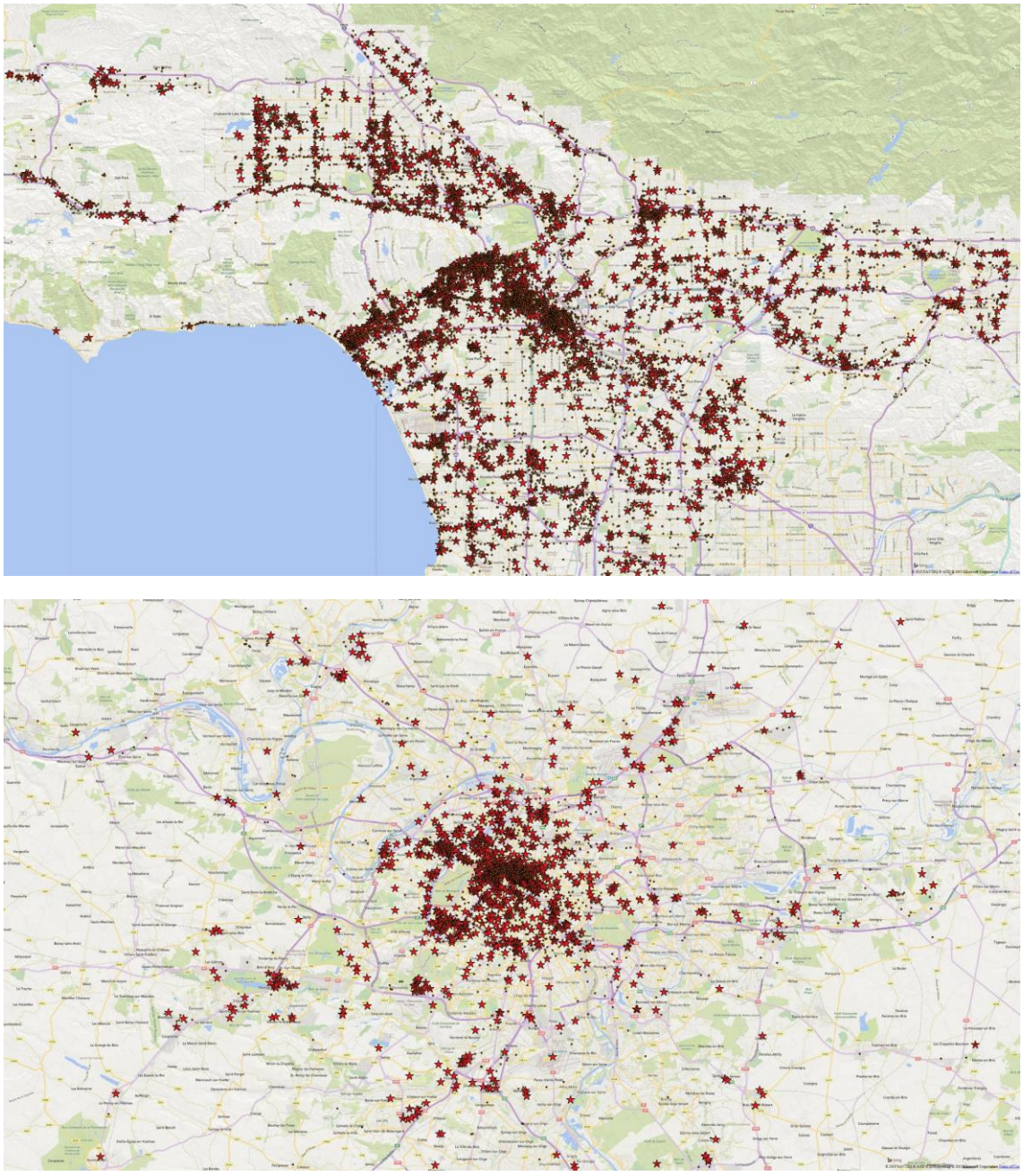
Kurlat, P., and J. Stroebel (2015) "Testing for Information Asymmetries in Real Estate Markets," *Review of Financial Studies* 28(8): 2429-2461.

Leary, M. T., and M. R. Roberts (2014) "Do Peer Firms Affect Corporate Financial Policy?" *Journal of Finance* 69(1): 139-178.

Sorensen M. (2008) "Learning by Investing: Evidence from Venture Capital," AFA 2008 New Orleans Meetings Paper.

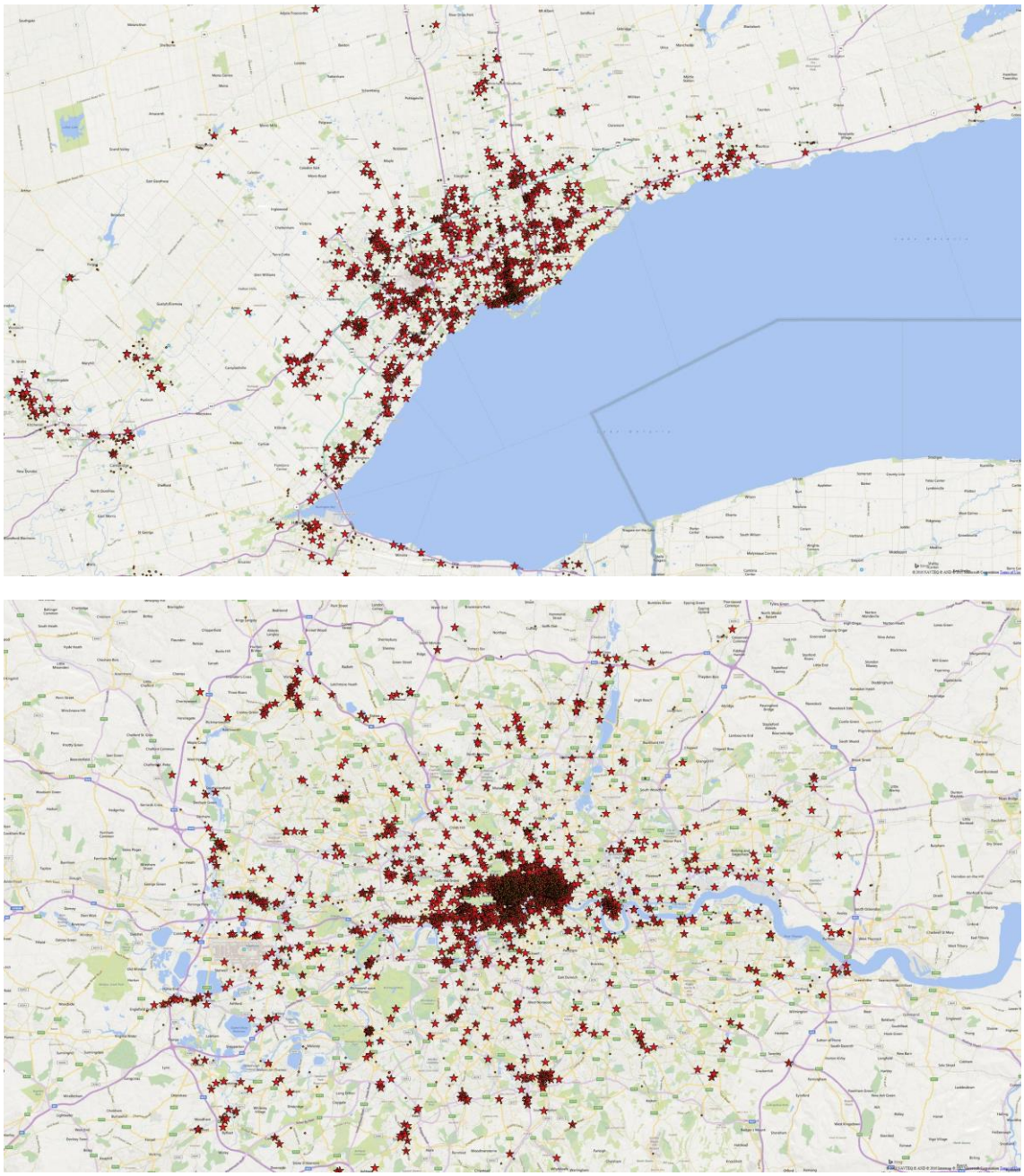
Figures and Tables

Figure 1: Location of properties (purchased by foreign and domestic investors)
(a) Los Angeles and Paris



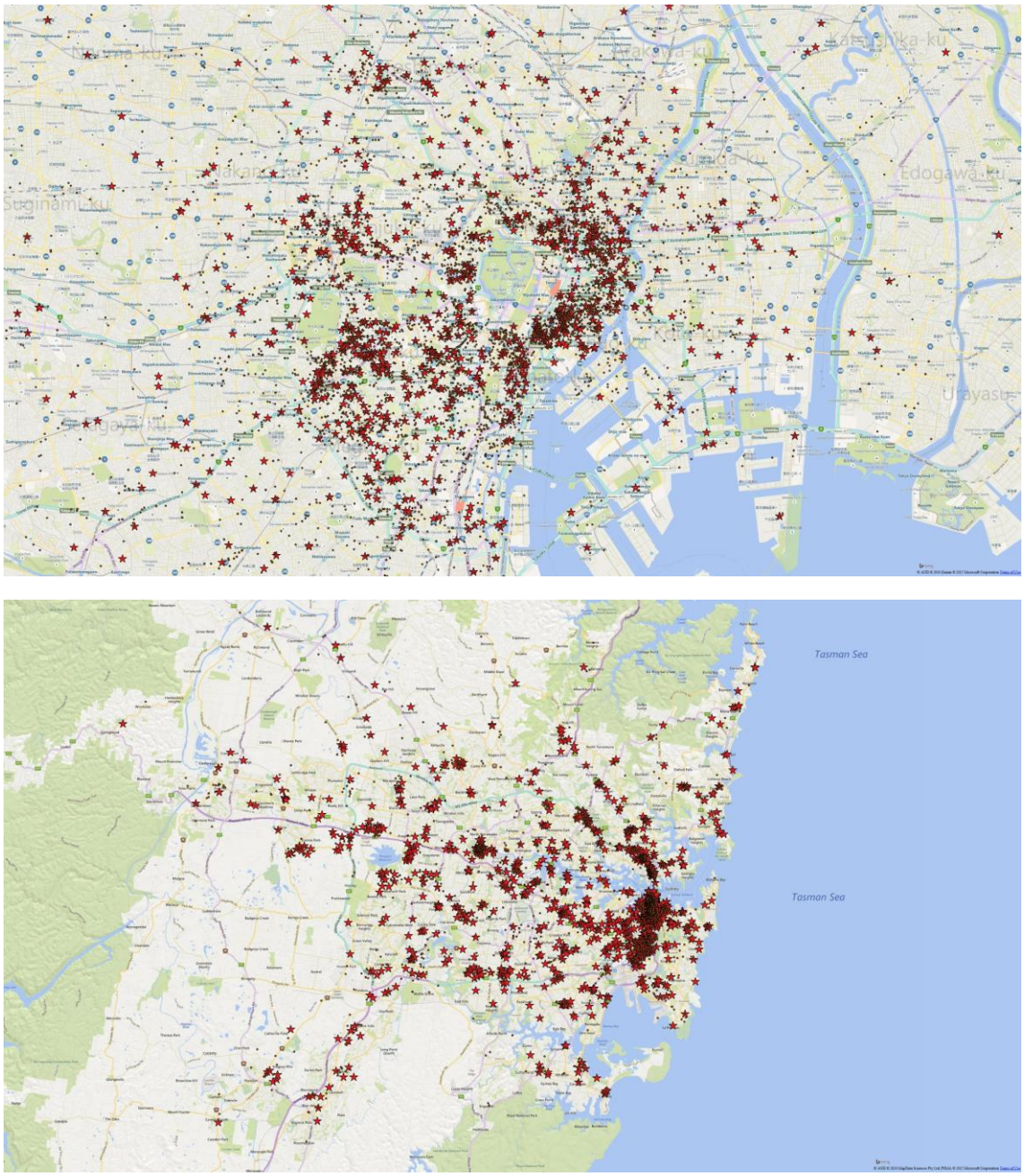
Note: The figure shows the locations of properties bought by foreign investors (stars) and domestic investors (dots) in Los Angeles (upper panel) and Paris (lower panel).

(b) Toronto and London



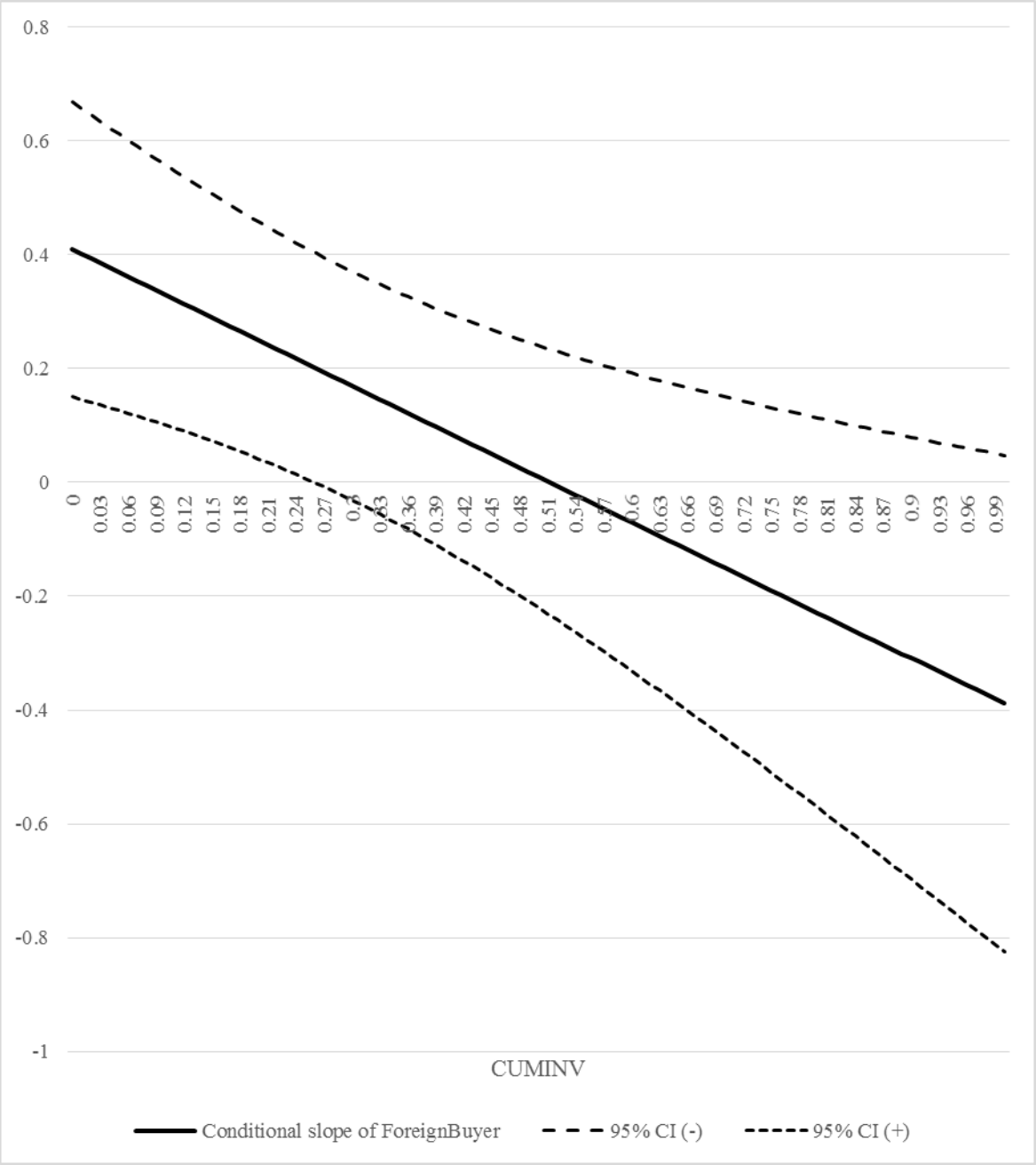
Note: The figure shows the locations of properties bought by foreign investors (stars) and domestic investors (dots) in Toronto (upper panel) and London (lower panel).

(c) Tokyo and Sydney



Note: The figure shows the locations of properties bought by foreign investors (stars) and domestic investors (dots) in Tokyo (upper panel) and Sydney (lower panel).

Figure 2: Marginal effect of *ForeignBuyer* (baseline)

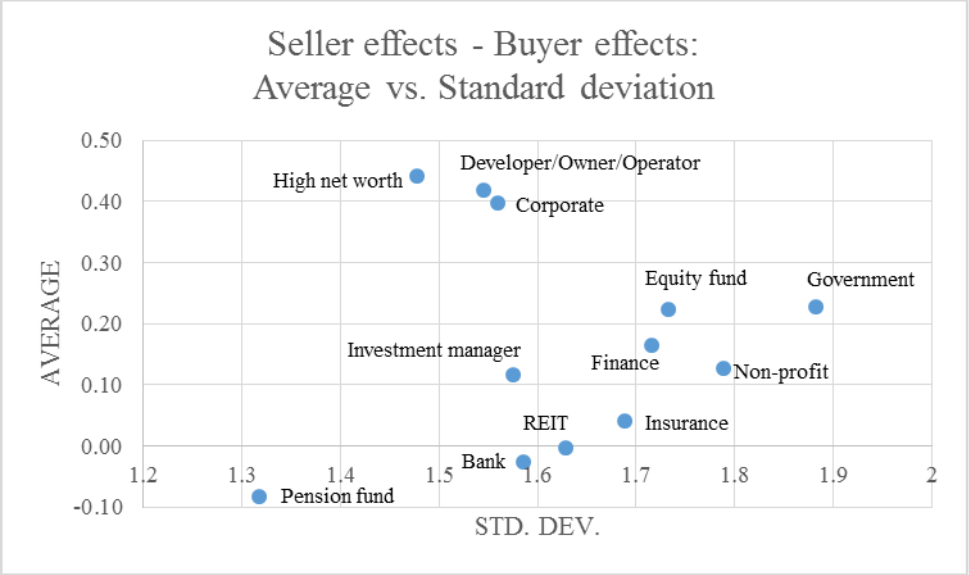


Note: The figure shows the marginal effect of *ForeignBuyer* conditional on the level of *CUMINV*. The estimated coefficients are taken from Table 3, column (2).

Figure 3: Difference between time-variant seller effects and buyer effects:
The cases of equity funds and pension funds

Note: The figure shows the difference between (i) coefficients on time-variant seller investor type dummies and (ii) coefficients on time-variant buyer investor type dummies. Specifically, the figure shows the differences for equity funds and pension funds. The estimated coefficients are taken from Table 3, column (4).

Figure 4: Average and standard deviation of
the difference between time-variant seller effects and buyer effects



Note: The figure shows the averages and standard deviations of the differences between (i) coefficients on time-variant seller investor type dummies and (ii) coefficients on time-variant buyer investor type dummies. We calculate the differences for all the types of investors. The estimated coefficients are taken from Table 3, column (4).

Table 1: Tabulation of transaction-level data

Panel (a): Property type

Category	Freq.	Percent	Cum.
Apartment	10,352	35.83	35.83
Development Site	50	0.17	36
Hotel	655	2.27	38.27
Industrial	5,537	19.16	57.43
Office	7,021	24.3	81.73
Other	120	0.42	82.15
Retail	4,966	17.19	99.34
Seniors Housing & Care	192	0.66	100
Total	28,893	100	

Panel (b): Year

Year	Freq.	Percent	Cum.
2005	1,719	5.95	5.95
2006	2,308	7.99	13.94
2007	2,817	9.75	23.69
2008	1,867	6.46	30.15
2009	1,164	4.03	34.18
2010	1,832	6.34	40.52
2011	2,282	7.9	48.42
2012	3,283	11.36	59.78
2013	3,771	13.05	72.83
2014	4,409	15.26	88.09
2015	3,441	11.91	100
Total	28,893	100	

Panel (c): Country of property location

Country	Freq.	Percent	Cum.
Australia	568	1.97	1.97
Canada	393	1.36	3.33
France	180	0.62	3.95
Hong Kong	62	0.21	4.16
Japan	6,162	21.33	25.49
Netherlands	26	0.09	25.58
United Kingdom	274	0.95	26.53
United States	21,228	73.47	100
Total	28,893	100	

Table 1: Tabulation of transaction-level data (continued from the previous page)

Panel (d): Buyer investor type

Category	Freq.	Percent	Cum.
Unknown	533	1.84	1.84
Bank	191	0.66	2.51
Cooperative	1	0	2.51
Corporate	1,563	5.41	7.92
Developer/Owner/Operator	16,819	58.21	66.13
Educational	112	0.39	66.52
Equity Funds	1,611	5.58	72.09
Finance	281	0.97	73.07
Government	151	0.52	73.59
High Net Worth	548	1.9	75.49
Insurance	192	0.66	76.15
Investment Manager	1,322	4.58	80.73
Listed Funds	35	0.12	80.85
Non-Traded REIT	389	1.35	82.19
Non-Profit	131	0.45	82.65
Open-Ended Funds	103	0.36	83
Other	23	0.08	83.08
Other/Unknown	2	0.01	83.09
Pension Funds	106	0.37	83.46
REIT	3,613	12.5	95.96
Religious	34	0.12	96.08
REOC	1,066	3.69	99.77
Sovereign Wealth Funds	67	0.23	100
Total	28,893	100	

Table 1: Tabulation of transaction-level data (continued from the previous page)

Panel (e): Seller investor type

Category	Freq.	Percent	Cum.
Unknown	710	2.46	2.46
Bank	726	2.51	4.97
CMBS	1	0	4.97
Cooperative	2	0.01	4.98
Corporate	2,040	7.06	12.04
Developer/Owner/Operator	16,813	58.19	70.23
Educational	40	0.14	70.37
Endowment	3	0.01	70.38
Equity Funds	1,395	4.83	75.21
Finance	602	2.08	77.29
Government	157	0.54	77.84
High Net Worth	669	2.32	80.15
Insurance	245	0.85	81
Investment Manager	1,766	6.11	87.11
Listed Funds	36	0.12	87.24
Non Traded REIT	120	0.42	87.65
Non-Profit	113	0.39	88.04
Open-Ended Funds	116	0.4	88.44
Other	13	0.04	88.49
Pension Funds	120	0.42	88.9
REIT	1,723	5.96	94.87
Religious	61	0.21	95.08
REOC	1,400	4.85	99.92
Sovereign Wealth Funds	22	0.08	100
Total	28,893	100	

Note: The panels show the distribution of property transactions by property type, transaction year, country of property location, type of buyer and type of seller, all of which we control for in the empirical analysis using dummy variables. In the empirical analysis, we also include dummies for the buyer country and seller country as control variables.

Table 2: Summary statistics

Variable	Definition	Obs.	Mean	Std. Dev.	Min.	Max.
LN_PriceUSD	Log of transaction price measured in USD	28893	16.03	1.21	0.00	21.41
CUMINV	Ratio of (i) cumulative investment amount from buyer country in property location country until the preceding month to (ii) the total cumulative investment of buyer country until the preceding month	28893	0.78	0.18	0.00	1.00
ForeignBuyer	Dummy variable taking a value of 1 if buyer country is different from property location country	28893	0.05	0.21	0	1
LN_Floor	Log of floor area measured in square feet	28893	10.54	1.20	-0.87	19.02
LN_Land	Log of land size measured in acres	28893	-0.45	1.83	-13.09	13.76
Age	Property age measured as the difference between the observation year and the year in which the property was developed	28893	42.78	31.83	-5	360
Occ	Dummy variable taking a value of 1 if the purpose of the investment is recorded as "Occupy" (i.e., own use)	28892	0.05	0.22	0	1
ValueAdded	Dummy variable taking a value of 1 if the purpose of the investment is recorded as "Value-Added Investment"	28892	0.19	0.39	0	1
Core	Dummy variable taking a value of 1 if the purpose of the investment is recorded as "Core Investment"	28892	0.45	0.50	0	1
Buyer_YoY_Return	Return measured as the growth rate of the housing price index in the buyer's country from 5 quarters prior to the current period to the quarter preceding the current period (i.e., 4 quarters = one year)	28011	0.02	0.05	-0.12	0.19
Host_YoY_Return	Return measured as the growth rate of the housing price index in the host country from 5 quarters prior to the current period to the quarter preceding the current period (i.e., 4 quarters = one year), divided by the average of these returns for all countries	28633	18.59	279.83	-6021	1981
INV_OTHER	Log of investment flows from all countries other than the buyer country to property location country during the current month measured in USD	28893	19.82	0.97	13	23

Note: The table shows the summary statistics of the variables used in our empirical analysis.

Table 3: Baseline estimation

Dependent Variable = LN_PriceUSD	(1)		(2)		(3)		(4)	
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.
<Independent Variables>								
ForeignBuyer	0.122	0.038 ***	0.409	0.122 ***	0.110	0.038 ***	0.163	0.042 ***
CUMINV			0.325	0.145 **				
ForeignBuyer×CUMINV			-0.798	0.260 ***			-0.835	0.246 ***
LN_Floor	0.701	0.007 ***	0.701	0.007 ***	0.697	0.007 ***	0.696	0.008 ***
LN_Land	-0.040	0.004 ***	-0.040	0.004 ***	-0.036	0.004 ***	-0.037	0.004 ***
Age	-0.001	0.000 ***	-0.001	0.000 ***	-0.001	0.000 ***	-0.001	0.000 ***
INV_OTHER	0.016	0.005 ***	0.014	0.005 ***				
Fixed effects								
Property type		yes		yes				
Year		yes		yes				
Property host country		yes		yes				
Buyer country		yes		yes				
Seller country		yes		yes				
Buyer investor type		yes		yes				
Seller investor type		yes		yes				
Property type×Year						yes		yes
Property host country×Year						yes		yes
Buyer country×Year						yes		yes
Seller country×Year						yes		yes
Buyer investor type×Year						yes		yes
Seller investor type×Year						yes		yes
Constant		yes		yes		yes		yes
No. Obs.		28,934		28,893		29,397		29,090
R-squared		0.70		0.70		0.73		0.73
Root MSE		0.6623		0.6621		0.6389		0.6393

Note: The dependent variable is the logarithm of the property price measured in US dollars. The definitions of the independent variables are provided in Table 2. The column labeled "Robust Std. Err." shows heteroskedasticity-robust standard errors. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 4: Robustness check

Dependent Variable = LN_PriceUSD	(1)		(2)		(3)		(4)	
	Matched sample based on geographical distance				Repeat sales sample with property fixed effects			
	Distance<500m		Distance<100m					
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.
<Independent Variables>								
ForeignBuyer	0.377	0.133 ***	0.645	0.237 ***	0.040	0.044	0.734	0.219 ***
CUMINV	0.308	0.158 *	0.666	0.283 **			0.842	0.262 ***
ForeignBuyer×CUMINV	-0.881	0.268 ***	-0.863	0.355 **			-1.037	0.292 ***
LN_Floor	0.711	0.009 ***	0.773	0.013 ***				
LN_Land	-0.036	0.005 ***	-0.043	0.011 ***				
Age	-0.001	0.000 ***	0.000	0.000	-0.003	0.001 ***	-0.003	0.001 ***
INV_OTHER	0.014	0.006 **	0.000	0.011	0.046	0.016 ***	0.030	0.017 *
Fixed effects								
Property type	yes		yes					
Year	yes		yes		yes		yes	
Property host country	yes		yes		yes		yes	
Buyer country	yes		yes		yes		yes	
Seller country	yes		yes		yes		yes	
Buyer investor type	yes		yes		yes		yes	
Seller investor type	yes		yes		yes		yes	
Property					yes		yes	
Constant	yes		yes		yes		yes	
No. Obs.	20,605		5,435		4,586		4,549	
R-squared	0.72		0.77		0.19		0.20	
Root MSE	0.6674		0.6647		n.a.		n.a.	

Note: The dependent variable is the logarithm of the property price measured in US dollars. The definitions of the independent variables are provided in Table 2. The column labeled "Robust Std. Err." shows heteroskedasticity-robust standard errors. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 5: Estimation for different observation periods

Dependent var = LN_PriceUSD	(1)		(2)		(3)		(4)	
	Year<=2010		Year>=2011		Year<=2008		Year>=2009	
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.
<Independent Variables>								
ForeignBuyer	0.449	0.161 ***	1.478	0.353 ***	0.026	0.176	1.418	0.290 ***
CUMINV	0.346	0.187 *	1.750	0.434 ***	-0.126	0.207	1.525	0.353 ***
ForeignBuyer×CUMINV	-1.190	0.370 ***	-1.163	0.489 **	-0.442	0.348	-2.201	0.477 ***
LN_Floor	0.720	0.010 ***	0.694	0.010 ***	0.745	0.011 ***	0.688	0.009 ***
LN_Land	-0.039	0.007 ***	-0.040	0.005 ***	-0.049	0.009 ***	-0.039	0.005 ***
Age	-0.003	0.000 ***	0.000	0.000	-0.003	0.000 ***	0.000	0.000
INV_OTHERS	0.017	0.009 *	0.005	0.007	0.022	0.011 **	0.007	0.006
<Fixed-effect>								
Property type	yes		yes		yes		yes	
Year	yes		yes		yes		yes	
Property host country	yes		yes		yes		yes	
Buyer country	yes		yes		yes		yes	
Seller country	yes		yes		yes		yes	
Buyer investor type	yes		yes		yes		yes	
Seller investor type	yes		yes		yes		yes	
Constant	yes		yes		yes		yes	
No. Obs.	11,707		17,186		8,711		20,182	
R-squared	0.73		0.70		0.75		0.69	
Root MSE	0.6259		0.6715		0.5940		0.6799	

Note: The dependent variable is the logarithm of the property price measured in US dollars. The definitions of the independent variables are provided in Table 2. The column labeled "Robust Std. Err." shows heteroskedasticity-robust standard errors. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 6: Estimation for different property types

Dependent var = LN_PriceUSD	(1) Apartment		(2) Hotel		(3) Industrial		(4) Office		(5) Retail	
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.
<Independent Variables>										
ForeignBuyer	0.274	0.283	2.867	1.539 *	0.506	0.180 ***	0.849	0.219 ***	0.465	0.497
CUMINV	0.114	0.322	2.835	1.912	0.490	0.221 **	1.023	0.256 ***	0.231	0.628
ForeignBuyer×CUMINV	-1.191	1.147	-2.961	2.312	-4.071	0.737 ***	-0.865	0.322 ***	-0.107	0.982
LN_Floor	0.690	0.019 ***	0.771	0.039 ***	0.562	0.013 ***	0.853	0.011 ***	0.584	0.015 ***
LN_Land	0.018	0.008 **	-0.047	0.029	-0.016	0.007 **	-0.065	0.008 ***	-0.033	0.009 ***
Age	-0.005	0.000 ***	0.001	0.001	0.003	0.000 ***	0.000	0.000	0.000	0.000
INV_OTHERS	0.007	0.008	0.041	0.046	0.010	0.012	0.018	0.010 *	0.003	0.015
<Fixed-effect>										
Year	yes		yes		yes		yes		yes	
Property host country	yes		yes		yes		yes		yes	
Buyer country	yes		yes		yes		yes		yes	
Seller country	yes		yes		yes		yes		yes	
Buyer investor type	yes		yes		yes		yes		yes	
Seller investor type	yes		yes		yes		yes		yes	
Constant	yes		yes		yes		yes		yes	
No. Obs.	10,352		655		5,537		7,021		1,966	
R-squared	0.65		0.76		0.60		0.77		0.66	
Root MSE	0.5652		0.6618		0.6044		0.6554		0.6977	

Note: The dependent variable is the logarithm of the property price measured in US dollars. The definitions of the independent variables are provided in Table 2. The column labeled "Robust Std. Err." shows heteroskedasticity-robust standard errors. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 7: Additional independent variables

Dependent var = LN_PriceUSD	Coef.	Robust Std. Err.
<Independent Variables>		
ForeignBuyer	0.291	0.142 **
CUMINV	0.168	0.154
ForeignBuyer×CUMINV	-1.786	0.590 ***
LN_Floor	0.715	0.010 ***
LN_Land	-0.051	0.005 ***
Age	-0.001	0.000 ***
INV_OTHERS	-0.003	0.007
ValueAdded	0.116	0.037 ***
Core	0.055	0.034
Buyer_YoY_Return	1.836	0.218 ***
Host_YoY_Return	0.000	0.000
<Fixed-effect>		
Property type	yes	
Year	yes	
Property host country	yes	
Seller country	yes	
Buyer investor type	yes	
Seller investor type	yes	
Constant	yes	
No. Obs.	19,276	
R-squared	0.70	
Root MSE	0.6771	

Note: The dependent variable is the logarithm of the property price measured in US dollars. The definitions of the independent variables are provided in Table 2. The column labeled "Robust Std. Err." shows heteroskedasticity-robust standard errors. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 8: Sample for spillover test

(a) 1(if distance<100m)_spillover		(b) 1(if distance<100m)_placebo		
		0	1	Total
	0	23,406	1,504	24,910
	1	2,101	494	2,595
	Total	25,507	1,998	27,505

Note: The table lists the number of transacted properties by domestic buyers. Among the 27,505 properties bought by domestic buyers, 23,406 do not have any properties bought by foreign investors nearby (i.e., within a radius of 100m). The number of properties bought by domestic investors that do have a property or properties bought by foreign investors nearby is a total of 4,099. In 1,504 of these case, the domestic investor bought the property before the foreign investor(s), while in 2,101 cases, the domestic investor bought the property after the foreign investor(s). Meanwhile, in 494 cases, foreign buyers bought properties nearby both before and after the domestic buyer.

Table 9: Spillover test

Dependent var = LN_PriceUSD	Coef.	Robust Std. Err.
<Independent Variables>		
1_spillover	0.189	0.016 ***
1_placebo	0.186	0.018 ***
1_spillover × 1_placebo	0.038	0.038
LN_Floor	0.693	0.008 ***
LN_Land	-0.046	0.004 ***
Age	-0.002	0.000 ***
INV_OTHERS	0.018	0.006 ***
<Fixed-effect>		
Property type	yes	
Year	yes	
Property host country	yes	
Seller country	yes	
Buyer investor type	yes	
Seller investor type	yes	
Constant	yes	
No. Obs.	27,505	
R-squared	0.68	
Root MSE	0.6637	

Note: The dependent variable is the logarithm of the property price measured in US dollars. The definitions of the independent variables are provided in main text. The column labeled "Robust Std. Err." shows heteroskedasticity-robust standard errors. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.