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Evidence from International Transaction-Level Data

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

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Abstract

In this paper, we examine the role of the international flow of capital in real estate prices by quantifying the relation between investors' geographical locations and the prices they pay for their realty investments. Our data set contains more than 30,000 realty investment transactions in Australia, Canada, France, Hong Kong, Japan, Netherlands, the United Kingdom, and the United States. First, we find that foreign investors pay significantly higher prices than domestic investors do even after taking a wide variety of controls into account. Second, this overpricing becomes smaller as the buyers' exposure to realty investments in the host countries becomes higher. Third, in support of these results, the investment returns of foreign investors are systematically lower than that of domestic investors. This negative excess return becomes smaller as the buyers' exposure to the host countries becomes higher. These results indicate that the overpricing of foreign investors occurs when investors are less informed about the local property market and lessens with the accumulation of investment experience.

Keywords: *Realty Price*; *Transaction Data*; *Geographical Location*; *Fixed Effects*
JEL classification: D83, F21, G12, R30

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1. Introduction

Given that international realty investment is one of the major alternative investments, a large body of literature has attempted to examine the impacts of the international money flow on realty prices. The interaction between the international money flow and real estate markets becomes more relevant in the age of the global saving glut in which a large influx of capital from emerging economies lowers long-term interest rates and contributes to a run-up in asset prices (Bernanke 2005). Recently, many studies examine the argument that global imbalances in money flows have contributed to a massive fluctuation in asset prices, above all, real estate prices. On the one hand, Jordà et al. (2014) point out that a change in monetary policy in one country could play an important role in generating a large fluctuation in realty prices in other countries through a change in the international money flow. On the other hand, Favilukis et al. (2013) counter the presumption that the change in the international monetary flow leads to a large fluctuation in local realty prices. In this study, we examine this unsettled question by using a unique data set that accounts for a large number of international property investment transactions.

Presumably, if the prices paid by foreign investors are systematically higher than domestic investors, then the international money flow could create a demand shock in the local market. Given that many pieces of anecdotal evidence suggest that foreign investors are the central cause of local property booms,[3] a considerable number of empirical studies examine the pricing implication of the international money flow in the context of realty prices. However, the majority of these studies use aggregated data (e.g., Aizenman and Jinjarak 2009; Favilukis 2013) and have yet to reach a decisive conclusion on the relation between foreign realty investments and its prices. This is partly due to a

[3] As one example of such a discussion, see http://www.news.com.au/finance/real-estate/buying/housing-affordability-are-foreign-investors-to-blame-for-australias-high-property-prices/news-story/710ba2cff1932f0fb3f81ce83a07946b.

lack of international transaction-level data on realty investment, although a limited number of exceptions exist such as Badarinza and Ramadorai (2015). To date, our knowledge on the characteristics of real estate transactions is not sufficiently clear on how the pricing patterns of domestic real estate investors differ from those of foreign investors.

The aim of this study is to investigate the impact of geography, especially the impact of crossing country borders, on the pricing patterns in real estate markets. We use the micro-level information associated with each investment transaction instead of aggregate-level data. To be more precise, we estimate the extent to which the prices that foreign investors pay for their realty investments are different from those of domestic investors. The estimations control for property characteristics (e.g., location, type, size, and age), and transaction characteristics (e.g., geographical locations of buyers and sellers, and the type of buyers and sellers).

Furthermore, based on theoretical considerations, our empirical analysis examines the role of the information accumulated by foreign investors in the real estate markets of host countries. Specifically, following the studies that focus on other financial markets, we assume that the information disadvantage of foreign investors gradually lessens over the course of their investment experience. Focusing on stock markets, for example, Coval and Moskowitz (2001) empirically show that the geographical distance between fund managers specializing in domestic corporate stocks and the portfolio companies matter for the performance of the fund managers. Based on their estimation results, they claim that the information advantage of fund managers that are geographically close to the target domestic firms contributes to better investment performance. While Coval and Moskowitz (2001) exclusively deal with the geographical distance between fund managers and domestic companies, the discussion of home country bias in the extant literature implies that distance matters more for the case of cross-border investments than for domestic investments. We further presume that, in the case that the investors' location is different from the host country, the abovementioned "learning-by-investment" (e.g., Sorensen 2008, Gompers et al. 2008) might help them to acquire information associated with the local real estate. Notably, given that the heterogeneity associated with real estate is supposed to be much higher than that of other traditional investment objects (e.g., stocks and bonds), the research finds that the effect of accumulated cross-border investment experience should effectively suppress the price difference between foreign and domestic investors. This study is the first to explicitly examine both the difference between the pricing behaviors of foreign and domestic investors in the context of the realty prices and the effect arising from firms' previous cross-border investment experience.

Our findings are as follows. First, we find, that foreign investors pay substantially higher prices than domestic investors do even after taking into account a wide variety of controls. Second, this price difference becomes smaller as the buyers' investment exposure to the host countries where the properties in their portfolio are located becomes higher. Third, consistent with these results, the investment returns of foreign investors are systematically lower than that of domestic investors. This negative excess return becomes smaller as the buyers' exposure to the host countries becomes higher. These results indicate that the overpricing occurs especially when foreign investors are less informed about the local realty markets.

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 study. We explain the data and our empirical framework in Section 3. In Section 4 we examine and discuss the empirical results associated with the realty prices paid by foreign and domestic investors. Section 5 concludes and presents future research questions.

2. Related Literature and Theoretical Underpinnings

In this section, we first provide a brief survey of the studies on the impacts of international money flow on local realty prices. We then survey the literature that highlights the role of the geographical location of investors in various security prices.

A considerable number of studies quantitatively examine the determinants of real estate prices. Aizenman and Jinjarak (2009) use aggregate-level data on 43 countries from 1978 to 2008 and show that current account deficits, which are largely associated with the international money flow to these countries, have positive impacts on the realty prices. Justiniano et al. (2014) also posit that international money flows accounted for a sizable portion of the increase in US house prices before the recent financial crisis of 2008. In contrast with the studies that emphasize the importance of money flow on real estate prices, Favilukis et al. (2013) also use aggregate-level statistics and insist that the impact of the international money flow on real estate market is limited. Ferrero (2014) also focuses on the negative association between house prices and the current account in the United States and in several other countries and states that several domestic factors such as credit and preference shocks can explain this association. In sum, these studies have yet to reach a decisive conclusion regarding the role of international money flows to the local realty market.

A number of studies use the micro-evidence on the determination of realty prices to focus on the information asymmetry in real estate. Kurlat and Stroebel (2015), for example, use the data on realty transactions for Los Angeles county in the United States and analyze the determinants of the change in realty prices. They find that the physical characteristics of both the property itself and nearby properties as well as the information asymmetry about these characteristics between insiders (i.e., residents in the area) and outsiders determine realty prices. Based on the empirical evidence that the increase in prices after investment is smaller when the share of informed sellers is higher and the buyer is less informed; they conclude that information asymmetry is an important determinant of realty prices. In a similar vein, Garmaise and Moskowitz (2004) use the realty transaction data in the United States and find that the geographical distance between the buyers and the property becomes shorter as the information asymmetry faced by the buyers becomes larger. They also show that the median distance between the buyers and the property is short (i.e., 47km) and such a distance becomes shorter as the dispersions of evaluated value and transaction prices become larger. Furthermore, the latter becomes less apparent for older property. In sum, they show that the geographical distance between the buyers and the property is an important characteristic associated with information asymmetry. The difference between their study and the present study is that we extend their discussion to international transactions. We presume that the theoretical predication in these studies becomes more critical in the context of international transactions where information asymmetry is more significant.

Somewhat in the same context, Badarinza and Ramadorai (2015), also feature the role of the proximity between buyers and property in the context of the transmission of shocks. In their study, they use detailed resident information in London and show that foreign residents transmit an exogenous shock in their home country (i.e., outside of UK) to the realty prices in the host country. This result indicates that the proximity between buyers and property affects the way of shocks in buyer countries to transmit to host countries, thus drives realty transactions. The biggest difference between their studies and the present study is that we use many pairs accounting for buyer countries and the countries where the properties are so that we have greater heterogeneity to extract a more detailed mechanism that affects realty transactions.

Literature already exists on this importance of geographical characteristics on investments in other financial markets. First, Coval and Moskowitz (2001) show that the geographical distance between the fund manager and the portfolio's companies matter for performance. They find that the abnormal return associated with the investment with a shorter distance is larger. Further, this pattern is more apparent for the investments in companies in small towns where information asymmetry matters more. The authors also find that the advantage of geographical proximity shows some persistency. While such a result in Coval and Moskowitz (2001) specifically shows the advantage of local investors, we could also presume that greater exposure to the distant companies allows fund managers to learn, which Sorensen (2008) theoretically models and empirically studies in the context of venture capital funds. Gompers et al. (2008) also study the importance of venture capital funds' investment experience. Given these discussions, the present paper examines the advantage of local investors and how such an advantage varies as the investment to distant properties accumulates.[4]

Another strand of studies, such as Autor et al. (2014), argue that an exogenous shock induces price changes in nearby properties. They use the termination of rent control in Cambridge, Boston, in 1995. Their natural experiment shows that the prices of the properties close to the property facing the termination of rent control increase. This spillover indicates that overpricing for other reasons, for example that of less informed investors, could exhibit a similar effect.

Given the abovementioned reasoning, we hypothesize that foreign investors pay substantially higher prices (lower returns) than domestic investors, and this price difference becomes smaller as the buyers' exposure to realty investments in the host country increases. In order to examine this hypothesis, we regress the property price on a wide variety of variables including the investors' geographical location and investment experience while controlling for a comprehensive list of transaction-level and aggregate-level characteristics.

[4] There are also many studies that measure proximity through various measures (see, e.g., Hochberg et al 2007; Patnum 2013; Shue 2013; Fracassi 2014; Leary and Roberts 2014; Serafinelli 2015).

3. Data and Method

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), which is one of the most influential data vendors specializing in real estate investments. The data in RCA reflects institutional investment activities and cover relatively large investment transactions, which are at least one million USD. The original data covers 71,000 realty transactions in Australia, Canada, France, Hong Kong, Japan, Netherlands, the United Kingdom, and the United States. While the properties in a large number (i.e., 1,223) of cities are recorded in the data, a large part of the data are concentrated in properties located in the major cities in the eight countries: Amsterdam, Chicago, Kyoto, LA, London, New York, Osaka, Paris, San Francisco, Sydney, Tokyo, Toronto, and Vancouver. In this sense, the data we use is mainly for large investments in major cities.

The data contains various information associated with the investment transactions. The first group of information covers the property included in the transaction: the price measured in USD, the size of the property's structure in square feet, and the size of the property's land in acre measured as the natural logarithms (*LN_PriceUSD*, *LN_Sqft*, and *LN_land_area_nb*). The data also contains the age of each structure (*Age*) as well as its type. The latter information is stored as a categorical variable accounting for apartment, development site, hotel, industrial, office, other, retail, and seniors housing and care facilities. In the present study, we construct eight dummy variables for these property types (*Property type*).

A wide variety of transaction-related information is also stored in the data set. This information comprises the identification of the countries where the invested property is (*Property location country*), buyer's location (*Buyer country*), and the seller's location (*Seller country*). In our empirical analysis, we control for these characteristics by including eight dummy variables for *Property location country*, and at most 102 dummy variables for *Buyer country* and *Seller country*, respectively. By using these information, we also construct a large number of dummy variables for the individual effects that pairs the property location and buyer country (*Property Location-Buyer Country*). This pair-level individual effect can be used to control for, for example, the geographical distance between the property's location and the buyer's location.[5]

The data further contains the characteristics of the buyers and the sellers in two categorical variables (*Buyer/Seller capital group* and *Buyer/Seller capital type*). The *Buyer/Seller capital group* mainly denotes what kind of investment entity the buyer and seller are. The category comprises equity, institutional, private, and public funds. Partly overlapping with this information, *Buyer/Seller capital type*, on the other hand, accounts for the detailed characteristics of investment funds (e.g., corporate, developer/owner/operator, investment manager, or REIT). Because the capital group and type of buyers and sellers are supposed to affect the transaction price, we construct dummy variables for the relative bargaining power between buyer and seller or the difference in their funding environments. Each panel of Table 1 tabulates the number of observations falling into each category.

We use the data on the location country associated with the property and the buyer to construct a dummy variable that equals one if these two locations are different (*dum_forbuyer*) and zero otherwise. We hypothesize that the higher information asymmetry in the case of *dum_forbuyer*=1 leads to higher (lower) transaction prices (return) compared to the case of *dum_forbuyer*=0 (i.e., domestic buyer). Then, in order to take into account the impact associated with buyer's investment experience, we construct the accumulated investment amount of the buyer

[5] In the original data set, we have the information associated with the top three buyers and sellers. While this information is certainly important to characterize the transaction, we only use the information associated with the top buyer and seller because a large part of the data contain only one buyer and seller.

located in a country to a host country and construct the natural logarithms of the sum of accumulated investment amount for all the buyers headquartered in the same country to each host country (*INVACC_unadj*). This pairwise variable is measured at each monthly data point for the previous month. Although we can compute this variable for each buyer, we choose to construct the variable at the country level. This choice reflects our presumption that there is information sharing to some extent among the buyers in one country (Badarinza and Ramadorai 2015). Since this variable monotonically increases over the data periods, following Gompers et al. (2008), we standardize it to construct a new variable *INVACC* by dividing it by the accumulated total sum of the investment amount of all the buyers located in a country to all the host countries measured at each monthly data point for the previous month. Figure 1 depicts the scatter plot between these two variables, which shows an apparent positive correlation. Table 2 lists the summary statistics for each variable. Note that the number of observations reduces from the original 71,000 to less than 30,000 due to the lack of information on some variables.

3.2. Empirical framework

Using our transaction-level data, we examine how the buyer's characteristics (esp., *dum_forbuyer*, *INVACC*, and its interaction term) as well as other transaction-specific information affect the transaction price through the following linear regression model:

$$LN\_PriceUSD_{i,p,b,s,t} = \alpha + \beta_1 dum\_forbuyer_{p,b} + \beta_2 INVACC_{p,b,t}$$
$$+\beta_3 dum\_forbuyer_{p,b} \times INVACC_{p,b,t} + \boldsymbol{X}_i\boldsymbol{\gamma} + \eta_p^1 + \eta_b^2 + \eta_s^3 + \eta_t^4 + \varepsilon_t \quad (1)$$

The left-hand variable accounts for the natural logarithm of the transaction price of property *i* in country p that is sold by the seller in country s to the buyer in country b in time t (measured monthly). This variable comprises property-level characteristics $\boldsymbol{X}_i$, which contains the property's size, age, and type. On the right-hand of the equation, $dum\_forbuyer_{p,b}$ accounts for the dummy variable that equals one if country p and b are different. The $INVACC_{p,b,t}$ is the standardized accumulated investment amounts from country b to country p in the month before t. We include the interaction term $dum\_forbuyer_{p,b} \times INVACC_{p,b,t}$ to test for the possibility that the impact associated with $dum\_forbuyer_{p,b}$ varies with the change in $INVACC_{p,b,t}$. The four variables $\{\eta_p^1, \eta_b^2, \eta_s^3, \eta_t^4\}$ account for the country-level fixed-effect for the property location, country-level fixed-effect for the buyer location, location-level fixed-effect for the seller country, and the time-level fixed effects, respectively.

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

$$LN\_PriceUSD_{i,p,b,s,t} = \alpha + \beta_1 dum\_forbuyer_{p,b} + \beta_2 INVACC_{p,b,t}$$
$$+\beta_3 dum\_forbuyer_{p,b} \times INVACC_{p,b,t} + \boldsymbol{X}_i \boldsymbol{\gamma} + \delta_{p,b}^1 + \eta_t^4 + \varepsilon_t \quad (2)$$

In this equation, we include an individual effect associated with the property location in country p and the buyer location in country b ($\delta_{p,b}^1$), instead of the two separate individual effects $\{\eta_p^1, \eta_b^2\}$. This specification omits η_s^3. Technically speaking, we can still include this country-specific individual effect for the seller location. Nonetheless, given that $\delta_{p,b}^1$ fairly controls for the location-related information, we omit η_s^3 in our specification.

While we include a fair number of characteristics that affect the transaction price, there could still be a concern about the existence of omitted variables. If, for example, we omit an important property characteristic that affects $LN\_PriceUSD_{i,p,b,s,t}$ and is correlated with

$dum\_forbuyer_{p,b}$, then the coefficient β_1 suffers from endogeneity bias. Among the characteristics potentially affecting the property price that we have not controlled for, the detailed location information (e.g., street) could be one potential omitted variable. In order to account for this concern, the six panels in Figure 2 depict the property locations 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. These panels show that there is no apparent fault line between the areas for properties bought by foreign and domestic investors.[6]

4. Empirical Analysis

4.1. Baseline estimation

In this section, we show the results based on the linear estimations of equations (1) and (2). Table 3 presents the estimation results. The first two columns in Table 3 list the estimate coefficients for the model without $dum\_forbuyer_{p,b}$ and $dum\_forbuyer_{p,b} \times INVACC_{p,b,t}$. As in the following tables, the first column corresponds to the specification in (1) and the second column corresponds to that in (2). In this estimation, the transaction price is higher when the size of the property's structure is larger, the size of the property's land is smaller, and the age of the structure is younger. Furthermore, the impact associated with $INVACC_{p,b,t}$ shows an ambiguous result between model (1) and model (2). Once we introduce $dum\_forbuyer_{p,b}$ and $dum\_forbuyer_{p,b} \times INVACC_{p,b,t}$ as in equations (1) and (2), the results consistently show that the transaction price becomes higher when the buyer is foreign (i.e., $\beta_1 > 0$). Most importantly, this positive impact associated with the status as foreign investors diminishes as the investment experience from country

[6] As alternative approaches to account for this concern, we can use (i) a street-level individual effect, (ii) the information associated with the floor level that we have not used for the analysis, and (iii) the exact pairing of the properties bought by foreign and domestic buyers based on geographical location. We leave this to the future research.

b accumulates for country p (i.e., $\beta_3 < 0$). These results are fairly robust for the two model specifications of equations (1) and (2) and show that even after controlling for a comprehensive list of information, foreign investors pay higher prices and the systematic change in such overpricing over the course of the investment experience is observed.

The coefficient associated with the single term $INVACC_{p,b,t}$ shows a positive sign that indicates that a higher $INVACC_{p,b,t}$ has an opposite effect for domestic buyers than for foreign buyers. One source of this difference is the fact that we use the standardized variable for $INVACC_{p,b,t}$. While we interpret this variable to represent investment experience for the case of foreign buyers, it could also be a proxy for the precursor of a property bubble in the case of domestic buyers. Because domestic buyers are already informed about domestic property, a larger exposure means the property bubble is heating up the market.

Using the results in Table 3, we compute the economic impact associated with $INVACC_{p,b,t}$. For example, the estimated coefficient associated with $dum\_forbuyer_{p,b}$ (0.423 for the equation (1)), $INVACC_{p,b,t}$ (-0.817 for the equation (1)), and the standard deviation of the variable (0.18) indicates that $INVACC_{p,b,t}$ needs to change by almost three standard deviations (0.54) to offset the impact associated with $dum\_forbuyer_{p,b}$ (i.e., 0.423 and (-0.817)*0.54 = -0.44118). These results show that the overpricing of foreign investors is not economically negligible.

4.2. Additional independent variables and nonlinearity of INVACC

In this section, to control for endogneity bias, we add two more variables to our estimation. First, we take into account the condition of the real estate market by adding the return calculated by using the housing price index in each country p. This addition reflects our concern that the positive correlation between the transaction price and *INVACC* is driven by the temporal price trend in local markets in country p. Second, we add the investment flow from the countries other than the buyer location county b to effectively control for demand from other countries. This addition corresponds to our concern that the positive correlation between the transaction price and *INVACC* is driven by the correlated (e.g., herding) behavior of the foreign investors who are locating in multiple countries.

The first four columns in Table 4 show these additional estimation results. The first and second columns correspond to equations (1) and (2) while controlling for the year-on-year return based on the quarterly housing price index for each property location. We add the return variables that correspond to the periods from 16, 15, 14, 13, 12, 11, 10, and 9 quarters prior to the data point of each observation to the 8, 7, 6, 5, 4, 3, 2, 1 quarter(s) prior to the data point of each observation, respectively. Thus, we add eight return variables to equations (1) and (2). The results are fairly robust and consistent with those in the baseline estimation.

The third and fourth columns correspond to equations (1) and (2) while controlling for the investment flows from other countries. For this estimation, we add the aggregated investment amount other than that from the buyer location country b during the previous month to the data point of each observation. While the newly added variable, which is supposed to account for the demand pressure from other countries, shows a positive sign, the results associated with $dum\_forbuyer_{p,b}$, $INVACC_{p,b,t}$, and $dum\_forbuyer_{p,b} \times INVACC_{p,b,t}$ are intact.

In the fifth and sixth columns of Table 4, we show that the estimation results for the nonlinearity of *INVACC*. To be more precise, we construct four dummy variables (*INVACC_Q1*, *INVACC_Q2*, *INVACC_Q3*, and *INVACC_Q4*) equal to one if *INVACC* falls in the first, second, third, and fourth quantiles, respectively. Adding the last three dummy variables (i.e., *INVACC_Q2*, *INVACC_Q3*, and *INVACC_Q4*) and their interaction terms with *dum_forbuyer* to the model, we estimate the two models as in specifications (1) and (2). This modification of the model also accounts for the concern about the high correlation between *dum_forbuyer* and *INVACC* in the baseline estimation. Notably, the correlation coefficients between *dum_forbuyer* and (*INVACC_Q1*, *INVACC_Q2*, *INVACC_Q3*, *INVACC_Q4*) are -0.5359, -0.0702, 0.097, and 0.5898, respectively.

First, in both columns, the coefficient associated with *dum_forbuyer* takes a positive value, which is consistent with the baseline result. Furthermore, the coefficient associated with the interaction terms between *dum_forbuyer* and *INVACC_Q2* (-2.163 for (1)), and *dum_forbuyer* and *INVACC_Q3* (-0.456 for (1)) show negative signs. These results, especially the relative size of the two coefficients, show that the contribution associated with the accumulated investment experience matters especially in the stage where the *INVACC* is small. This is consistent with the presumption that the additional information acquired through investment experience does not largely matter once the foreign investors acquire enough information.[7]

4.3. Subsample analysis

In this subsection, we present whether the estimation results in Table 3 are affected by the subsample analysis or not. First, we split the sample into two subsamples corresponding to the early transaction periods (i.e., before 2011) and the late transaction periods (i.e., 2011 and onward). The results in Table 5 show, first, that the qualitative features are consistent with those in Table 3. Furthermore, given that the appropriateness of *INVACC* could potentially be affected by the length of periods we use for its calculation, this exercise also checks the validity of *INVACC* computed by

[7] We also conducted two robustness checks for the estimation results by using only the INVACC smaller than one to exclude the case where a country has exposure to properties in only one country. Then, we employ INVACC_unadj, which is the natural logarithm of the accumulated investment amounts instead of INVACC. Both the estimations provide consistent results with the baseline results.

using the early transaction periods and the late transaction periods). The results show that, at least qualitatively, *INVACC* adds useful information to our analysis regardless of the length of periods we use to compute the variable. Second, we find that the impact associated with *dum_forbuyer* is larger in the third and fourth columns. Given that the latter periods correspond to the periods when the real estate markets revived from the global financial crisis, this result shows that under a heated market environment, the value of information asymmetry matters more.

In Table 6, we split the sample based on the property type. In particular, we focus on the following four categories: apartment, industrial, office, and retail. We find that the pattern in the baseline results only occurs for industrial and office properties. Importantly, in the case of apartments, we could not find any systematic pattern associated with *dum_forbuyer* and *INVACC*. This result means that the information asymmetry we presume to exist and to be mitigated through investment experience matters only for a selected categories of properties.

4.4. Return analysis

In Tables 3 to 6, we used the transaction price as the dependent variable for our empirical analysis. However, even if a foreign investor pays higher prices, the higher price would not be a problem if these investors sell the property at higher prices. In order to evaluate the performance of the foreign investors, we need to measure how realty prices have changed after their purchase.

For this purpose, we construct the year-on-year return based on the quarterly housing price index in each host country, which is publicized by Dallas Fed.[8] As the new dependent variables, we use the return variables that correspond to the periods from 1, 2, 3, and 4 quarter(s) after the data point of each observation to 5, 6, 7, and 8 quarters after the data point of each observation,

[8] http://www.dallasfed.org/institute/houseprice/index.cfm.

respectively. In this sense, we use the return of the country-level housing price index to represent the investment return for each observation. As the right-hand side variables, we use the same set of independent variables as in equation (1).

Table 7 shows the results. First, as the baseline results indicate, the estimated coefficient for *dum_forbuyer* shows a negative sign while that of the interaction term between *dum_forbuyer* and *INVACC* is positive. This pattern is consistent with the implication we obtain from the baseline estimation using the transaction price as the dependent variable. Second, the impact of these two variables becomes larger as we use the return away from the investment periods. This impact means that the obtained information through investment experience helps foreign investors to improve long-term investment returns.

5. Conclusion

In this paper, we study how investors' geographical locations are related to the prices they pay for their realty investments. We use more than 30,000 observations that cover the realty investment transactions in eight countries. Further, we control for a comprehensive list of property and transaction characteristics. We find, first, that foreign investors pay substantially higher prices than domestic investors even after taking into account the controls. Second, this price difference becomes smaller as the buyers' exposure to realty investments in the host countries becomes higher. Third, consistent with these results, the investment returns of foreign investors are systematically lower than that of domestic investors and this return difference becomes smaller as the buyers' exposure experience becomes higher. These results show that the overpricing of foreign investors exists when investors are less informed about local property markets and lessens with the accumulation of investment experience.

Further, we highlight the potential avenues for future research. First, the present study does not explicitly examine the spillover effect associated with the overpricing of foreign investors but only studies the relation between the transaction price and the investors' location. As we have detailed information associated with the property address as well as the timing of each transaction, we can study the spillover effect with a careful consideration for the causal identification. Second, investors' characteristics, which we mainly use as control variables in the present paper, could be used to study, for example, the pricing behavior of specific investors after the financial crisis (e.g., hedge funds' fire sale). Third, another important direction might be to examine investors' choice over multiple investment locations. We believe all of these potential extensions could provide further insights for a better understanding of the pricing implication of international real estate transaction.

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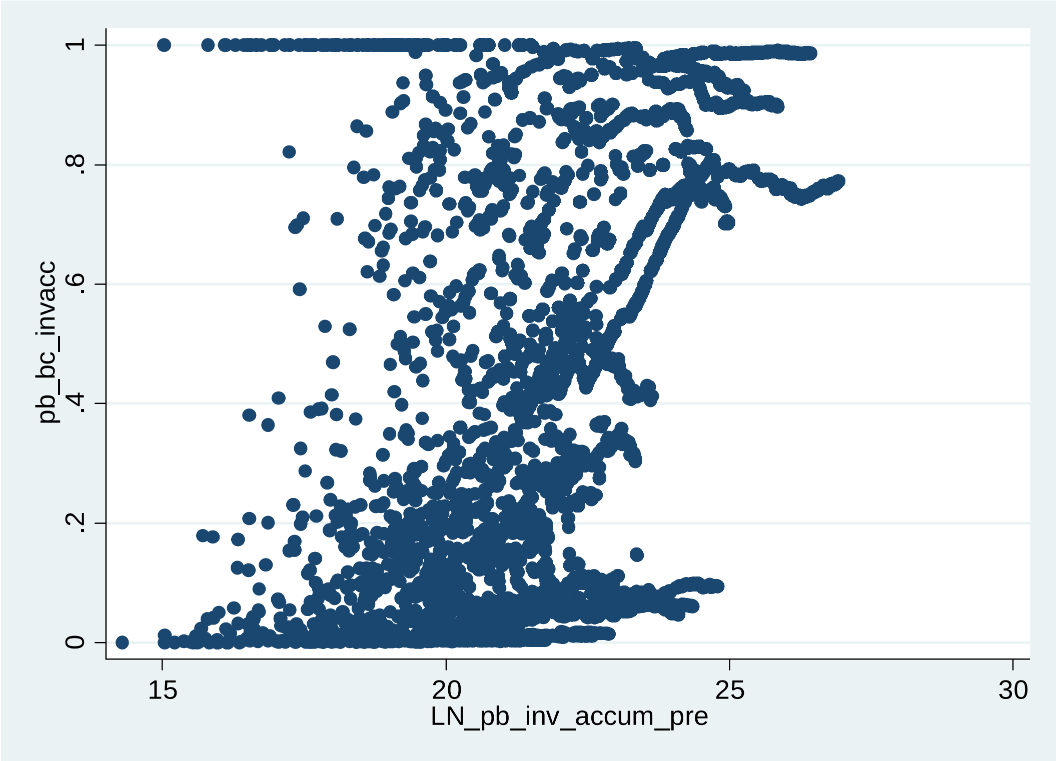
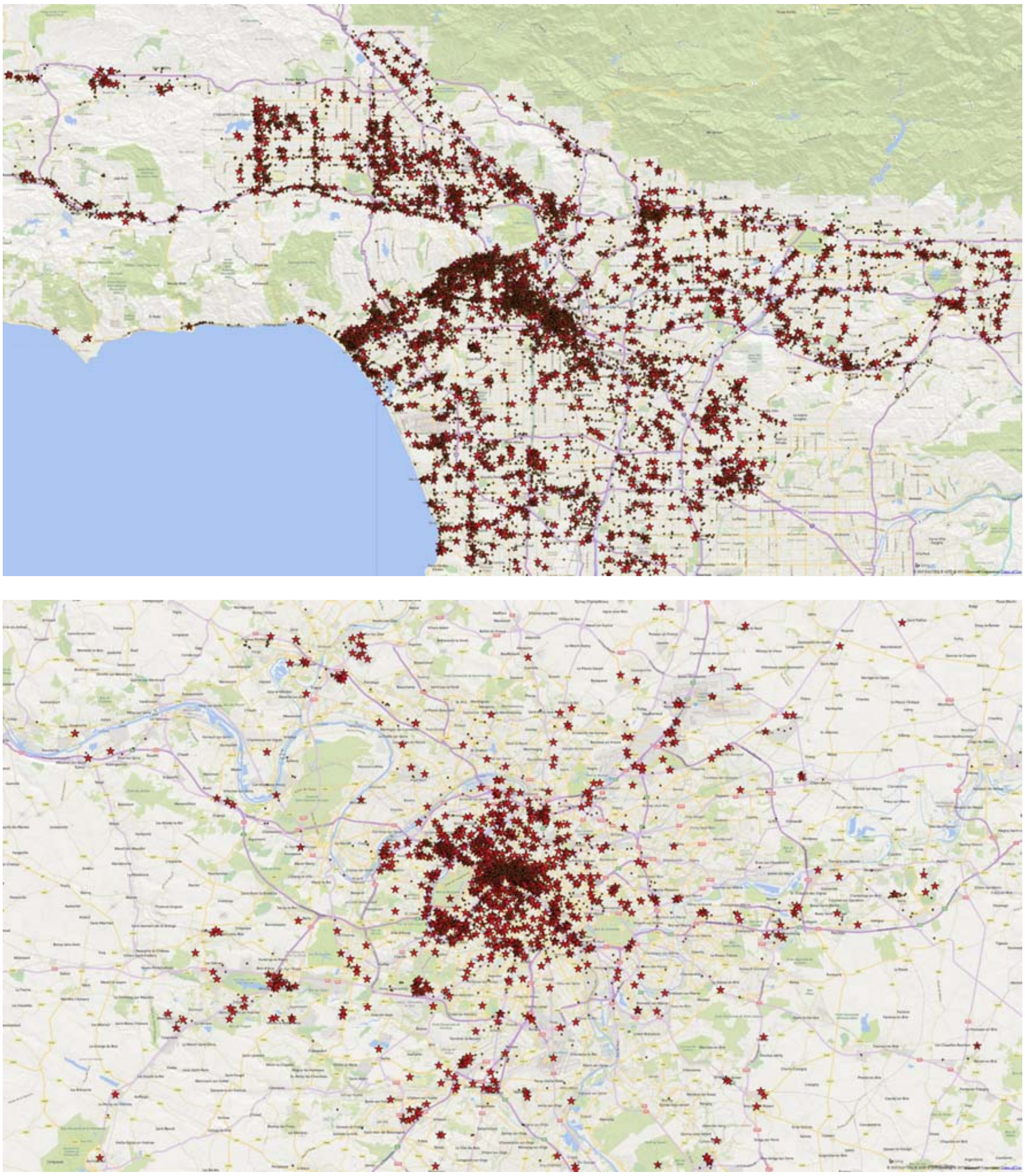
Tables and Figure

Figure 1: *INVACC* and *INVACC_unadj*



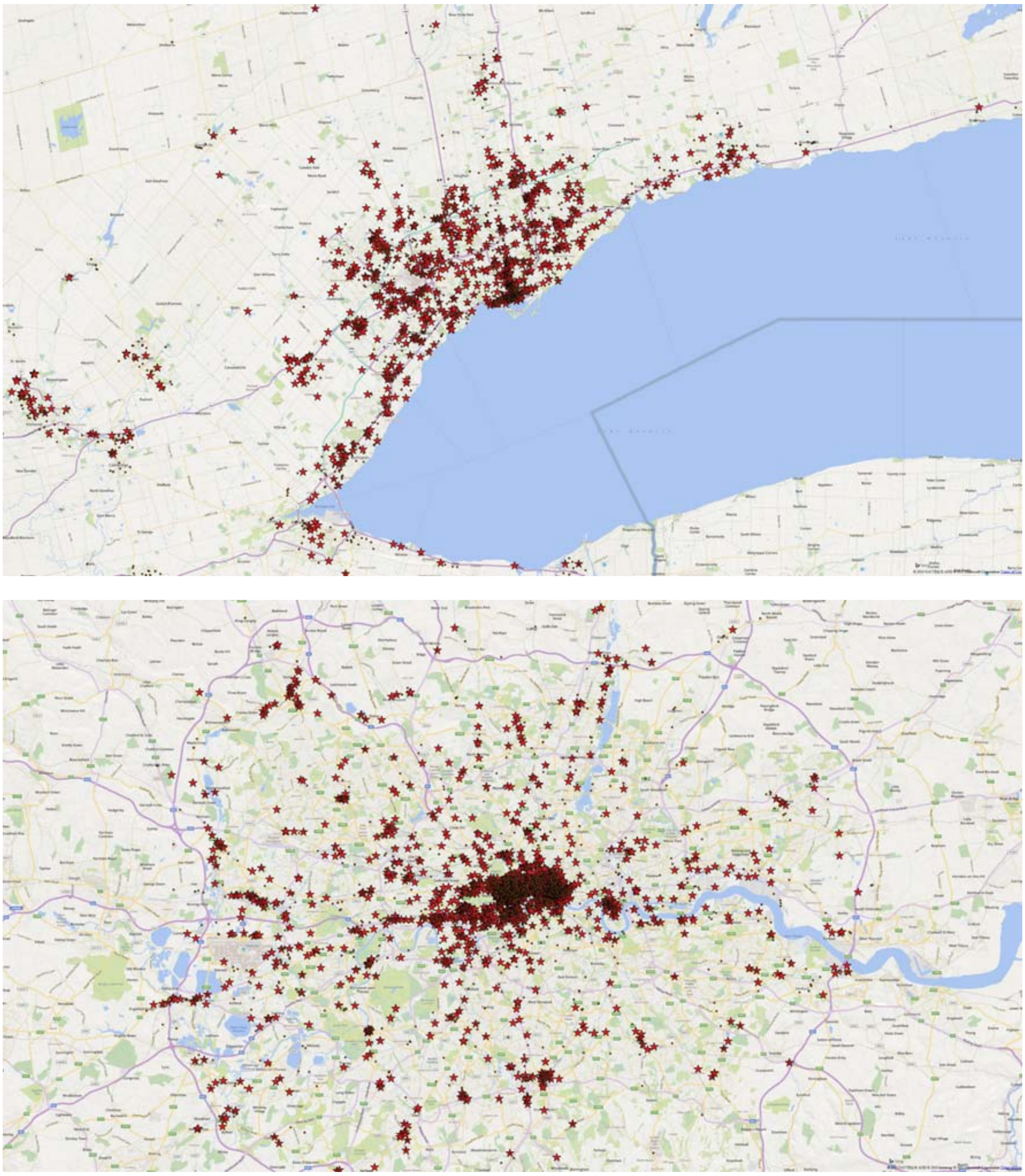
Note: The horizontal axis corresponds to the natural logarithm of the accumulated investment amounts from the buyer's country to each host county for the previous period (i.e., month), while the vertical axis represents the ratio of such an amount to the natural logarithm of the accumulated investment amounts from the buyer's country to all host countries for the previous period.

Figure 2 (i): Property location (foreign investor & domestic investor) in Los Angeles and Paris



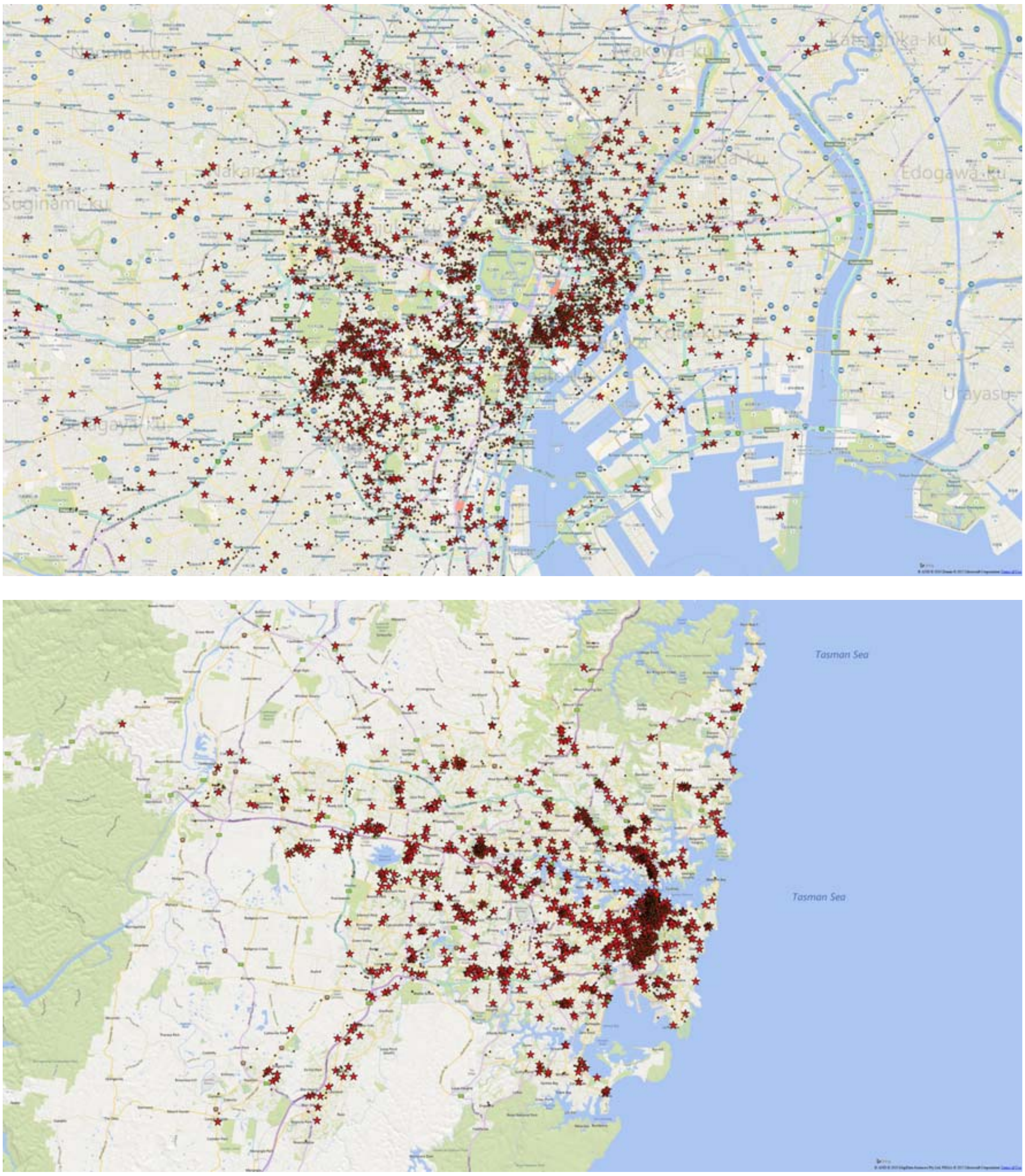
Note: The figure shows the locations of properties bought by foreign investors (star) and domestic investors (dot) in Los Angeles (upper panel) and Paris (lower panel).

Figure 2 (ii): Property location (foreign investor & domestic investor) in Toronto and London



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

Figure 2 (iii): Property location (foreign investor & domestic investor) in Tokyo and Sydney



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

Table 1: Tabulation of transaction-level data

Panel (a): Property type

Category	Freq.	Percent	Cum.
Apartment	10,439	35.89	35.89
Dev Site	50	0.17	36.06
Hotel	670	2.3	38.36
Industrial	5,540	19.04	57.4
Office	7,101	24.41	81.82
Other	120	0.41	82.23
Retail	4,978	17.11	99.34
Seniors Housing & Care	192	0.66	100
Total	29,090	100	

Panel (b): Year

Category	Freq.	Percent	Cum.
2005	1,816	6.24	6.24
2006	2,355	8.1	14.34
2007	2,820	9.69	24.03
2008	1,868	6.42	30.45
2009	1,164	4	34.46
2010	1,833	6.3	40.76
2011	2,326	8	48.75
2012	3,285	11.29	60.04
2013	3,771	12.96	73.01
2014	4,409	15.16	88.16
2015	3,443	11.84	100
Total	29,090	100	

Panel (c): Property location country

Category	Freq.	Percent	Cum.
Australia	579	1.99	1.99
Canada	393	1.35	3.34
France	184	0.63	3.97
Hong Kong	64	0.22	4.19
Japan	6,336	21.78	25.97
Netherlands	32	0.11	26.08
United Kingdom	274	0.94	27.03
United States	21,228	72.97	100
Total	29,090	100	

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

Panel (d): Buyer capital group

Category	Freq.	Percent	Cum.
<unknown>	533	1.83	1.83
Equity Fund	1,612	5.54	7.37
Institutional	2,293	7.88	15.26
Private	17,787	61.14	76.4
Public	4,842	16.64	93.05
User/Other	2,023	6.95	100
Total	29,090	100	

Panel (e): Seller capital group

Category	Freq.	Percent	Cum.
<unknown>	710	2.44	2.44
CMBS	1	0	2.44
Equity Fund	1,404	4.83	7.27
Institutional	3,645	12.53	19.8
Private	17,684	60.79	80.59
Public	3,208	11.03	91.62
User/Other	2,438	8.38	100
Total	29,090	100	

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

Panel (f): Buyer capital type

Category	Freq.	Percent	Cum.
<unknown>	533	1.83	1.83
Bank	199	0.68	2.52
CMBS	1	0	2.52
Cooperative	1,570	5.4	7.92
Corporate	16,850	57.92	65.84
Developer/Owner/Operator	112	0.39	66.23
Educational	1,612	5.54	71.77
Finance	282	0.97	72.74
Government	152	0.52	73.26
High Net Worth	548	1.88	75.14
Insurance	193	0.66	75.81
Investment Manager	1,338	4.6	80.41
Listed Funds	35	0.12	80.53
Non Traded REIT	389	1.34	81.86
Non-Profit	131	0.45	82.31
Open-Ended Fund	106	0.36	82.68
Other	23	0.08	82.76
Other/Unknown	2	0.01	82.76
Pension Fund	106	0.36	83.13
REIT	3,733	12.83	95.96
Religious	34	0.12	96.08
REOC	1,074	3.69	99.77
Sovereign Wealth Fund	67	0.23	100
Total	29,090	100	

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

Panel (g): Seller capital type

Category	Freq.	Percent	Cum.
<unknown>	710	2.44	2.44
Bank	728	2.5	4.94
CMBS	1	0	4.95
Cooperative	2	0.01	4.95
Corporate	2,051	7.05	12
Developer/Owner/Operator	16,895	58.08	70.08
Educational	40	0.14	70.22
Endowment	3	0.01	70.23
Equity Fund	1,404	4.83	75.06
Finance	602	2.07	77.13
Government	157	0.54	77.67
High Net Worth	669	2.3	79.97
Insurance	249	0.86	80.82
Investment Manager	1,803	6.2	87.02
Listed Funds	36	0.12	87.14
Non Traded REIT	120	0.41	87.56
Non-Profit	113	0.39	87.94
Open-Ended Fund	118	0.41	88.35
Other	13	0.04	88.39
Pension Fund	120	0.41	88.81
REIT	1,730	5.95	94.75
Religious	62	0.21	94.97
REOC	1,442	4.96	99.92
Sovereign Wealth Fund	22	0.08	100
Total	29,090	100	

Note: Each table accounts for the distribution of the seven (i.e., property type, transaction year, property location country, buyer capital group, seller capital group, buyer capital type, and seller capital type) which we control for by using the categorical dummy variables in the empirical analysis.

Table 2: Summary statistics

Variable	Definition of variables	Obs	Mean	Std. Dev.	Min	Max
LN_PriceUSD	Accumulated investment amounts from buyer country to property location country until the previous month	29090	16.03	1.21	0.00	21.41
INVACC (note: see the header of the column)	Accumulated investment amounts from buyer country to property location country until the previous month (this variable is adjusted by the accumulated investamounts from buyer country until the previous month)	29090	0.78	0.18	0.00	1.00
INVACC_unadj (note: see the header of the column)	Unadjusted INVACC	29090	25.67	1.41	14.30	26.92
dum_forbuyer	Dummy varibale takling value of 1 if buyer country is different from property location country	29090	0.05	0.21	0	1
LN_Sqft	Property size measured by square feet	29090	10.54	1.19	-0.87	19.02
LN_land_area_acres_nb	Land size measured by acres	29090	-0.45	1.83	-13.09	13.76
Age	Observation year minus developped year	29090	42.58	31.84	-5	360

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

Table 3: Baseline estimation

Dependent var = LN_PriceUSD	Baseline estimation							
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.
<Independent Variables>								
INVACC	-0.183	0.047 ***	0.414	0.120 ***	0.315	0.143 **	0.602	0.127 ***
dum_forbuyer					0.423	0.119 ***	1.586	0.393 ***
INVACC×dum_forbuyer					-0.817	0.257 ***	-0.971	0.404 **
LN_Sqft	0.702	0.007 ***	0.683	0.007 ***	0.702	0.007 ***	0.683	0.007 ***
LN_land_area_acres_nb	-0.040	0.004 ***	-0.036	0.004 ***	-0.040	0.004 ***	-0.036	0.004 ***
Age	-0.001	0.000 ***	-0.001	0.000 ***	-0.001	0.000 ***	-0.001	0.000 ***
_cons	9.661	0.154 ***	8.462	0.113 ***	8.627	0.162 ***	8.334	0.116 ***
<Fixed-effect>								
Property type	yes		yes		yes		yes	
Year	yes		yes		yes		yes	
Property location country	yes				yes			
Buyer country	yes				yes			
Seller country	yes				yes			
Buyer capital group	yes		yes		yes		yes	
Seller capital group	yes		yes		yes		yes	
Buyer capital type	yes		yes		yes		yes	
Seller capital type	yes		yes		yes		yes	
Property Location-Buyer Country			yes				yes	
No. Obs.	29090		34585		29090		34585	
R-squared	0.70		0.70		0.70		0.70	
Root MSE	0.6615		0.6507		0.6614		0.3506	

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

Table 4: Estimations including additional variables

Dependent var = LN_PriceUSD	(i) Control for relative (i.e., to world) return of housing price index associated with the country where property locates				(ii) Control for the investment amounts from other countries				(iii) Non-linearity of INVACC			
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.
<Independent Variables>												
INVACC	0.210	0.143	0.501	0.128 ***	0.325	0.145 **	0.598	0.130 ***				
INVACC_Q2									0.134	0.017 ***	0.123	0.016 ***
INVACC_Q3									0.177	0.020 ***	0.179	0.018 ***
INVACC_Q4									0.117	0.032 ***	0.153	0.027 ***
dum_forbuyer	0.339	0.119 ***	1.370	0.402 ***	0.409	0.122 ***	1.474	0.400 ***	0.245	0.038 ***	2.620	0.163 ***
INVACC×dum_forbuyer	-0.701	0.265 ***	-0.842	0.409 **	-0.798	0.260 ***	-0.894	0.411 **				
INVACC_Q2×dum_forbuyer									-2.163	0.444 ***	-3.808	0.164 ***
INVACC_Q3×dum_forbuyer									-0.456	0.188 **	-0.877	0.253 ***
INVACC_Q4×dum_forbuyer									0.072	0.083	0.005	0.111
LN_Sqft	0.702	0.008 ***	0.683	0.007 ***	0.701	0.007 ***	0.682	0.007 ***	0.703	0.007 ***	0.684	0.007 ***
LN_land_area_acres_nb	-0.040	0.004 ***	-0.037	0.004 ***	-0.040	0.004 ***	-0.036	0.004 ***	-0.039	0.004 ***	-0.036	0.004 ***
Age	-0.001	0.000 ***	-0.001	0.000 ***	-0.001	0.000 ***	-0.001	0.000 ***	-0.001	0.000 ***	-0.001	0.000 ***
Past YoY return (t-1, ⋯, t-8)		(Suppressed)										
INV_OTHERS					0.014	0.005 ***	0.015	0.005 ***				
_cons	8.734	0.164 ***	8.362	0.117 ***	7.989	2754.232	8.058	0.149 ***	9.566	0.624 ***	8.645	0.080 ***
<Fixed-effect>												
Property type	yes		yes		yes		yes		yes		yes	
Year	yes		yes		yes		yes		yes		yes	
Property location country	yes				yes				yes			
Buyer country	yes				yes				yes			
Seller country	yes				yes				yes			
Buyer capital group	yes		yes		yes		yes		yes		yes	
Seller capital group	yes		yes		yes		yes		yes		yes	
Buyer capital type	yes		yes		yes		yes		yes		yes	
Seller capital type	yes		yes		yes		yes		yes		yes	
Property Location-Buyer Country			yes				yes		yes		yes	
Realtive past returns	yes		yes									
Investment from other countries					yes		yes					
No. Obs.	28828		34291		28893		34360		29397		34996	
R-squared	0.70		0.70		0.70		0.70		0.71		0.70	
Root MSE	0.6619		0.6508		0.6621		0.6508		0.6601		0.6490	

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

Table 5: Subperiod estimation

Dependent var = LN_PriceUSD	Year<2011				Year>=2011			
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.
<Independent Variables>								
INVACC	0.354	0.181 **	0.605	0.162 ***	1.758	0.432 ***	4.255	0.592 ***
dum_forbuyer	0.481	0.152 ***	1.232	0.254 ***	1.495	0.350 ***	4.916	0.460 ***
INVACC×dum_forbuyer	-1.248	0.359 ***	-1.467	0.678 **	-1.209	0.485 **	-4.369	0.965 ***
LN_Sqft	0.723	0.010 ***	0.694	0.009 ***	0.693	0.010 ***	0.679	0.009 ***
LN_land_area_acres_nb	-0.040	0.007 ***	-0.029	0.006 ***	-0.040	0.005 ***	-0.039	0.005 ***
Age	-0.003	0.000 ***	-0.002	0.000 ***	0.000	0.000	0.000	0.000
_cons	13.237	0.537 ***	8.114	0.139 ***	7.495	0.461 ***	5.914	0.437 ***
<Fixed-effect>								
Property type	yes		yes		yes		yes	
Year	yes		yes		yes		yes	
Property location country	yes				yes			
Buyer country	yes				yes			
Seller country	yes				yes			
Buyer capital group	yes		yes		yes		yes	
Seller capital group	yes		yes		yes		yes	
Buyer capital type	yes		yes		yes		yes	
Seller capital type	yes		yes		yes		yes	
Property Location-Buyer Country			yes				yes	
No. Obs.	11856		14639		17234		19946	
R-squared	0.74		0.73		0.70		0.69	
Root MSE	0.6244		0.6079		0.6714		0.6683	

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

Table 6: Estimation results for each property type

Dependent var = LN_PriceUSD	Apartment			Industrial			Office			Retail		
	Coef.	Robust Std. Err.		Coef.	Robust Std. Err.		Coef.	Robust Std. Err.		Coef.	Robust Std. Err.	
<Independent Variables>												
INVACC	0.030	0.318		0.507	0.212	**	1.099	0.232	***	-0.356	0.642	
dum_forbuyer	0.222	0.283		0.538	0.170	***	0.938	0.195	***	0.001	0.506	
INVACC×dum_forbuyer	-1.376	1.026		-4.120	0.737	***	-0.985	0.305	***	0.425	0.996	
LN_Sqft	0.692	0.019	***	0.562	0.013	***	0.853	0.010	***	0.585	0.015	***
LN_land_area_acres_nb	0.018	0.008	**	-0.016	0.007	**	-0.065	0.008	***	-0.033	0.009	***
Age	-0.005	0.000	***	0.003	0.000	***	0.000	0.000		0.000	0.000	
_cons	9.394	0.554	***	12.919	0.510	***	6.733	0.271	***	10.021	0.683	***
<Fixed-effect>												
Property type	yes			yes			yes			yes		
Year	yes			yes			yes			yes		
Property location country	yes			yes			yes			yes		
Buyer country	yes			yes			yes			yes		
Seller country	yes			yes			yes			yes		
Buyer capital group	yes			yes			yes			yes		
Seller capital group	yes			yes			yes			yes		
Buyer capital type	yes			yes			yes			yes		
Seller capital type	yes			yes			yes			yes		
Property Location-Buyer Country												
No. Obs.	10439			5540			7101			4978		
R-squared	0.66			0.60			0.77			0.66		
Root MSE	0.5640			0.6044			0.6542			0.6986		

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

Table 7: Return estimation

Dependent var = YoY return measured for quarter frequency	QTR_RETURN (+5quarter)		QTR_RETURN (+6quarter)		QTR_RETURN (+7quarter)		QTR_RETURN (+8quarter)	
	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.	Coef.	Robust Std. Err.
<Independent Variables>								
INVACC	-0.042	0.010 ***	-0.095	0.009 ***	-0.149	0.010 ***	-0.191	0.012 ***
dum_forbuyer	-0.032	0.008 ***	-0.073	0.007 ***	-0.113	0.008 ***	-0.147	0.010 ***
INVACC×dum_forbuyer	0.033	0.014 **	0.086	0.014 ***	0.144	0.015 ***	0.188	0.017 ***
LN_Sqft	0.000	0.000 ***	0.000	0.000 ***	0.000	0.000 **	0.000	0.000 ***
LN_land_area_acres_nb	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Age	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Past YoY return (t-1, ⋯, t-8)	(Suppressed)		(Suppressed)		(Suppressed)		(Suppressed)	
_cons	0.107	0.009 ***	0.128	0.013 ***	0.097	0.015 ***	0.120	0.017 ***
<Fixed-effect>								
Property type	yes		yes		yes		yes	
Year	yes		yes		yes		yes	
Property location country	yes		yes		yes		yes	
Buyer country	yes		yes		yes		yes	
Seller country	yes		yes		yes		yes	
Buyer capital group	yes		yes		yes		yes	
Seller capital group	yes		yes		yes		yes	
Buyer capital type	yes		yes		yes		yes	
Seller capital type	yes		yes		yes		yes	
Property Location-Buyer Country								
No. Obs.	22241		21184		20073		19043	
R-squared	0.80		0.81		0.80		0.81	
Root MSE	0.0202		0.0194		0.0199		0.0197	

Note: The dependent variable is the year-on-year return of the quarterly-level housing price index associated with the country where the property is. For example, QTR_RETURN (+5quarter) corresponds to the return of the housing price index from (a) the quarter that includes the month after the month when each property is bought to (b) that of five quarters later (i.e., one year later). Table 2 provides the definitions of the independent variables. The column labeled "Robust Std. Err." shows the heteroskedasticity robust standard error. The ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.