Journal of International Money and Finance 147 (2024) 103164

Contents lists available at ScienceDirect

Journal of International Money and Finance

journal homepage: www.elsevier.com/locate/jimf

Can rising urban house prices actually limit the outward FDI by firms in a home country? A story from China

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ARTICLE INFO

Keywords:
Urban house prices
Resource misallocation
TFP
Outward FDI
China

ABSTRACT

We investigate the effects of rising urban house prices on manufacturing firms' decisions on outward foreign direct investment (outward FDI) in a home country. By utilizing the panel data of Chinese industrial enterprises in 2005–2013, our estimates suggest that, for every 210 manufacturing firms or 13 listed companies in China, one firm will forgo outward FDI when house prices double. As a result, there could have been 95 percent more manufacturing firms or 70 percent more listed firms conducting outward FDI if house prices remained unchanged during the study period. To address potential endogeneity issues, we exploit a fixed-effects instrumental variable model, a difference-in-differences strategy, and housing discontinuities at provincial borders among neighboring city/county pairs. To elucidate potential mechanisms, we employ the "Olley and Pakes" covariance to assess resource allocation efficiency and observe its negative correlation with house prices. Furthermore, we delve into the impact of house prices and resource allocation efficiency on TFP, and find that house prices and TFP are negatively correlated, while resource allocation efficiency and TFP are positively correlated. Finally, heterogeneity analyses reveal that rising house prices exert a stronger negative influence on outward FDI entry for firms that are less productive, larger, domestically-owned, more closely linked to the real estate industry, labor-intensive, and in industries with higher levels of outward FDI participation. These results underscore the fact that rising house prices could exacerbate resource misallocation, leading to a decline in enterprise TFP and subsequently reducing their outward FDI.

1. Introduction

Despite some ups and downs, when technology innovation is striving to come up with breakthroughs, globalization is reaching a new level. As a powerful economic tool for promoting both processes, outward foreign direct investment (outward FDI or OFDI hereinafter) has been rising, particularly in emerging markets. In 2019, developing countries accounted for about a quarter of the total FDI around the world.[1] With the sustained development of its economy and rising income levels, China's climbing outward FDI coincides with its diminishing "demographic dividend". However, China's outward FDI stock as a percentage of GDP (14.6 %) is still lagging behind that of other developing countries (28.3 %) and even further away from that of developed economies (47.8 %) in 2018

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[1] Based on the United Nations Conference on Trade and Development, it was estimated to be about 22.9%.

https://doi.org/10.1016/j.jimonfin.2024.103164

Available online 12 August 2024

(see Fig. 1). Therefore, the China context provides us an opportunity to investigate the constraints and mechanisms driving firms' decisions on outward FDI, which has important practical and theoretical significance.

The literature on the determinants of outward FDI has discussed numerous factors from both its host country and home country. The notable factors in a host country include institutional environment (Kamal et al., 2020; Zhang et al., 2024; Yang and Li, 2021), investment facilitation (Chen et al., 2020), market opportunities (Eden and Dai, 2010), and natural resources (Ren and Yang, 2020). For the perspective of outward FDI's home country, there are emerging studies that examine the role of political, economic and legal factors in influencing firms' ability to engage in such investment (Luo and Wang, 2012; Stoian, 2013; Kong et al., 2020; Jiang et al., 2020; Zhao et al., 2023; Li and Wu, 2023). However, the role of rising urban house prices, as a key feature of emerging markets, in shaping outward FDI has been relatively less studied in this branch of literature.

Over the past two decades, emerging economies have experienced much faster growth in house prices compared to developed economies. In China, since the comprehensive housing commercialization in 1998, the real estate industry has not only entered a rapid development phase but also increasingly faced "real estate bubbles" and other financing issues. Moreover, the rising prices can lead to firms' capital misallocation, which further affects their total factor productivity (TFP) (Chen et al., 2017, 2015; Shi, 2017). Since both financing (Klein et al., 2002; Buch et al., 2009; Demaeseneire and Claeys, 2012) and TFP (Chen and Tang, 2014) are reported to directly affect outward FDI, a natural further question is, how do urban house prices in China affect outward FDI decisions of Chinese firms in general? This paper takes a new perspective on the role of house prices in an open economy, aiming to enrich the relevant research on the determinants of outward FDI and provide a possible explanation for why the outward FDI of a large developing country can lag behind that of others.

The literature on how rising house prices affect financing and TFP builds a theoretical foundation for our hypothesis that it may hinder outward FDI on average, although it can help some firms to alleviate their financing constraints. Admittedly, real estate, as a fixed asset, has its collateral attribute: enterprises investing in real estate, in addition to earning capital income, can also use it as a kind of financing collateral to obtain more mortgage financing loans to alleviate the pressure of external financing (Barro, 1976). This "collateral effect" theory suggests that, when house prices rise, some firms can finance real estate mortgages more easily, and the financial advantage enables them to leverage their residential properties to secure additional funds, providing more capital for their core operations (Bahaj et al., 2016), or new projects (Chaney et al., 2012), thereby exerting a positive influence on investment. However, this is not necessarily the case for an average firm. Subsequent empirical studies have indicated that rising real estate prices do not always have a positive impact on firms' investment behavior, while negative effects also exist (Wu et al., 2015; Wang et al., 2017; Chakraborty et al., 2018; Martín et al., 2021). This is because that, although firms can obtain more mortgage financing loans with their properties, firms without properties may find it more difficult to obtain loans from banks due to the lack of collateral, creating a "crowding-out effect" (Miao and Wang, 2014). Even for those firms with real estate properties, the sustained rise in China's real estate prices can exacerbate the "speculation effect",[2] drawing more resources than necessary into the real estate industry (Chen et al., 2017, 2015; Shi, 2017). As a result, when real estate prices rise, the crowding-out effect can further widen the gap in financing constraints between real estate-holding and non-real estate-holding firms, generating uncertainty about future prices for non-real estate-holding firms and strengthening the speculation effect of real estate-holding enterprises, resulting in firm resource misallocation. The resource misallocation caused by the crowding-out effect and the speculation effect could further dampen firm TFP (Lu et al., 2019), imposing a negative impact on firms' future investment. A recent study further points out that, house price appreciation does elevate financial institutions' financing costs (Ma and Zhang, 2024), which can hinder outward FDI for an average firm further.

Building on the preceding analyses, rising house prices could affect firm financing and efficacy through resource misallocation resulted from the interactions of the above-mentioned effects. It relaxes financial constraints of real estate-holding firms by the collateral effect, but could induce them to speculate in real estate and to reduce other investments, and crowd out financing to non-real estate-holding firms. The consequences of the speculation and crowding-out effects of real estate shocks tend to enlarge the gaps in financial constraints faced by firms with and without real estate holdings. And even for real estate-holding firms, rising house prices induce them to take more real estate investments unrelated to their core businesses, resulting in firm resource misallocation. The resource misallocation, on the one hand, affects the firm decision on outward FDI directly through financing. On the other hand, it could make firms less efficient by lowering their TFP, which strengthens the negative effects on outward FDI (Fig. 2).[3]

Fig. 3 shows China's outward FDI flows in the period 2005–2018. It started with an upward trend, during which its growth rate fluctuated, and then turned to a downward trend after 2016. At the same time, China's average urban house prices have followed an upward trend in recent years, accompanied by fluctuations in growth rates as well, from 2005 to 2018. A simple comparison of these trends reveals that, in the periods of 2007–2009 and 2013–2018, when urban house prices were climbing relatively slowly or even decreasing, the outward FDI of Chinese enterprises experienced a more rapid growth; when urban house prices were rapidly increasing, the outward FDI exhibited a trend of slowing down or declining. Based on these simple observations, this paper

[2] In the Chinese literature, Kuang (2010) investigated the impact of the expectation and its speculation on house prices. Using the data of 35 major cities in China from 1996 to 2007, the author shows that the expectation and its speculation have a greater influence on the house price volatility.

[3] According to Feng et al. (2023), higher house prices can lead to crowding-in of manufacturing firms. This again suggests that investment can be more concentrated in the domestic markets rather than the foreign markets.

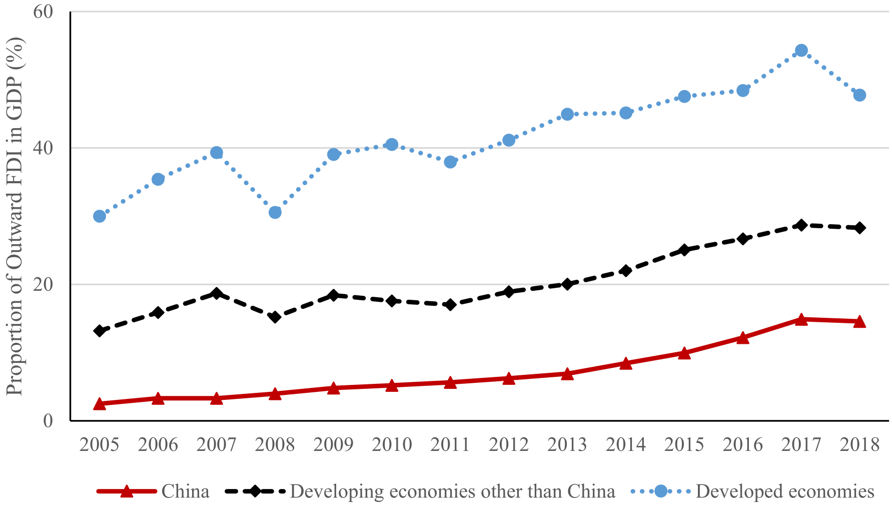

Fig. 1. Share of outward FDI stock in GDP from 2005 to 2018. Data Source: United Nations Conference on Trade and Development, CCEF study.

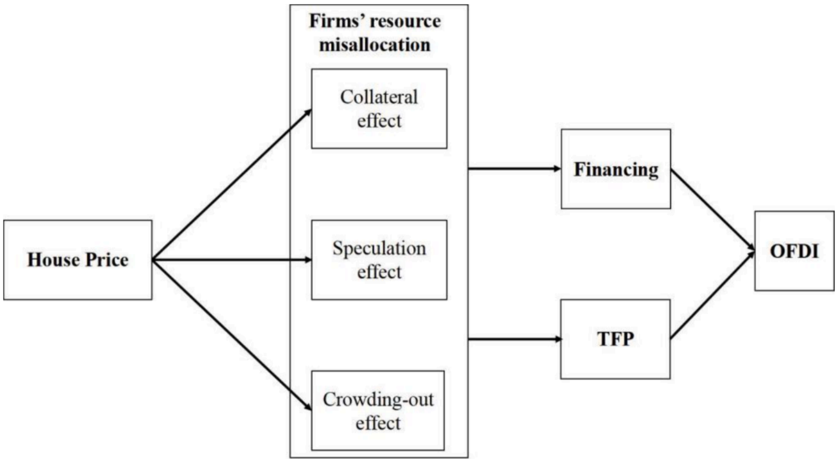

Fig. 2. Theoretical framework for the effect of house prices on outward FDI.

hypothesizes that the relationship between urban house prices and outward FDI can be negative,[4] and we will dive into a potential mechanism—resource misallocation.

One may note that, in the Chinese literature, there is a recent paper by Guo et al. (2020) giving a different conclusion. They find that outward FDI can be promoted by rising house prices. We would like to point out a key difference between our research and theirs, which is that our empirical strategy is based on the "changes" or growth rates of variables (e.g., the right panel of Fig. 3) rather than the "levels" of variables (e.g., the left panel of Fig. 3), as we control for firm fixed effects. As a result, our findings should also be interpreted in terms of changes rather than levels. We consider it a better strategy for causal inference as there can be firm-specific time-invariant unobserved factors that affect the outward FDI decisions of firms.[5] Although Dong et al. (2022) find that the crowding-out effect dominates the collateral effect in China, there is limited empirical evidence supporting the story for outward FDI, and this paper aims

[4] There are some discussions in the literature on how inward FDI might push up house prices in the host country (Feng et al. 2017; Kim and Lee, 2022). Li et al. (2018) also suggested that inward FDI can promote outward FDI. Our hypothesis does not necessarily contradict these findings. Rather, we believe that inward FDI would promote outward FDI more if it did not push up house prices. That is, there are several channels through which inward FDI can promote outward FDI, but house prices may not be one of them.

[5] Nevertheless, we try to replicate Guo et al. (2020)'s result by not controlling for the firm fixed effects with our sample, which is smaller due to the need for repeated measures to construct a panel and the data for estimating productivity. Our replication shows that, with all our control variables except firm fixed effects, the coefficient of lagged log house price becomes 0.00213, which is significant at the 1% level with a t-value of 3.43. This suggests that the differences between our results and theirs are mainly driven by whether or not the estimations are based on changes.

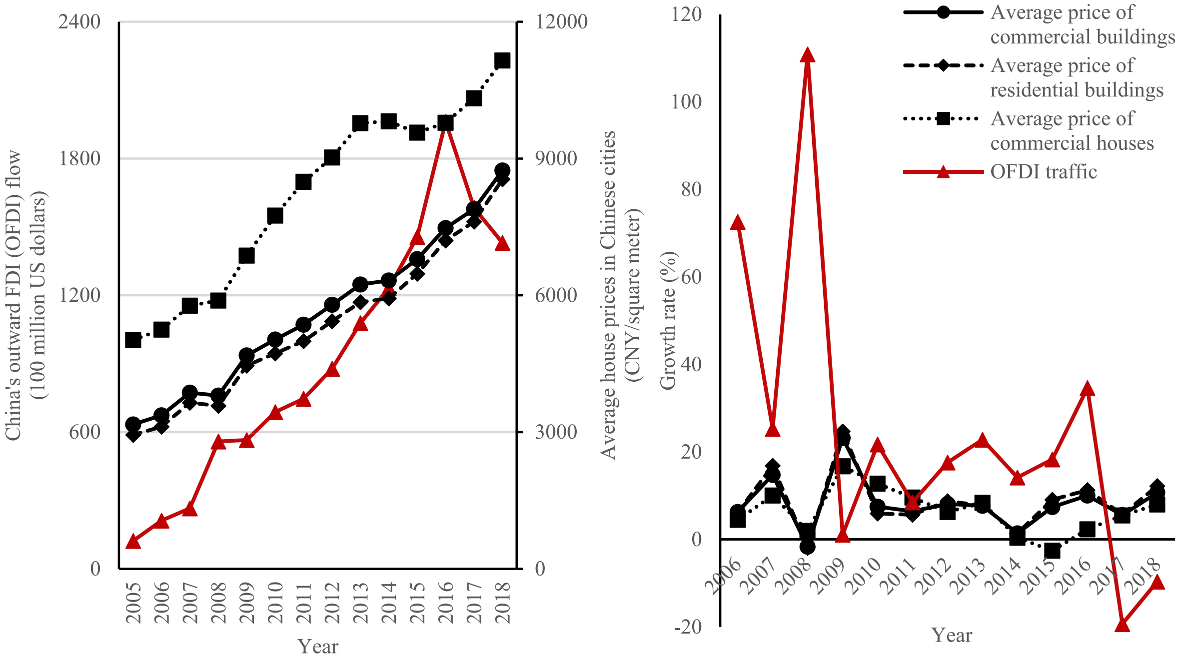

Fig. 3. Trends of China's outward FDI flows and urban average house prices from 2005 to 2018. Notes: Data in this figure are obtained from the Statistical Bulletin of China's Foreign Direct Investment and China Statistical Yearbook for the corresponding years.

to fill this gap.

One might ask a further question: are there differential effects of rising urban house prices on outward FDI by different firms? In China, firms with lower productivity are facing greater financing constraints, and thus are more eager to invest their capital in the more lucrative real estate sector, which can be adversely affected by the crowding-out and speculation effects. However, there are high barriers to entry in the real estate sector in China, such as real estate development licenses, high cash deposits, etc. Shi (2017) find that, more productive firms in China are "richer" and thus more likely to occupy the real estate sector with their capital. Nevertheless, more productive firms do not necessarily have more comparative advantages in real estate, and capital speculation in real estate can lead to a decline in the R&D inputs, capital investment, and efficiency of their original productive activities. Accordingly, we hypothesize that the impact of urban house prices on firms' outward FDI decisions is mainly driven by firms with lower productivity rather than those with higher productivity.

This paper contributes to the literature in two notable ways. First, using China as a case study, the paper examines a less explored perspective of house price increases in emerging markets, enriching the relevant research on the determinants of outward FDI and putting forward a new direction for subsequent studies. Second, distinct from prevailing research on the financial effects of house prices, this paper steps further by considering how house prices influence firms' outward FDI through the lens of firm resource misallocation. The rest of the paper is organized as follows: Section II describes how we construct the dataset and presents our empirical strategy; Section III provides estimation results; we analyze the mechanism briefly and further by exploring heterogeneous effects in Sections IV and V; Section VI concludes the paper.

2. Data and empirical strategy

2.1. Data sources and variable constructions

We combine different sources of data, which can be categorized into three types in our analysis below.

First, we use the micro-enterprise data from China Outward FDI Enterprise Directory and the Database of Chinese Industrial Enterprises from National Bureau of Statistics (NBS), the latter of which is also known as the Annual Surveys of Industrial Firms (ASIF). Among them, the China Outward FDI Enterprise Directory is provided by the Ministry of Commerce (MOFCOM), which is currently the only available nationwide enterprise-level Outward FDI data in China, including information of all Outward FDI enterprises filed with MOFCOM since the 1980 s in terms of the names of domestic enterprises, the names of overseas organizations, investment regions, registration years, investment categories, etc. The sample covers the registration information of all non-financial outward FDI firms across all industries. Since each outward FDI foreign organization in this directory appears only once in the year of its establishment, and whether it withdraws or makes additional investments in the future is not known, we only analyze firms' decisions to enter the outward FDI market without considering their exit decisions.

The ASIF provides all state-owned enterprises as well as non-state-owned enterprises above the scale from 1999 to 2013, giving detailed information at the enterprise level, including hundreds of variables pertaining to each enterprise's geographic location, the industry one belongs to, the year of establishment, the total industrial output value, the total sales revenue, the number of employees, and so on. When using the ASIF, this paper refers to the cleaning methods of previous scholars to process the data as follows: (1) as the legal person codes of some sample enterprises have changed, this paper refers to the method of Brandt et al. (2012) and uses not only the enterprise's legal person code, but also the enterprise's name, legal person's name, area code, industry code, establishment year, address, and main product name, to construct a new panel dataset by generating new identification codes for firms; (2) also referring to the approach of Brandt et al. (2012), we delete the observations for firms with fewer than eight employees; (3) following the approach of Cai and Liu (2009), we delete samples that lack the information of total assets, net fixed assets, sales revenue, and/or gross industrial output value; (4) based on the approach of Feenstra et al. (2014), we delete observations that do not comply with the Generally Accepted Accounting Principles (GAAP), i.e., the samples of firms whose current assets are greater than total assets, those whose total fixed assets are greater than total assets, those that do not have an identifying number, and those with invalid time of inception; (5) since China adopted a new industry classification code in 2003, this paper standardizes and unifies the industry classification code based on the approach of Brandt et al. (2012); (6) since the total industrial output value of 2004 is missing from the ASIF, this paper uses the total industrial output value from the 2004 Economic Census Database instead.

Second, our city-level data is mainly from the China City Statistical Yearbooks. Data for the prefecture-level cities in the statistical yearbooks covers agriculture, services, population, employment (by sectors), average wages, fixed assets investment, as well as the fiscal revenues and expenditures of local governments. Missing values for some years are supplemented by the China Statistical Yearbooks for Regional Economy, covering industrial output, highways, railroads, and so on. This paper uses city-level data to control for the effects of urban factors.

Third, our data for urban house prices are mainly from the China Statistical Yearbooks for Regional Economy. In the yearbooks, we can get the nominal commercial building prices for 333 prefecture-level cities in China from 2005 to 2013. Meanwhile, we obtained the city-level Consumer Price Index (CPI) from 2005 to 2013 for deflating all variables (to the base year, 1999).

We merge and organize the above four databases by the following steps. First, after processing the ASIF and the China Outward FDI Enterprise Directory, we merge the two databases based on the name of each enterprise and year. Second, since the research of this paper requires relevant data at the city level, we integrate the data on employment and average wages in the China City Statistical Yearbooks and the data on house prices at the prefecture level in the China Statistical Yearbooks for Regional Economy. Finally, we obtain 725,739 firm-level observations from 2005 to 2013 as the basis for our empirical study.[6] From Figs. 1 and 3 above, it can be found that both China's outward FDI and house prices have changed significantly during this study period, which can help us investigate the impact of house price changes on Chinese firms' outward FDI.

Table 1 reports the descriptive statistics of the main variables to be used in this paper. As shown, about seven thousand firm-years (1 % of our sample) have ever engaged in outward FDI. The total house prices range from 753 to 23,426 Chinese yuan (CNY) per square meter (m^2) during our study period (between 2005 and 2013). The simple average is slightly below five thousand CNY/m^2 (see Appendix B's Exhibit 5), which is about 35.6 % of the average annual per capita GDP across our study cities, with 926 thousand to 23.6 million residents per city. Our study firms have varying sizes too, ranging from an eight-employee firm to one with nearly 0.2 million employees. We also observe young firms that just entered the market in a study year, as well as old firms with up to 64 years of registration history.

Besides the firm-level variables, we further control for city-level macroeconomic variables (i.e., minimum wage, real GDP growth rate, R&D labor share, exchange rates, and tariffs) in all regression models. First, labor costs, as one of the significant costs in business production, have a crucial impact on firms' international decisions. According to the concentration-proximity trade-off hypothesis (Markusen, 1984; Helpman et al., 2004), the fundamental trade-off in a firm's decision to undertake FDI lies between the relative variable costs of production abroad and the fixed costs of establishing additional plants. The increase in operating costs associated with labor employment in the home country implies a decrease in the relative variable costs abroad, thereby resulting in greater cost savings and a stronger motivation to engage in outward FDI. Fan et al. (2018) focused on the Chinese market to examine the impact of minimum wage increases on the probability of firms engaging in outward FDI. They found that the increase in minimum wage could explain 32.3 % of China's outward FDI growth from 2001 to 2012. Considering the influence of labor costs on firms' outward FDI, we incorporate minimum wage as a covariate into our regression model. Second, previous studies have found that some macroeconomic variables, e.g., technological progress, may affect firms' outward FDI, potentially leading to biases in our previous estimates. Therefore, the real GDP growth rate and R&D labor share are obtained from the China City Statistical Yearbooks. Third, different cities face different exchange rate shocks due to differences in the composition of trading partners. On one hand, exchange rate fluctuations are an important factor when considering potential outward FDI projects. On the other hand, exchange rate movements may affect government decisions in setting local monetary policies, which will lead to changes in urban house prices. To address this issue, we incorporate exchange rate shocks into the regressions using a firm-specific exchange rate calculation proposed by Xu et al. (2016). Specifically, the city-specific exchange rate calculation process is shown below:

$$CityXR_{it} = 100 \times \prod_{k=1}^{n} \left(\frac{e_{k_y t}}{e_{k_y 2000}} \right)^{\omega_{i,k,2000}} \tag{1}$$

[6] To promote transparency, in Appendix A.2, we explain how the sample size reduces from 2,463,201 in the raw sample to 725,739 in the study sample.

Table 1
Descriptive statistics for the study sample (N=725,739).

Variable Name	Description	Mean	SD	Max	Min
OFDI	Whether the enterprise invests in foreign countries	0.010	0.099	1.00	0.000
log *house price*	Log (commercial building price) (CNY/m^2)	8.30	0.631	10.1	6.62
log *residential house price*	Log (residential building price) (CNY/m^2)	8.35	0.617	10.1	6.84
log *GDP per capita*	Log (urban GDP per capita) (CNY/person)	9.47	0.353	10.6	7.10
log *population*	Log (urban population) (persons)	15.5	0.645	17.0	13.7
log *firm capital*	Log (total assets) (CNY)	19.5	1.45	28.6	12.9
log *firm employment*	Log (number of employees) (person)	5.05	1.09	12.2	2.08
firm age	Firm age = statistical year − Time of registration (year)	10.1	8.21	64.0	0.000
firm productivity	Labor productivity of firms = Log (gross industrial output per employee)	5.87	1.06	16.0	−4.49
OFDI breadth	Cumulative number of OFDI engagements	0.004	0.249	85.0	0.000
OFDI depth	Number of OFDI engagements in the year	0.002	0.056	12.0	0.000
OPcov	OP covariance of firm share and productivity	−0.046	0.097	0.408	−0.545
log *minwage*	Log (monthly minimum wage) (CNY)	6.37	0.263	7.00	5.56
GDP growth	Municipal real GDP growth rate (1/100 percentage point)	0.031	0.037	0.306	−0.063
R&D labor share	Ratio of R&D persons to total employees in the city	0.020	0.016	0.112	0.001
log *exshockex2000*	Log (export share-weighted city-level exchange rates)	4.47	0.182	4.90	3.24
log *exshockim2000*	Log (import share-weighted city-level exchange rates)	4.50	0.085	4.83	3.49
log *duty_in*	Log (tariffs on intermediate goods) (1/100 percentage point)	0.127	0.006	0.141	0.069
log *duty_out*	Log (tariffs on final goods) (1/100 percentage point)	0.165	0.002	0.167	0.073

Notes: The values are all calculated by authors from observed data for 2005–2013. For the logarithmic variables, see Table 5 in Appendix B for the summary statistics of their original values. We provide summary statistics of these variables within the benchmark regression sample. For numbers smaller than 1, we keep 3 digits; for those between 1–10, we keep 2 digits; for those between 10–100, we keep 1 digit; for those over 100, we round them to the nearest integers. All the values are CPI-adjusted.

where $e_{k_y t}$ is the geometric mean of the country exchange rate at time t, measuring the conversion ratio between country k's currency and the CNY, $\omega_{i,k,2000}$ is the share of city i's trade in country k's trade with the world in 2000. In the sampling process, we use trade shares prior to 2000 to avoid potential endogeneity problems. When calculating $CityXR_{it}$, we standardize the currency by dividing the specific exchange rate of each country/region by its value in 2000. Based on the formula above, we can calculate two different exchange rate indicators: one is weighted by import shares, and the other by export shares. As summarized, the former ranges from 32.8 to 125, with an average of 90.5; the latter ranges from 25.6 to 134, with the average being 88.2.

Finally, the outward FDI decisions of firms may be affected by the fact that they experienced tariff declines during the sample period. To address this issue, we need to obtain our tariff indicators—we follow the methodology of Amiti and Konings (2007) and use provincial input–output tables for 2002 to calculate provincial sectoral input tariffs. The specific formula is:

$$\tau_{pst}^{input} = \sum_{q} a_{psqt} \tau_{qt}^{output} \quad (2)$$

In equation (2), τ_{qt}^{output} is the output tariff imposed on sector q at time t; a_{psqt} is the percentage of total industry costs sector s spent on products supplied by industry q as intermediate inputs for industry s in province p at time t. As summarized, the average tariffs on intermediate and final goods are 114 and 118 percentage points.

2.2. Empirical strategy

In order to analyze the impact of urban house prices on firms' outward FDI decisions, we developed the following regression model:

$$OFDI_{it} = \beta_0 + \beta_1 \ln(houseprice)_{c,t-1} + \beta_2 Z_{c,t-1} + \beta_3 X_{i,t-1} + \varphi_i + \varphi_{rt} + \varphi_{ot} + \varepsilon_{it} \quad (3)$$

where i denotes a firm, r denotes a region,[7] c denotes a city, o denotes an ownership type,[8] and t denotes a year. $OFDI_{it}$ indicates whether a firm engaged in outward FDI in a given year. $\ln(houseprice)_{c,t-1}$ denotes the main explanatory variable, urban house prices at time $t-1$, which is expressed as the logarithm of the total urban house prices. Meanwhile, given the lag effect of urban house prices,

[7] There are three regions. The eastern region includes 11 provinces or provincial municipalities: Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan. There are 8 provinces in the central region: Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, and Hunan. Then, the remaining 12 provinces or provincial municipalities in mainland China are in the western region.

[8] We categorize ownership types into three groups: state-owned, domestically-owned (which includes private and hybrid/collective), and foreign-owned (from Hong Kong, Macau, Taiwan province, and all other countries).

this paper lags it by one period in the regression model. In this model, the main parameter of our interest is β_1, the estimated coefficient of the core explanatory variable, with the positive (negative) value of β_1 indicating the positive (negative) impact of urban house prices on the probability of firms' outward FDI. $Z_{c,t-1}$ contains all lagged city-level control variables, including gross urban product per capita and urban population. $X_{i,t-1}$ are lagged firm-level control variables, including total firm assets, employment, age, and labor productivity, to control for the effects generated by other observed firm factors. φ_i is the firm fixed effect, which in fact automatically controls for city fixed effects when firm locations do not change over time. That is, we focus on changes in outward FDI within the firm caused by the urban house prices faced by the firm. φ_{rt} are region-time fixed effects, and φ_{ot} are firm ownership-time fixed effects, both of which are used to control for time trends at the region and ownership levels. Note also that, although we do not write φ_t (the overall time fixed effects) in equation (3), it is in effect included in the region-time and ownership-time fixed effects. In addition, to control for potential heteroskedasticity and spatial correlation problems, we refer to Bertrand et al. (2004) and adjust the standard error for clustering at the city level.

3. Empirical findings

3.1. The overall impact of urban house prices on firms' outward FDI entry

The estimation results of the benchmark regression for the impact of urban house prices on firms' outward FDI entry are provided in Table 2. In column (1), we try to replicate Guo et al. (2020)'s result by not controlling for the firm fixed effects, while controlling for the two-digit industry and other fixed effects,[9] and we find that urban house prices have a significant positive impact on firms' outward FDI entry, with an estimated coefficient of 0.00213, which is significant at the 1 % level. However, when we control for the firm fixed effects, a significant but negative impact emerges, with an estimated coefficient of −0.00477, as shown in column (2). This opposite result translates into one firm out of every 210 firms forgoing outward FDI when the house prices double. The result is significant at the 1 % level as well. From 2005 to 2013, the average value of urban house prices in the sample increased from 3,118 to 7,030 CNY/m^2, which translates into a 0.60 % decrease ($-0.00477 \times \frac{7{,}030-3{,}118}{3{,}118} \times 100\% \approx -0.598\%$) in the probability of outward FDI by firms during the sample period. While only one percent of the enterprises in the sample have ever engaged in outward FDI, the probability of outward FDI by firms within the sample period from 2005 to 2013 increased from 0.91 % to 1.54 %—this is an increase of 0.63 %, indicating that the effect of rising urban house prices on outward FDI by enterprises is salient, explaining about 95.2 % (0.60/0.63*100 %) of missed growth. That is, the number of firms conducting outward FDI among these enterprises could have been two times the current figure if the urban house prices remained unchanged during the study period.

In column (3), to verify the robustness of our benchmark regression results, we use residential building prices instead of the original overall house prices for the regression model, and the results show that the negative effect of rising house prices on outward FDI by firms is still quite salient, with a similar magnitude. Moreover, while the existing literature mostly investigates if firms engage in outward FDI, this paper further attempts to explore the impact of rising house prices on the "depth" and "breadth" of outward FDI in columns (4) and (5). Among them, the depth of outward FDI in this paper is measured by the number of outward FDI firms in that year (the flow), whereas the breadth is expressed by the number of outward FDI firms accumulated to that year (the stock). The results in columns (4) and (5) of Table 2 show that, the rise in urban house prices has a negative effect on the depth of outward FDI, while it has an insignificant effect on the breadth of outward FDI.

3.2. Endogeneity issues

The endogeneity problem regarding house prices is mainly due to the issues of reverse causality, self-selection and omitted variables. In particular, firms' investment can involve real estate investment, which can in turn affect house prices (Chaney et al., 2012). Second, the rise in house prices may not be random—e.g., cities where house prices rise fast can also have more corporate investment, leading to underestimation of the negative impact of rising house prices on corporate outward FDI. Third, the impact of house prices on enterprises' outward FDI may also encounter endogeneity problems caused by omitted variables brought about by certain unobservable factors: for instance, real estate prices are closely related to the real estate cycle in the region where different enterprises are located; house price changes are linked to the degree of financing constraints (Cull and Xu, 2005); the prosperity of the real estate market also acts on business investment through other channels, etc. The identification strategies of previous studies on the endogeneity problem of house prices are as follows. First, regarding reverse causality, previous studies typically lag house prices by one period or use GMM estimation methods. Second, regarding the non-randomness of house price increases, some scholars utilize the purchase restriction policies and estimate a difference-in-differences model. Third, regarding omitted variables, previous studies mainly increased the number of control variables to reduce the endogeneity problem. Himmelberg et al. (2005) and Chaney et al. (2012) use instrumental variables to solve the problem. Clearly, there is still room for improvement in the treatment of the endogeneity

[9] Given that economic conditions vary significantly across regions, based on data from the NBS, we divide mainland China into eastern, central, and western regions, controlling for region-time fixed effects to capture any regional shocks that may change over time affecting both urban house prices and corporate outward FDI. In addition, our sample includes firms with different ownership types. As it is possible that ownership-specific policy shocks may be related to urban house prices and firms' outward FDI decisions, to address this issue, this paper further controls for firm ownership-time fixed effects.

Table 2
Benchmark regression models.

	(1) OFDI	(2) OFDI	(3) OFDI	(4) OFDI breadth	(5) OFDI depth
Lagged log *house price*	0.00213***	−0.00477***		0.000769	−0.00121*
	(3.43)	(−6.16)		(0.18)	(−1.69)
Lagged log *residential house price*			−0.00361***		
			(−5.15)		
Lagged log *GDP per capita*	−0.00143**	−0.000570	−0.000759	−0.000185	−0.000417
	(−2.42)	(−1.02)	(−1.36)	(−0.20)	(−0.77)
Lagged log *population*	−0.000593	0.00404***	0.00411***	−0.00369	0.000402
	(−1.52)	(6.18)	(6.27)	(−0.81)	(0.50)
Lagged log *firm capital*	0.00744***	0.00282***	0.00282***	0.00297***	0.00256***
	(26.39)	(11.05)	(11.04)	(3.06)	(9.12)
Lagged log *firm employment*	0.00333***	−0.00263***	−0.00265***	0.00325	−0.000573
	(9.28)	(−7.86)	(−7.93)	(0.78)	(−1.46)
Lagged firm age	−0.0000329	0.0000286	0.0000291	−0.0000580	−0.0000205
	(−1.08)	(0.72)	(0.73)	(−0.78)	(−0.64)
Lagged firm productivity	0.00190***	−0.000290	−0.000311*	−0.00118	0.000163
	(7.44)	(−1.54)	(−1.65)	(−0.81)	(0.92)
Lagged log *minwage*	−0.00535***	−0.00246**	−0.00265**	−0.00201	−0.00271***
	(−3.96)	(−2.22)	(−2.39)	(−0.98)	(−2.77)
Lagged GDP growth	−0.00734**	−0.00497**	−0.00482**	0.00456	0.00267
	(−2.45)	(−2.31)	(−2.24)	(0.57)	(0.78)
Lagged R&D labor share	0.0279*	0.0459*	0.0425*	0.0797**	0.0457**
	(1.94)	(1.87)	(1.74)	(1.98)	(2.09)
Lagged log *exshockex2000log*	0.00458***	0.00546	0.00527	0.00330	0.00793**
	(3.09)	(1.19)	(1.15)	(0.37)	(2.07)
Lagged log *exshockim2000log*	0.00781**	−0.00239	−0.00158	0.0104	0.00182
	(2.42)	(−0.43)	(−0.29)	(1.01)	(0.38)
Lagged duty_in	−0.114***	0.0262	0.0235	−0.0428	−0.0474
	(−2.84)	(0.64)	(0.58)	(−0.74)	(−1.22)
Lagged duty_out	−0.0869	−0.0811	−0.0772	0.0507	0.0322
	(−1.26)	(−1.43)	(−1.36)	(1.05)	(0.90)
Firm FE	No	Yes	Yes	Yes	Yes
Industry FE	Yes				
Time FE	Yes	Yes	Yes	Yes	Yes
Ownership-year FE	Yes	Yes	Yes	Yes	Yes
Region-year FE	Yes	Yes	Yes	Yes	Yes
Observations	725,739	725,739	725,739	725,739	725,739
R^2	0.020	0.794	0.794	0.738	0.297

Notes: 1) t-statistics are in parentheses; 2) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; 3) robust standard errors are clustered at the city level; 4) FE stands for fixed effect; 5) for columns (2) to (5), industry FE is muted as firm FE is has been controlled for.

problem concerned, such as the problem of how to choose the number of lagged periods, or how to increase the number of purchase restriction cities to cover the whole country and make the sample more nationally representative.[10]

In the earlier investigation, we have tried to control for a series of relevant variables in the benchmark regression, and lagged house prices by one period for the regression, in order to mitigate the bias caused by endogeneity issues as much as possible. For the endogeneity problems that may still remain to be solved, we extend our benchmark regression model by resorting to an instrumental variable (IV) approach, constructing a difference-in-differences (DID) model using purchase restriction policies, and also referring to cross-provincial border city and county pairs—we utilize the discontinuity of housing restriction policies across provincial boundaries to validate the causal relationship of urban house prices on corporate outward FDI.

3.3. A FE-IV estimator

Following Ke et al. (2014), we apply a fixed-effects instrumental variable (FE-IV) estimator to our panel dataset. Given the spatial interactions across neighboring cities, we instrument our log house prices in city c at time $t-1$ with the log house prices in its neighboring cities either at time $t-1$ or $t-2$ (the sample size decreases as data availability decreases).[11]

In Table 3, we present the first-stage and second-stage results for both IVs. As shown, both columns (2) and (4) suggest a significantly positive spatial correlation in house prices, especially the contemporary prices (i.e., those at time $t-1$). Given the large t-statistics, the F statistics of the IVs are much larger than 10, satisfying the "powerful condition" of strong IVs. From columns (1) and (3), we observe that the discouraging effect of house prices on outward FDI not only remains quite significant but also becomes larger in magnitude. This confirms the robustness of our result and suggests that our benchmark estimate can be a conservative "lower bound". Of course, we need to interpret the estimated effects with care—these larger effects are obtained based on the "compliers" who face higher local house prices when their neighboring cities do.

3.4. A DID approach to study the impact of purchase restrictions

In order to investigate the impact of purchase restriction policies on firms' outward FDI entry, this subsection compiles cities that implement purchase restrictions as a quasi-experiment, compared to cities that do not have purchase restrictions, and uses a DID method to test whether outward FDI entry is higher in cities that implement purchase restriction policies than in other cities. Specifically, before using the DID method, the experimental and control groups should be identified.

In this paper, the cities that implement purchase restriction policies between 2010 and 2011 are selected into the experimental group, and the cities that do not implement any purchase restriction policies are selected into the reference group. Meanwhile, considering that purchase restriction policies are not implemented at the same time point, some cities can be in the reference group at time t and become a member of the experimental group at time $t+1$. Thus, this paper adopts a continuous-time DID model for estimation (Angrist and Pischke, 2009; Zheng et al., 2016), and the specific regression model is set as follows:

$$OFDI_{it} = \beta_0 + \beta_1 Restrict_{ct} \times Post_t + \beta_2 Z_{ct} + \beta_3 X_{it} + \varphi_i + \varphi_{rt} + \varphi_{ot} + \varepsilon_{it} \quad (4)$$

where i, r, c, o, t, and $OFDI_{it}$ all follow the notations of equation (3). We denote $Restrict_{ct}$ as the dummy variable indicating whether there are any housing purchase restrictions in city c. $Post_t$ is an indicator for the duration of purchase restrictions, which takes the value 1 if city c has implemented purchase restriction policies, and 0 otherwise. Z_{ct} and X_{it} are contemporaneous city-level and firm-level controls. φ_i denotes the firm fixed effect, while φ_{rt} and φ_{ot} are time fixed effects (including time trends at the region and ownership levels). The regression results are presented in Table 4, indicating that purchase restrictions increase firms' outward FDI capacity. This is consistent with previous research findings that the implementation of purchase restriction policies (which can lower the growth of house prices) can help mitigate the negative impacts of rising urban house prices.

The assumption of parallel trends between the experimental and control groups is a prerequisite for the DID analysis model to work. Conversely, if there is already a difference in trends between the experimental and control groups, then the conclusion that purchase restrictions affect outward FDI cannot be drawn. For this reason, we need to verify whether there is a parallel trend in outward FDI between the experimental and control groups before the implementation of purchase restrictions. As shown in Fig. 4, before the implementation of purchase restrictions, both the experimental and control groups' urban house prices have no significant impacts on the outward FDI entry of enterprises. However, after the implementation of purchase restrictions, purchase restrictions have significant positive impacts on their outward FDI entry, especially in the second and third years.[12] This is reassuring for the use the DID model.

[10] Purchase restrictions mainly target large cities. Some scholars even propose that purchase restrictions may affect the demand in addition to house prices.

[11] As pointed out by Moralı and Yılmaz (2022), house prices are highly spatially (auto)correlated.

[12] Note that, the explanatory variables are not lagged, and $t+3$ denotes three years after the implementation of purchase restrictions. Since our study period is 2015–2013, $t+3$ is actually the largest time period. If we lag all explanatory variables except the interaction term, we get an estimate of 0.00418 (significant at the 1% level with a t-value of 7.34). If we further lag the interaction term, we get an estimate of 0.00278, suggesting a smaller effect when we include one more period before the implementation of purchase restrictions.

Table 3
FE-IV regression results.

	(1) Neighbor t-1	(2)	(3) Neighbor t-2	(4)
	Second Stage	First Stage	Second Stage	First Stage
Lagged log *house price*	−0.0124***		−0.0280***	
	(−4.17)		(−3.87)	
IV		0.200***		0.145***
		(89.27)		(50.24)
Lagged log *GDP per capita*	−0.000638	0.0394***	−0.00214***	0.0228***
	(−1.15)	(23.84)	(−2.76)	(10.55)
Lagged log *population*	0.00665***	0.282***	0.00920***	0.254***
	(7.17)	(46.54)	(4.38)	(39.54)
Lagged log *firm capital*	0.000329*	0.00600***	−0.000125	0.00400***
	(1.94)	(12.34)	(−0.53)	(7.42)
Lagged log *firm employment*	−0.000457**	0.000746	−0.000173	−0.00200**
	(−2.18)	(1.12)	(−0.56)	(−2.46)
Lagged firm age	−0.0000428	−0.000147*	0.00000479	−0.0000969
	(−1.54)	(−1.75)	(0.12)	(−1.09)
Lagged firm productivity	0.000231	0.00324***	0.000524**	0.00270***
	(1.52)	(7.11)	(2.18)	(4.57)
Other controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Ownership-year FE	Yes	Yes	Yes	Yes
Region-year FE	Yes	Yes	Yes	Yes
Observations	489,991		317,542	

Notes: 1) t-statistics are in parentheses; 2) * p < 0.1, ** p < 0.05, *** p < 0.01; 3) robust standard errors are clustered at the city level; 4) FE stands for fixed effect; 5) other controls include the minimum wage, municipal real GDP growth rate, R&D labor share, export and import share-weighted city-level exchange rates, tariffs on intermediate goods and on final goods.

Table 4
DID analysis with housing purchase restrictions as external shocks.

	(1) OFDI
I(purchase restrictions) × *Post*	0.00452***
	(7.37)
log *GDP per capita*	−0.000766
	(−1.33)
log *population*	0.00108*
	(1.85)
log *firm capital*	0.00487***
	(14.84)
log *firm employment*	−0.00537***
	(−13.88)
firm age	0.0000270
	(0.70)
firm productivity	−0.000341
	(−1.46)
Other controls	Yes
Firm FE	Yes
Time FE	Yes
Ownership-year FE	Yes
Region-year FE	Yes
Observations	707,934
R^2	0.794

Notes: 1) t-statistics are in parentheses; 2) * p < 0.1, ** p < 0.05, *** p < 0.01; 3) robust standard errors are clustered at the city level; 4) FE stands for fixed effect; 5) other controls include the minimum wage, municipal real GDP growth rate, R&D labor share, export and import share-weighted city-level exchange rates, tariffs on intermediate goods and on final goods.

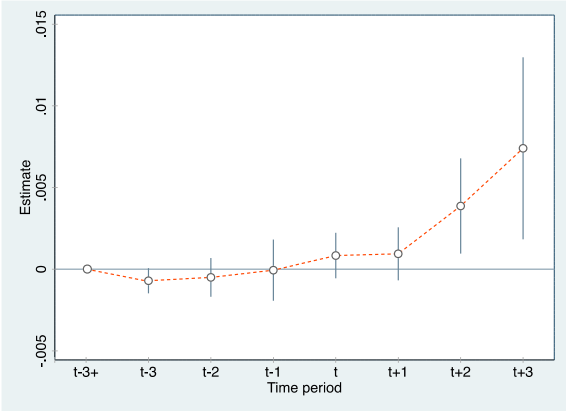

Fig. 4. Event study plot of purchase restriction on firms' outward FDI. Notes: The vertical bands represent ±1.96 times the standard errors of each point estimate. The estimate for the reference (i.e., time periods before $t-3$) is set to 0.

3.5. *The application of cross-provincial border city/county pairs*

For the endogeneity problem due to factors such as omitted variables that cannot be solved by the previous regression model, we follow Fan et al. (2018) and utilize the discontinuity in housing restrictions across provincial borders to construct a dataset of all city/county pairs across provincial borders in China. A city/county pair is defined as two cities/counties with a shared boundary but locating in two different provinces. In particular, we construct a dataset of all city/county pairs across inter-provincial boundaries in mainland China. As shown in Fig. 5, the shaded areas are the cities across the inter-provincial borders, from which we can see that most cities and a good number of counties in mainland China touch the inter-provincial borders. In our data, there are 152 neighboring cities and 586 neighboring counties. Because a city/county may belong to multiple city/county pairs, a single city/county may have multiple duplicate entries the dataset, resulting in data duplication. In our data, there are 228 city pairs and 751 county pairs. To solve this issue, we match the firm-level dataset with our city/county-pair dataset to form a new city/county-pair firm dataset. Then, we control for city/county-pair fixed effects, further controlling for the effects of spatial unobserved factors. Note that, given that provincial border cities/counties tend to be far away from the provincial governments that determine housing policies in the region, house prices in provincial border cities/counties may be less affected by their local economic conditions. Finally, weighted regression is performed according to the repetitions of observations.

We replace region fixed effects by city/county pair fixed effects in the baseline model (3). This allows us to control for the factors that characterize city pairs during our study period. As neighboring cities/counties have more geographic characteristics similar than non-neighboring cities/counties, by controlling for city/county pairs, we can arguably study the impact of house price changes in neighboring cities/counties on firms' outward FDI entry more accurately. Table 5 shows the new regression results, in which the regressions in columns (1) and (2) use the city-pair dataset, while columns (3) and (4) use the county-pair dataset instead. The results show that the coefficient of the impact of urban house prices on firms' outward FDI entry remains negative and significant, which is consistent with the benchmark regression results. At the same time, we find that the coefficients in columns (1) to (4) are smaller than that in column (2) of Table 2 in magnitude, suggesting that omitted variables related to cross-provincial borders are likely to inflate the benchmark regression results. This is different from the results of Fan et al. (2018), who find that minimum wages have greater impacts on firms' outward FDI entry after controlling for city pair-time fixed effects. In summary, the benchmark regression results still hold when endogeneity is addressed through different strategies.

3.6. *The results for listed companies*

With all the above strategies to address endogeneity issues, one might still concern about the data quality of ASIF, or worry about how representative our results are, since the firms who are willing and able to conduct outward FDI only account for a small portion of our ASIF sample. To address these remaining concerns, we apply our benchmark regression model to a sample of listed companies.

We started with 17,824 observations for 2005–2013. After merging with the data for house prices, we are left with 16,044 observations. To facilitate comparability with our main study sample, we only keep the 9,187 observations for manufacturing firms. After lagging our variables and keeping observations without missingness, we obtain 6,691 observations for the regression analysis.

As shown in Table 6, the negative impacts of rising house prices seem to be more salient among listed companies. For outward FDI entry, the estimated coefficient in column (1) is −0.0771, suggesting that for every 13 listed companies in China, one of them will forgo outward FDI when urban house prices double. From 2005 to 2013, the average value of urban house prices in the sample increased

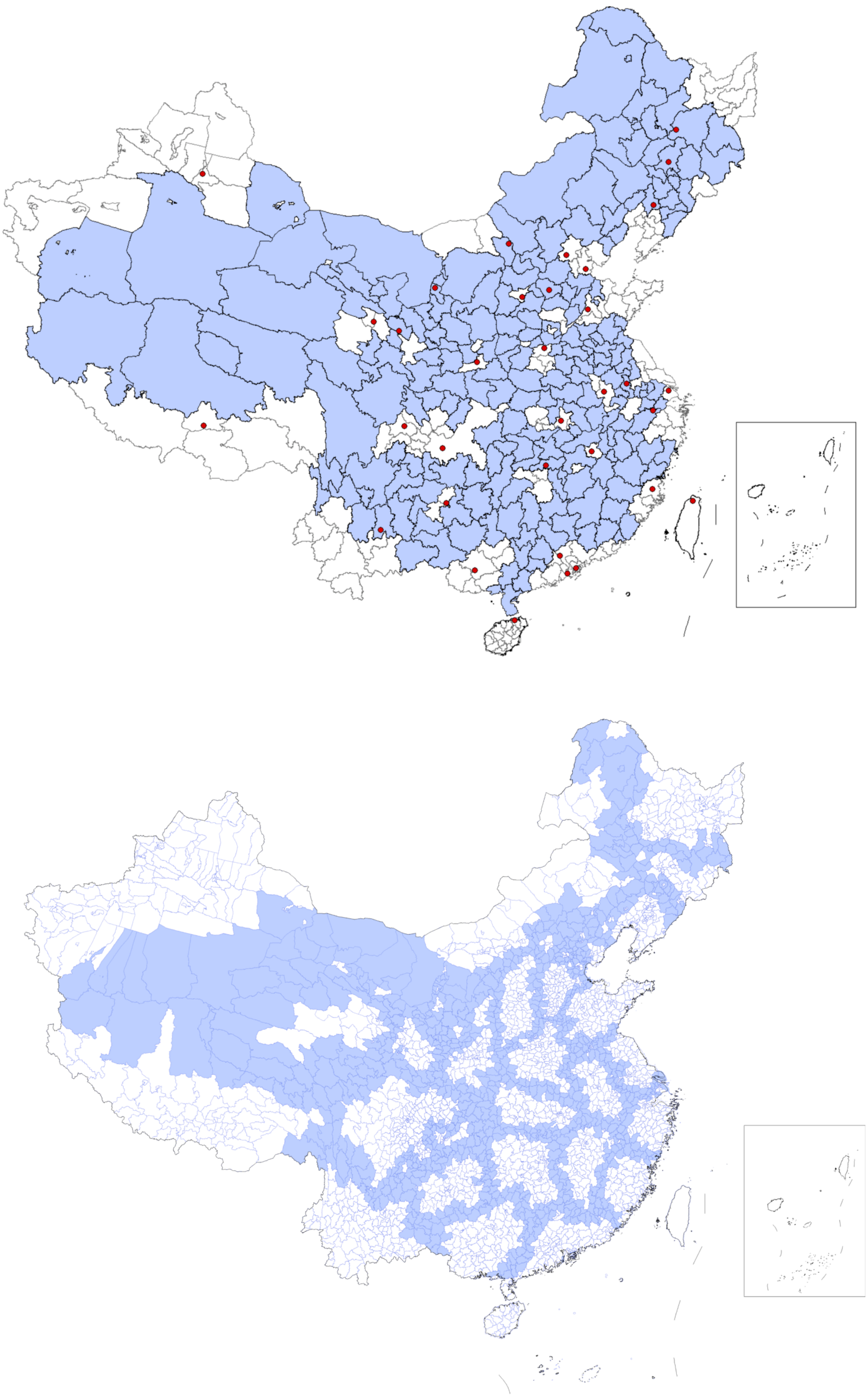

Fig. 5. Trans-provincial border cities and counties in mainland China. Notes: The upper panel presents the *trans*-provincial border cities, while the bottom panel illustrates the border counties. In the upper panel, capital cities of different provinces of China are marked by dots.

Table 5
Regressions based on the city/county-pair firm-level sample.

	(1) City-pair data	(2)	(3) County-pair data	(4)
	Unweighted	Weighted	Unweighted	Weighted
Lagged log *house price*	−0.00273**	−0.00309***	−0.00254**	−0.00382*
	(−2.40)	(−3.02)	(−2.04)	(−1.94)
Lagged log *GDP per capita*	−0.00222***	−0.00283***	0.000329	0.0000905
	(−2.91)	(−3.28)	(0.54)	(0.16)
Lagged log *population*	−0.000410	−0.000168	−0.00877*	−0.00645
	(−0.52)	(−0.21)	(−1.93)	(−1.53)
Lagged log *firm capital*	0.00165***	0.00180***	−0.0000330	−0.000205
	(4.48)	(5.38)	(−0.13)	(−0.75)
Lagged log *firm employment*	−0.00257***	−0.00252***	−0.000507	−0.000371
	(−4.94)	(−5.35)	(−1.36)	(−0.58)
Lagged firm age	0.0000280	0.0000275	0.0000534	0.0000261
	(0.62)	(0.62)	(1.56)	(0.91)
Lagged firm productivity	−0.000309	−0.000102	−0.000530**	−0.000298
	(−1.14)	(−0.40)	(−2.04)	(−0.94)
Other controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Ownership-year FE	Yes	Yes	Yes	Yes
City or county pair FE	Yes	Yes	Yes	Yes
Observations	817,497	817,497	368,408	368,408
R^2	0.832	0.825	0.872	0.841

Notes: 1) t-statistics are in parentheses; 2) * p < 0.1, ** p < 0.05, *** p < 0.01; 3) robust standard errors are clustered at the city level; 4) FE stands for fixed effect; 5) other controls include the minimum wage, municipal real GDP growth rate, R&D labor share, export and import share-weighted city-level exchange rates, tariffs on intermediate goods and on final goods.

from 2,991 to 9,180 CNY/m^2, which translates into a 16.0 % decrease in the probability of outward FDI by firms during the sample period.[13] While 22.9 percent of the listed companies in the sample have ever engaged in outward FDI, the probability of outward FDI by firms within the sample period from 2005 to 2013 increased from 12.6 % to 35.3 %—this is an increase of 22.7 %, again indicating an salient effect of rising urban house prices on outward FDI, explaining almost 70.5 % (16.0 %/22.7 %) of missed growth. That is, the number of listed companies conducting outward FDI among these firms could have been 1.7 times the current figure if the urban house prices remained unchanged during the study period. For the outward FDI amount, which is only available for listed companies, we also find a negative effect of house prices. The estimated coefficient (−1.009) in column (2) of Table 6 suggests that, the amount of outward FDI decreases by 1 % when the house price increases by 1 %.

4. Mechanism analysis

4.1. The investigation of the "Olley and Pakes" covariance

The lesson from the above empirical analysis is that the rise in urban house prices has a significant negative impact on the outward FDI entry of enterprises. Then, how do rising urban house prices affect enterprises' outward FDI decisions? At the start of the paper, we proposed that rising urban house prices may affect firms' exposure to heterogeneous financing constraints through the collateral effect, crowding-out effect and speculation effect, leading to resource misallocation, which in turn affect their outward FDI entry negatively. To investigate this channel, we follow Bartelsman et al. (2013) and measure the efficiency of resource allocation. To calculate the degree of resource misallocation, we need to first estimate productivity, and we thus choose the total factor productivity (TFP) of each firm as an indicator. In addition to the measurement of the input and output of various factors, the core issue in TFP estimation is to solve the endogeneity problem in the estimation of production functions. Scholars have proposed various methods, e.g., fixed-effects, instrumental variables, generalized moments, and the control-function methods, among which the most commonly accepted methods are the control function methods, e.g., the OP, LP, and ACF methods (Olley and Pakes, 1996; Levinsohn and Petrin, 2003; Ackerberg et al., 2015). In this paper, we adopt the OP method as the benchmark, and use the ACF method for robustness testing, which combines the robustness of OP with the efficiency of LP and is increasingly utilized in firm-level TFP estimation (De Loecker and Warzynski, 2012; Huang and Zhuang, 2022). See Appendix A.1 for more details of the data processing and measurement.

Based on the calculation of firms' TFP and drawing on the existing literature (e.g., Bartelsman et al., 2013), this paper mainly uses the OP covariance (OPcov) indicator to characterize the degree of resource misallocation. Referring to the decomposition method of Olley and Pakes (1996), the TFP of Chinese manufacturing industry is decomposed and the decomposition equation is:

[13] That is, $-0.0771 \times \frac{9{,}180-2{,}991}{2{,}991} \times 100\% = -15.95\%$.

Table 6
Results for listed manufacturing companies.

	(1) OFDI entry	(2) OFDI amount
Lagged log *house price*	−0.0771**	−1.009*
	(−2.58)	(−1.83)
Lagged log *GDP per capita*	−0.0205	−0.619
	(−0.70)	(−1.15)
Lagged log *population*	−0.115	0.290
	(−1.30)	(0.16)
Lagged log *firm capital*	0.0768***	1.526***
	(5.75)	(5.61)
Lagged log *firm employment*	0.0327	0.428
	(0.76)	(0.51)
Lagged firm age	−0.0106	0.112
	(−0.63)	(0.34)
Other controls	Yes	Yes
Firm FE	Yes	Yes
Time FE	Yes	Yes
Ownership-year FE	Yes	Yes
Region-year FE	Yes	Yes
Observations	6,691	6,691
R^2	0.787	0.778

Notes: 1) t-statistics are in parentheses; 2) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; 3) robust standard errors are clustered at the city level; 4) FE stands for fixed effect; 5) other controls include the minimum wage, municipal real GDP growth rate, R&D labor share, export and import share-weighted city-level exchange rates, tariffs on intermediate goods and on final goods.

$$\Omega_t = \sum_i s_{it} w_{it} = \overline{w}_t + \sum_i (s_{it} - \overline{s}_t)(w_{it} - \overline{w}_t) \tag{5}$$

where s denotes the output (or employee) share of a firm in the industry, and $\overline{s}$ denotes the mean share; Ω_t denotes industry productivity weighted by the shares of all firms in the industry, w denotes the productivity of a firm, and $\overline{w}$ represents the average productivity of all firms in the industry. The second term on the right-hand side of equation (5) is the covariance of firms' shares with productivity (OPcov), which refers to the covariance between firms' share and productivity, measuring whether a firm's share grows proportionally to its productivity. If resources are optimally allocated, firms with higher productivity should receive more resources; the degree of resource misallocation would be higher if resources are not allocated in this way. Generally speaking, in the case of optimal allocation of resources, large firms tend to have higher productivity, and if the distribution of firms' production size is inconsistent with the distribution of productivity (or, more commonly, large-scale firms do not have higher levels of productivity), this reflects certain misallocation of resources in the real economy. Therefore, the lower the OPcov is, the more serious the resource misallocation is: e.g., when the OPcov is equal to 0, it means that good firms do not receive resources that match their productivity contribution at all (i.e., random allocation). In the United States, OPcov is as high as 0.51, while in comparison it is very low in transitional economies, and in China it is negative and close to the lowest level according to some estimates (Bartelsman et al., 2013).

We first study the impact of rising urban house prices on the resource misallocation indicator. In column (1) of Table 7, we find that rising urban house prices exacerbate resource misallocation (by lowering the efficiency of resource allocation). Second, we control for the indicator of resource misallocation to study the impact of rising urban house prices on firms' outward FDI entry. By reading the column (2) of Table 7 in comparison with the benchmark regression results, we find that the magnitude of the coefficient decreases from 0.00477 to 0.00472. While the decline does not seem to be significant, it does not reject the possibility that urban house prices are likely to have a certain degree of negative impact on enterprises carrying out outward FDI through the exacerbation of resource misallocation.[14]

According to the theory of resource allocation, efficient resource allocation implies an equilibrium in the marginal product of returns among firms. If it is further assumed that firms within an industry have common cost markup and capital elasticity, then the marginal product value of capital and labor is proportional to the average productivity (Hsieh and Song, 2015). To further understand the sources of resource misallocation due to rising house prices, we construct an indicator for capital misallocation and another one for labor misallocation, drawing on the approach of Wu et al. (2020). Specifically, the covariance of the ratio of value added to a firm's capital stock and the firm's share is used as the capital misallocation indicator and the covariance of the ratio of value added to a firm's number of employees and the firm's share is used as the indicator for labor misallocation. Table 7′s columns (3) and (4) show the estimated effects of urban house prices on the misallocation of labor and capital resources, respectively, and it is found that the rise in

[14] A more drastic decline in magnitude would then suggest that the resource misallocation channel is a stronger mediator. Exploring which channel is the major mechanism is beyond the scope of this paper, but we believe that it can be an important topic for a future study. One possible alternative is that the "institutional distance" between the host countries and China is larger when house prices are higher, and Li et al. (2020) find that institutional gaps can have a statistically significant negative effect on China's outward FDI.

Table 7
House prices and resource misallocation.

	(1) OPcov	(2) OFDI	(3) Labor productivity cov	(4) Capital productivity cov
Lagged log *house price*	−0.0205***	−0.00472***	−0.00994***	−0.0482***
	(−39.09)	(−6.12)	(−2.97)	(−20.88)
Lagged OPcov		0.00279*		
		(1.93)		
Lagged log *GDP per capita*	0.00503***	−0.000606	0.0557***	0.0256***
	(11.84)	(−1.08)	(19.39)	(11.24)
Lagged log *population*	0.0142***	0.00399***	0.0106***	−0.0222***
	(56.08)	(6.14)	(5.85)	(−15.17)
Lagged log *firm capital*	−0.000172	0.00282***	0.00534***	0.00243***
	(−0.99)	(11.05)	(4.94)	(3.11)
Lagged log *firm employment*	−0.00458***	−0.00261***	−0.0372***	−0.0218***
	(−23.72)	(−7.82)	(−29.41)	(−23.81)
Lagged firm age	0.000125***	0.0000285	0.000146	0.000296**
	(3.68)	(0.72)	(0.78)	(2.27)
Lagged firm productivity	−0.00434***	−0.000276	−0.0391***	−0.0226***
	(−28.08)	(−1.46)	(−40.06)	(−31.57)
Other controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Ownership-year FE	Yes	Yes	Yes	Yes
Region-year FE	Yes	Yes	Yes	Yes
Observations	725,739	725,739	725,739	725,739
R^2	0.822	0.794	0.913	0.726

Notes: 1) t-statistics are in parentheses; 2) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; 3) robust standard errors are clustered at the city level; 4) FE stands for fixed effect; 5) other controls include the minimum wage, municipal real GDP growth rate, R&D labor share, export and import share-weighted city-level exchange rates, tariffs on intermediate goods and on final goods.

urban house prices leads to the misallocation of capital and labor at the same time, and the capital misallocation is more serious. This is consistent with the results of previous studies. For example, Chen et al. (2017) find that rising house prices may cause firms' resource misallocation through a "capital speculation" effect and crowding-out effect. Shi (2017) find that rising house prices can decrease R&D input, capital investment, and efficiency of their original production activities, through capital speculation and inefficient reallocation of entrepreneurial talent.

4.2. *The investigation of TFP*

To depict a more complete picture of our resource misallocation story and delve into the more direct consequences of firms reallocating resources to the real estate sector, we supplement the underlying mechanisms of how rising house prices negatively impact firms' outward FDI by investigating how rising house prices and resource misallocation affect firms' TFP. In Table 8, we present the estimated coefficients for the relationships between log house price as well as resource misallocation and firms' TFP. These findings offer new insights into explaining the reasons for the decline in firms' outward FDI in the presence of rising housing prices. On the one hand, rising house prices may lead to resource re-allocation through financial constraints, directly reducing firms' outward FDI. On the other hand, they can also result in resource misallocation and reduce firms' TFP, indirectly lowering their outward FDI. From columns (1) and (2), we find that house prices are negatively correlated with TFP, and this implies that rising house prices can dampen productivity. This negative effect is likely to be driven by resource misallocation, as we find a positive correlation between TFP and resource allocation efficiency from columns (3) and (4).

In Appendix A.3, we also discuss how rising house prices affect domestic investment (which includes real estate investment) to understand how TFP is negatively affected. We find that domestic investment is increased by house prices, and we believe that it is more likely to be driven by real estate speculation rather than increased machinery and equipment investment. However, since a detailed decomposition of the domestic investment is not available in our data, we do not directly test this possibility.

5. Heterogeneity analyses

5.1. *Basic firm heterogeneity*

According to the analysis above, thus, we hypothesize that, rising urban house prices are more likely to lead to resource misallocation for less productive firms. The question is that, different types of firms and firms in different regions are subject to different degrees of resource misallocation caused by rising house prices, and thus there are differences in the impact on firms' outward FDI. In view of this, we further analyze effect heterogeneity by firm productivity, firm size, firm location, and firm ownership.

First, we use the OP and ACF methods to calculate TFP to measure firm productivity (see Appendix A.1 for details of the calculation methods), and divide the sample into high-productivity (greater than the sample median) and low-productivity (less than the sample

Table 8
House prices, resource misallocation, and TFP.

	(1) TFP by OP	(2) TFP by ACF	(3) TFP by OP	(4) TFP by ACF
Lagged log *house price*	−0.00119*** (−13.63)	−0.000227*** (−3.35)		
Lagged OPcov			0.00117*** (5.08)	0.000675*** (4.44)
Lagged log *GDP per capita*	0.0000296 (0.38)	−0.0000656 (−1.15)	−0.0000958 (−1.23)	−0.0000909 (−1.60)
Lagged log *population*	0.000279*** (4.99)	0.0000186 (0.40)	0.000276*** (4.94)	0.0000115 (0.25)
Lagged log *firm capital*	−0.00857*** (−173.76)	−0.00115*** (−46.10)	−0.00857*** (−173.68)	−0.00115*** (−46.10)
Lagged log *firm employment*	−0.00289*** (−67.28)	−0.00450*** (−124.57)	−0.00290*** (−67.64)	−0.00450*** (−124.54)
Lagged firm age	0.00000230 (0.50)	−0.0000293*** (−8.13)	0.00000240 (0.52)	−0.0000293*** (−8.14)
Lagged firm productivity	−0.00212*** (−64.87)	−0.000961*** (−44.17)	−0.00213*** (−65.24)	−0.000961*** (−44.20)
Other controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Ownership-year FE	Yes	Yes	Yes	Yes
Region-year FE	Yes	Yes	Yes	Yes
Observations	725,739	725,739	725,739	725,739
R^2	0.956	0.883	0.956	0.883

Notes: 1) t-statistics are in parentheses; 2) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; 3) robust standard errors are clustered at the city level; 4) FE stands for fixed effect; 5) other controls include the minimum wage, municipal real GDP growth rate, R&D labor share, export and import share-weighted city-level exchange rates, tariffs on intermediate goods and on final goods.

median) enterprises based on the levels of TFP. The regression results for the effect of urban house prices on outward FDI entry are shown in column (1) of Table 9, where the negative impact is mainly driven by the low-productivity firms. Consistent with the previous research, there is a difference in the impact of urban house prices on resource misallocation of firms with different productivity, in which the coefficient for low-productivity enterprises is about 1.2 times that for high-productivity firms in column (2) in magnitude, which further corroborates the proposed mechanism of how urban house prices negatively affect outward FDI of enterprises, which is to exacerbate resource misallocation of these enterprises.

Firm size is related to but different from firm productivity, so we use the number of employees as a criterion for firm size and divide the sample into large-scale firms (greater than the sample median) and small-scale firms (less than the sample median) for regression analysis. As seen from Table 9, in the sub-sample regression results, the coefficient that reflects the negative impact of rising house prices on outward FDI by large-scale firms is larger and more significant. Meanwhile, although urban house prices have a significantly negative impact on the resource allocation efficiency of enterprises of different sizes, the negative effect on large-scale enterprises is greater, indicating that outward FDI of large-scale enterprises is more sensitive to urban house prices than that of small-scale enterprises.

There are significant differences in economic development across regions of China. Since firms in the more economically developed eastern region tend to have higher production activities and face higher house prices, we hypothesize that enterprises in the eastern region are more sensitive to house price increases. Enterprises in the eastern part of China in this paper account for about 78.2 % of the research sample, and for this reason, we divide the sample enterprises into just eastern and non-eastern regions for the subsample analysis. As can be seen from Table 9, interestingly, the coefficients for the impacts of urban house prices on enterprises' outward FDI entry in the eastern and non-eastern regions are both negative, and the coefficient for non-eastern firms is even slightly larger. Nevertheless, the results for how house prices affect the resource allocation efficiency of firms show that, urban house prices significantly exacerbate the resource misallocation of firms mainly in the eastern rather than the non-eastern part of China, which is consistent with our expectation. One possibility is that, firms in the eastern part of China already over-invested in the real estate industry, while those in the non-eastern part did not. As a result, eastern firms have to misallocate more resources in order to increase real estate investment, which leads to more severe resource misallocation in the eastern part of China. In other words, reducing

Table 9
Results for productivity, size, location, and ownership heterogeneity.

		(1) OFDI	(2) OPcov	(3) *Observations*
Lagged log *house price*				
TFP by OP	<Median	−0.00649***	−0.0229***	363,277
		(−4.90)	(−31.69)	
	>Median	−0.000463	−0.0174***	362,462
		(−0.83)	(−22.76)	
TFP by ACF	<Median	−0.00692***	−0.0219***	362,699
		(−5.35)	(−30.19)	
	>Median	−0.00116*	−0.0188***	363,040
		(−1.69)	(−24.76)	
Number of employees	<Median	−0.00119*	−0.0195***	359,603
		(−1.71)	(−25.51)	
	>Median	−0.00666***	−0.0223***	366,136
		(−5.19)	(−30.88)	
Region	Eastern	−0.00438***	−0.0232***	567,500
		(−4.77)	(−47.15)	
	Non-eastern	−0.00487***	−0.0149***	158,223
		(−3.60)	(−8.43)	
Ownership	SOE	0.00470	−0.0168***	14,185
		(0.71)	(−3.00)	
	Domestic	−0.00641***	−0.0154***	515,380
		(−7.42)	(−24.27)	
	Foreign	0.000266	−0.0385***	191,373
		(0.17)	(−39.31)	
Controls		Yes	Yes	
Firm FE		Yes	Yes	
Time FE		Yes	Yes	
Ownership-year FE		Yes	Yes	
Region-year FE		Yes	Yes	

Notes: 1) t-statistics are in parentheses; 2) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; 3) robust standard errors are clustered at the city level; 4) FE stands for fixed effect; 5) controls include the GDP per capita, population, firm capital, firm employment, firm age, firm productivity, minimum wage, municipal real GDP growth rate, R&D labor share, export and import share-weighted city-level exchange rates, tariffs on intermediate goods and on final goods.

outward FDI is more likely to be realized by more resource misallocation among eastern firms, while non-eastern firms may find way to relocate resources away from outward FDI without affecting efficiency too much.

Our sample also covers different ownership types, including state-owned enterprises (SOEs), domestically-owned enterprises (DOEs), and foreign-owned enterprises (FOEs). In general, DOEs face more financial complications than SOEs and foreign firms do (Shi, 2017) and typically have more flexibility in adjusting their main businesses, which means that these firms may invest more funds in the real estate speculation, which affects their internationalization decisions.[15] Hence, we further examine the effect heterogeneity by firm ownership. The results are shown in Table 9, where we find that rising house prices have a negative impact only on DOEs, with the coefficient for DOEs significant at the 1 % level. Meanwhile, urban house prices have a significantly negative impact on resource allocation efficiency for all ownership types, indicating that resource misallocation among SOEs and FOEs may not lead to a reduction in outward FDI, but resource misallocation among DOEs can do. In other words, when house prices rise, DOEs tend to relocate resources away from outward FDI to finance their real estate investment, while SOEs and FOEs may relocate other funds and still incur more resource misallocation.

5.2. Extended analyses

In this subsection, we extend our subgroup analyses to strengthen our story. First, we explore the heterogeneity by firms' closeness to the real estate industry. Following Guo et al. (2020), we create a measure of the closeness based on the input–output table of 2012. We divide firms into two groups: those in the industries more closely connected to the real estate industry (high),[16] and those less connected (low). Based on Table 10, firms more closely connected to the real estate industry incur both higher resource misallocation and larger reduction in outward FDI when house prices rise. It is quite intuitive that these firms decide to focus more on the domestic market when domestic house prices rise, as they can benefit more from it.

Second, we explore the heterogeneity by firms' capital intensiveness. We divide firms into labor-intensive (i.e., firms with "low"

[15] Hsieh and Song (2015) used a database of industrial firms to compare SOEs and private firms from 1998 to 2005. They found that capital productivity was much lower in SOEs compared to private firms. Song et al. (2011) also noted that SOEs did not seem to follow the profit maximization objective.

[16] The "high" group includes the industries of chemical products, metal products, general machinery, special equipment, transportation equipment, and electrical, machinery and equipment manufacturing.

capital intensiveness) and capital-intensive ones (high) based on their capital-to-labor ratio—the firms with the ratio below 75 % are categorized into the "low" group, following Guo et al. (2020). Indeed, we do not find a significant effect on the capital-intensive firms. According to Guo et al. (2020), these firms are less likely to be affected by rising labor costs and incur labor shortage. As a result, they may be able to maintain a certain level of outward FDI. Our results further point out the other side of "the coin", which is that labor-intensive firms are more likely to reduce outward FDI through misallocating their resources, possibly toward the real estate industry. Column (2) is quite supportive of this claim, as rising house prices reduce the efficiency of resource allocation more among labor-intensive firms.

Finally, we investigate the heterogeneity by industries' outward FDI intensiveness. We calculate the average proportion of outward FDI participation for each industry, and then divide them into two groups according to the median. Firms in the below-median industries are then categorized into the "low" group. It turns out that, the firms in the industries with higher outward FDI participation are more likely to forgo outward FDI when urban house prices rise; the firms in the industries with low outward FDI entry are less likely to forgo outward FDI due to rising house prices. One explanation for this finding may be that the firms that do conduct outward FDI in the industries with low outward FDI participation really benefit from it, and it is harder for them to forgo the benefits. Nevertheless, rising house prices still worsen their efficiency in resource allocation. For the firms in the industries with high outward FDI participation, their resource allocation efficiency also drops when house prices rise, but the misallocation of resources do lead to their exit of outward FDI.

6. Discussion and conclusion

This paper examines the impact of increasing urban house prices on outward FDI, offering a fresh perspective and enriching the literature of outward FDI determinants. Through empirical investigations, we find that rising house prices reduce enterprises' outward FDI entry. This result is robust to various approaches that deal with the endogeneity of prices, including FE-IV models, the DID strategy based on housing purchase restriction policies, and focusing on cross-provincial boundary city/county pairs. Furthermore, we delve into the underlying mechanisms through which rising house prices affect enterprises' outward FDI. Our findings reveal that rising house prices can exacerbate resource misallocation through the interactions of collateral, crowding-out, and speculation effects, thereby hindering outward FDI entry. This misallocation of resources can lead to increased financing costs, directly impeding outward FDI. Moreover, it reduces total factor productivity, further diminishing the ability to conduct outward FDI. Additionally, rising house prices disproportionately affect enterprises with lower productivity, larger scale, and closer ties to the real estate industry, exacerbating resource misallocation and thus resulting in more pronounced negative impacts on their outward FDI.

Admittedly, this paper still bears certain limitations. For example, the research data in this paper are not updated to the latest year, but it is the latest and most complete "large sample" available. In the future, as the availability of firm-level data increases, the hypotheses presented in this paper should be tested again. Second, due to the inability to obtain a detailed decomposition of the domestic fixed-asset investment data (which include real estate investment and other investments) in our sample, we are not able to directly test if rising house prices indeed lead more firms to invest in real estate through speculative motives. Third, the resource misallocation discussed in this paper are between firms, rather than within each firm. Limited by the existing methods, we also leave the distinction between the two types of resource mismatches for future research.

The implications drawn from this paper are not only for enterprises to carry out more outward FDI, but also for the healthy development of a real estate industry. First, we believe that governments at all levels should pay attention to the impacts of excessive expansions of real estate investments and continuing increases in housing prices on an economy. Local governments may be tempted to generate a quick economic boost by promoting the rise of house prices, but it is likely to be an unsustainable way: while real estate may bring short-term economic growth, in the long run it can also cause problems such as low levels of internationalization of enterprises, which may not be conducive to the promotion of "domestic-international dual circulation".[17] Second, enterprises may be more willing to invest in real estate rather than other parts of the real economy to obtain more profits. Therefore, the government could strengthen the promotion of market-oriented reforms, reduce the non-market allocations of credit resources, and gradually eliminate the distortion of investment incentives induced by the long-term interest rate control. The government can effectively prevent investment funds from flowing into the real estate sector by adopting market-oriented measures such as levying real estate tax, and avoiding political interventions on house prices. Given the existence of the "collateral security" channel among enterprises, in order to avoid the negative transmission effect of the decline in house prices on enterprise investment, governments could reduce the rate of return on speculation in the real estate industry through market-oriented policies, expand small and medium-sized enterprises' financing channels, and enhance the rate of return on investment in other parts of the real economy. In summary, maintaining the relative stability of real estate prices could provide a strong guarantee for the realization of a high-quality economic development, not only for China, but likely for transitional economies sharing similar situations.

CRediT authorship contribution statement

Feng Yu: Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Project administration, Methodology, Data curation, Conceptualization. **Ning Li:** Writing – review & editing, Visualization, Investigation, Formal analysis, Data

[17] This is a strategy of the Chinese government to emphasize domestic consumption ("internal circulation") and remain open to international trade and investment ("external circulation").

Table 10
Results for more heterogeneity.

		(1) OFDI	(2) OPcov	(3) *Observations*
Lagged log *house price*				
Closeness to the real estate industry	Low	−0.00331***	−0.0198***	447,878
		(−3.81)	(−28.30)	
	High	−0.00489***	−0.0226***	262,242
		(−3.08)	(−24.56)	
Capital intensiveness	Low	−0.00351***	−0.0203***	527,104
		(−4.99)	(–32.97)	
	High	−0.00321	−0.0163***	152,363
		(−1.29)	(−13.47)	
Industry outward FDI intensiveness	Low	−0.00109	−0.0203***	313,667
		(−1.28)	(−25.62)	
	High	−0.00680***	−0.0159***	355,516
		(−4.76)	(−19.26)	
Controls		Yes	Yes	
Firm FE		Yes	Yes	
Time FE		Yes	Yes	
Ownership-year FE		Yes	Yes	
Region-year FE		Yes	Yes	

Notes: 1) t-statistics are in parentheses; 2) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; 3) robust standard errors are clustered at the city level; 4) FE stands for fixed effect; 5) controls include the GDP per capita, population, firm capital, firm employment, firm age, firm productivity, minimum wage, municipal real GDP growth rate, R&D labor share, export and import share-weighted city-level exchange rates, tariffs on intermediate goods and on final goods.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

Zhuang acknowledges financial support from Peking University School of Economics Research Seed Grant (Grant ID: 6309900019/283), and the Fundamental Research Funds for the Central Universities, Peking University (2024 Grant ID: 7100604568). The authors are responsible for all errors.

Appendix A

Additional materials

Details on TFP calculation

Due to the adjustment of the national statistical system, both "industrial value added" and "intermediate inputs" are missing in the data for 2008–2013, and they are the key variables for calculating total factor productivity (TFP). In response to this issue, this paper calculates the ratio of value added to total output of different industries through the national input–output table, which is called the rate of value added, and assigns this rate to all enterprises in this industry, and estimates the value added of each enterprise through the following formula: Value added = (Output + VAT) * Rate of value added. The intermediate inputs of each enterprise are then estimated by the following formula: Intermediate inputs = Output + VAT − Value added. Specifically, the national input–output table is published every five years. This paper uses the input–output table of 2007 and 2012: the value-added rates of 2008 and 2009 are calculated through the input–output table of 2007, while the value-added rates of 2011 to 2013 are calculated through the input–output table of 2012. The assumption made here is that all firms within the industry have similar value-added rates. This might not be a very realistic assumption, but it is as reasonable as possible within the scope of available data. First, although enterprises within an industry may have different value-added rates due to differences in production and management efficiency, the differences are much smaller than the differences in value-added rates brought about by different production characteristics between industries. Second, it is better to use industry-level than provincial-level value-added rates for supplementation, since the differences in value-added rates between regions are mainly due to the differences in industrial structure. Further, this paper uses the data of some provinces that continue to publish the value added of industrial enterprises above designated size after 2008 to carry out the test. The value-added data of enterprises supplemented by the above methods are summed up at the provincial level and compared with the available provincial value-added data of industrial enterprises above designated size, and it is found that 85.83 % of the enterprises are within the range that the absolute value of deviation is less than 10 %. In the estimation, this paper excludes enterprises in the mining industry and the production and supply of electricity, gas and water, because natural resources play an important role in the production process of these industries, and their production functions cannot be simply assumed to be in the Cobb-Douglas form, and the final estimation retains only manufacturing enterprises. In this paper, according to the 2-digit national economy industry classification code, the production function is estimated by industry, and then the TFP of each enterprise is calculated. In Exhibits 1 and 2, we provide processing details of each year's data, along with other information.

Referring to the methodology of Brandt et al. (2012), this paper uses the input–output relationship between industries in the input–output table and the PPI to derive an intermediate goods price index (IGPI) for each industry, which is used to deflate the intermediate goods of firms in the industry to calculate real intermediate goods. When summing up the TFP of firms to the whole manufacturing industry level, or to the industry level, a weighted average is calculated, and the weights can be set as output share, added value share, or labor employment share. Larger firms are given greater weights, while firms under 20 million, although large in number, have less impacts on industry TFP. Exhibit 3 lists the weighted average values of TFP for enterprises of different sizes and their contribution to the overall TFP of the manufacturing industry from 2005 to 2009. It can be seen that the industrial enterprises with an annual main business income of more than 20 million CNY contribute to over 95.4 % of the overall manufacturing industry TFP in 2005, and this figure rose to about 99.4 % in 2009; for the enterprises with a size of 5 to 20 million CNY, their whole year TFP contribution to the overall manufacturing industry fell from about 4.6 % in 2005 to around 0.6 % in 2009. Another reason for this result is probably inflation, for the enterprises with a main business income of over 20 million yuan, their actual/real size in 2009 is often smaller than their actual/real size in 2005. Thus, over time, enterprises of 5 to 20 million yuan contribute less and less to the overall manufacturing TFP. Given this, it is arguably reasonable to state that, for 2011–2013, using only the TFP of firms with main business income of more than 20 million yuan to sum up to the industry-level one will not have much impact on the results. Therefore, this paper does not make any special adjustments to the TFP of firms in 2011–2013.

Details on the study sample size

We start with the raw ASIF sample with 2,463,201 observations between 2005 and 2013. Then, we merge it with the China Outward FDI Enterprise Directory, leading to 2,156,178 matched observations. The firm-level TFP has been calculated separately according to Appendix A.1. Then, we merge the sample used for TFP estimation with the dataset with outward FDI information, leading to 1,350,093 observations. Note that, in this step, the data for 2010 are excluded due to quality issues. Next, we merge the current dataset with the China City Statistical Yearbooks and the China Statistical Yearbooks for Regional Economy. After excluding observations without population, we are left with 1,342,216 observations; after excluding those without house prices, we are left with 1,253,284 observations. Then, we deal with issues in the ASIF data: we delete 5,090 observations with duplicate legal person codes, 19,903 observations with missing values for firm-level control variables, and then 208,604 observations without macroeconomic controls. At this stage, we still have 1,019,687 observations. Lastly, we lag most variables by one year, which eventually leaves us with 725,739 observations with lagged values for our main regressions.

The investigation of domestic investment

To depict a more complete picture of our resource misallocation story and strengthen our argument that firms relocate their resources more toward the real estate industry due to the speculation effect, we investigate how rising house prices affect domestic fixed-asset investment (which includes real estate investment). To measure it, we use the information on the total fixed assets, K_t, and calculate the investment in fixed assets by the formula $I_t = K_t - (1 - \delta)K_{t-1}$, where δ is the depreciation rate set at 7.6 %. Among the 386,794 observations after our calculation, the average amount of domestic investment is around 154 million CNY, with the minimum being only 120 CNY, while the maximum being 365 billion CNY. In Table A1, we show the estimated coefficient between log house price and log domestic investment.

Table A1
House prices and domestic investment.

	(1) Log domestic investment
Lagged log *house price*	0.172***
	(7.79)
Lagged log *GDP per capita*	−0.0487***
	(−2.58)
Lagged log *population*	−0.124***
	(−8.59)
Lagged log *firm capital*	0.165***
	(19.93)
Lagged log *firm employment*	0.174***
	(19.84)
Lagged firm age	0.000956
	(0.84)

(*continued on next page*)

Table A1 (*continued*)

	(1) Log domestic investment
Lagged firm productivity	0.193*** (28.81)
Other controls	Yes
Firm FE	Yes
Time FE	Yes
Ownership-year FE	Yes
Region-year FE	Yes
Observations	386,794
R^2	0.711

Notes: 1) t-statistics are in parentheses; 2) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; 3) robust standard errors are clustered at the city level; 4) FE stands for fixed effect; 5) other controls include the minimum wage, municipal real GDP growth rate, R&D labor share, export and import share-weighted city-level exchange rates, tariffs on intermediate goods and on final goods.

Our estimate shows that, a 10 % increase in urban house prices can lead to a 1.72 % rise in the amount of domestic investment. Therefore, during our study period, we do observe a relocation of resources from outward FDI to domestic investment due to the rising urban house prices. Combined with the results reported in Table 8, this increase in domestic fixed-asset investment is more likely to be driven by increased real estate investment rather than machinery and equipment investment, as TFP is lowered by the rise in house prices. Nevertheless, our data do not allow for a detailed decomposition of the domestic investment categories, and we have stated this limitation at the end of the main text.

Appendix B

Additional tables

Table B4 presents the weighted average and growth rate of manufacturing TFP from 2005 to 2013, and the average annual growth rate of manufacturing TFP in China in this period is 3.8 %. This result is similar to the existing literature based on the Database of Chinese Industrial Enterprises in 1998–2007, in which the average annual growth rate of China's manufacturing TFP is between 3 % and 5 %.

Table B1
Observations and statistical indicators of major variables in China's industrial enterprise database over the years.

Year	Enterprises number Each	Total outputs Trillion CNY	Gross value added (GVA) Trillion CNY	Total employment Million people	Total assets Trillion CNY	Total fixed assets Trillion CNY	Total export delivery value Trillion CNY
2005	271,835	25.16	7.22	68.96	24.48	10.59	4.77
2006	301,931	31.64	9.10	73.57	29.10	12.51	6.05
2007	336,767	40.51	11.70	78.75	35.30	14.67	7.34
2008	412,212	47.95	–-	84.85	40.95	17.09	8.04
2009	320,778	43.77	–-	69.70	38.58	16.16	5.96
2011	302,593	82.27	–-	96.42	66.39	24.97	9.78
2012	311,314	86.98	–-	102.85	72.75	26.68	10.20
2013	344,875	100.87	–-	147.55	83.17	30.34	11.08

Note: Data for 2010 were excluded from the sample owing to data quality issues.

Table B2
Percentage of businesses matched to the previous year to the number of businesses in the current year.

Year	Matching based on enterprise organization code (%)	Matching by business name (%)	Matches based on other information (%)	Total matches (%)	Number of enterprises
2005	84.63	0.69	1.11	86.44	271,835
2006	81.15	0.44	0.92	82.52	301,931
2007	81.12	0.31	0.73	82.16	336,767
2008	0.00	58.92	6.24	65.16	412,212
2009	0.00	98.35	0.18	98.53	320,778
2011	37.94	19.83	1.46	59.23	302,593
2012	87.19	0.03	0.11	87.34	311,314
2013	81.27	0.09	0.35	81.71	344,875

Note: Data for 2010 have been excluded, and the number of matches in 2011 is relative to 2009, so the match ratio is low.

Table B3
Weighted Average TFP and Contribution of Enterprises of Different Sizes, Calendar Years 2005–2009.

Year	All enterprises' TFP	> 20 million CNY enterprises' TFP		5–20 million CNY enterprises' TFP	
	Weighted average	Weighted average	Contribution (%)	Weighted average	Contribution (%)
2005	220.31	210.22	95.42	10.09	4.58
2006	234.91	226.37	96.37	8.53	3.63
2007	242.41	235.14	97.00	7.27	3.00
2008	229.45	227.58	99.19	1.87	0.81
2009	242.18	240.71	99.39	1.47	0.61

Note: The weights are the share of output for each enterprise.

Table B4
Manufacturing TFP and its growth rate.

Year	Manufacturing TFP	Manufacturing TFP moving average	Manufacturing TFP growth rate
2005	220.31	219.06	4.59
2006	234.91	232.54	6.16
2007	242.41	235.59	1.31
2008	229.45	238.01	1.03
2009	242.18	235.81	−0.92
2010	–-	260.35	10.41
2011	278.53	285.30	9.58
2012	292.07	286.96	0.58
2013	290.27	291.17	1.47

Table B5
Non-log descriptive statistics for logarithmic variables in Table 1.

Variable Name	Description	Mean	SD	Max	Min
house price	Commercial building price (CNY/m^2)	4,907	3,415	23,426	753
residential house price	Residential building price (CNY/m^2)	5,121	3,520	24,402	932
GDP per capita	Urban GDP per capita (10 thousand CNY)	1.38	0..493	3.83	0.122
population	Urban population (10 thousand persons)	675	463	2,360	92.6
firm capital	Total assets (million CNY)	1,445	14,425	2,735,357	0.420
firm employment	Number of employees (persons)	321	1,089	198,972	8.00
Other controls					
minwage	Monthly minimum wage (CNY)	605	157	1,097	261
exshockex2000	Export share-weighted city-level exchange rates	88.2	14.3	134	25.6
exshockim2000	Import share-weighted city-level exchange rates	90.5	7.35	125	32.8
duty_in	Tariffs on intermediate goods (1/100 percentage point)	1.14	0.007	1.15	1.07
duty_out	Tariffs on final goods (1/100 percentage point)	1.18	0.003	1.18	1.08

Notes: The values are all calculated by authors from observed data for 2005–2013. We provide summary statistics of these variables within the benchmark regression sample. For numbers smaller than 1, we keep 3 digits; for those between 1–10, we keep 2 digits; for those between 10–100, we keep 1 digit; for those over 100, we round them to the nearest integers. All the values are CPI-adjusted.

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