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Sectoral Booms and Misallocation of Managerial Talent: Evidence from the Chinese Real Estate Boom

by Yu Shi

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Sectoral Booms and Misallocation of Managerial Talent: Evidence from the Chinese Real Estate Boom[1]

Prepared by Yu Shi

Authorized for distribution by Maria Soledad Martinez Peria

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Abstract

This paper identifies a new mechanism leading to inefficiency in capital reallocation at the extensive margin when an economy experiences a sectoral boom. I argue that imperfections in the financial market and capital barriers to entry in the booming sector create a misallocation of managerial talent. Using comprehensive firm-level data from China, I first provide evidence that more productive firms reallocate capital to the booming real estate sector, and demonstrate that the pattern is likely driven by fewer financial constraints on these firms. I then use a structural estimation to verify the talent misallocation. Finally, I calibrate a dynamic model and find that the without the misallocation, the TFP growth in the manufacturing sector would have improved by 0.5% per year.

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Author's E-Mail Address: YSHI2@imf.org

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1 Introduction

Economic cycles are often driven by sectoral shocks (e.g., oil price shocks, housing booms, etc.), accompanied by capital reallocation across sectors. Most of the literature studying capital reallocation focuses on the *intensive margin*: within a firm, how much capital is reallocated to take advantage of good investment opportunities (Almeida and Wolfenzon, 2005; Eisfeldt and Rampini, 2006, 2008; Cui, 2014). In this paper, I instead study the implication of capital reallocation at the *extensive margin*: the decision of whether or not to reallocate capital to the booming sector. I use comprehensive firm-level data from China to show that when a sector with a high entry barrier booms, financial market imperfections could lead to suboptimal captial reallocation at the extensive margin and a misallocation of managerial talent across sectors.

What would give rise to the misallocation of managerial talent? In short, it would happen due to a misalignment between firms' wealth and managers' comparative advantage in the booming sector. In an economy without any barriers to capital reallocation, managers would choose projects that generate maximum returns to capital. In equilibrium, the decisions to reallocate capital to the booming sector would depend solely on managers' comparative advantage. However, with financial frictions and barriers to entry to the booming sector, less wealthy managers would be constrained from reallocating capital to the booming sector. A misallocation of managerial talent would occur, as long as the unwealthy and thus constrained managers do not have the comparative advantage in their current sector.

Analyzing the misallocation of managerial talent in real estate booms is particularly pertinent for China, due to the prolonged real estate boom, the highly imperfect financial market, and the massive entry regulations in the land market. Additionally, there is apparent social inefficiency. Since the entry barrier to the real estate sector often varies with land prices, when entering the real estate sector, wealthy firms would bid up land prices, making poor firms even more constrained and thus generating a pecuniary externality.

In this paper, I first provide motivating reduced-form evidence of private firms reallocating capital to the real estate sector. The reduced-form evidence highlights the importance of financial market imperfection in determining capital reallocation at the extensive margin. First, among private firms in the manufacturing sector, the more productive ones are more likely to start real estate businesses. However, this pattern is possibly driven by more productive private firms being less financially constrained. After controlling for initial asset value and credit scores, I show that it is the unproductive firms that are more likely to move to the real estate sector. Second, local real estate booms, but not manufacturing investment opportunities, cause firm-level capital reallocation to the real estate sector. To establish this fact, I use an instrumental variable approach and exploit factors that are only crucial to returns on real estate development: firm connections with the local land bureau interacted with local land supply constraints. I classify the potential links between managers and the head of local land bureau based on their ethnic enclaves[1]. My identifying assumption is that in cities with constrained land supply, managers with potential connections with the local land bureau do not face worse opportunities in the manufacturing sector. The assumption is reasonable, given that manufacturing firms with better access to the scarce land factor would at least do as well compared to the situation when land supply is adequate.

Second, I structurally estimate the comparative advantage of private-firm managers to formally conclude the existence of misallocation. The model follows the Roy models in the literature (Costinot et al., 2012; Adao 2015; Hurst et al, 2016) to assume that managers can produce at constant returns to scale. Managers are divided into 20 groups based on pre-determined characteristics: education and experience. Talent distribution is homogeneous within groups[2] and heterogeneous across groups, with the group-average productivity being non-time-varying. Identification of the comparative advantage of each group comes from comparing the observed returns on capital in the manufacturing sector and the real estate sector for only managers who entered the real estate sector during the boom. To account for the endogeneity in selection into the real estate sector, I proxy for the selection bias using a non-parametric function of manager and firm characteristics, and local real estate factors[3] as instruments (Das, Newey, and Vella, (2003)). My estimation implies that managers running more productive manufacturing firms also have a comparative advantage in the manufacturing sector, so they should not have moved to the real estate sector in the boom.

Using a two-period model, I then demonstrate that in addition to the misallocation of managerial talent, financial market imperfection also leads to social inefficiency. The key is the existence of a pecuniary externality given that managers do not internalize the impact of their capital reallocation on land prices. If only managers with ample wealth choose to start developing real estate properties, land prices would rise. This result leaves other managers more constrained by the entry barrier. Financial market imperfections are essential not just to creating distortions at the extensive margin. In the context of China, these imperfections also imply a positive correlation between firm-level wealth and managerial talent[4]. As a result, talented manufacturing managers who also have a comparative advantage in manufacturing accumulate more wealth than the untalented ones. Therefore, they are more likely to be unconstrained from moving to the real estate sector.

Finally, to quantify the aggregate impact of talent misallocation, I calibrate the Chinese economy in transition to a balanced growth path[5]. The key innovation of this paper is to jointly estimate the comparative advantage of mnagers and the entry barrier in the real estate sector. In calibrating the

[1]The sociology literature has established the economic importance of this factor (Zhang, Xie (2013), Edin et al. (2003), Haselmann et al. (2016))

[2]The assumption in this paper is more general than the one in the literature. The within-group distribution of managerial talent does not need to be identical, but can be a nonparametric function of the average productivity of each group.

[3]For example, land supply and firm connections with the land bureau.

[4]I verify the correlation in the sample of privately-owned firms.

[5]I added back the SOEs following Song et al. (2011) by assuming the SOEs are not credit-constrained and may have different productivities in the real estate and the manufacturing sector.

model, both factors map to the average productivity of managers who decide to reallocate capital to the real estate sector. Therefore, the standard calibration approach would run out of degrees of freedom. I solve this problem by taking the comparative advantage estimate from the structural estimation and then using the aggregate moment to pin down the entry barrier.

Using the quantitative framework, I analyze three policy tools that are potentially welfare-improving: liberalizing the financial market, reducing the entry barrier in the real estate sector, and taxing the returns from operating in the real estate sector. Liberalizing the financial market improves social welfare but also aggravates the social inefficiency. In a more liberalized financial market, the already wealthy firms can borrow more, which further increases land prices. As a result, more firms with low wealth and the comparative advantage in the real estate sector are constrained by the entry barrier. Lowering the entry barrier in the real estate sector has an ambiguous impact on welfare. It creates more investment opportunities so generally untalented managers continue to run their businesses, resulting in a decline in total credit supply. A taxation on real estate returns can improve both social welfare and efficiency. The gains are economically significant: a 3% tax on real estate returns improves manufacturing productivity by 0.3% after the boom starts.

This paper contributes to the literature on capital reallocation by studying the decisions at the extensive margin. Previous research emphasizes the intensive-margin distortions that prevent firms to take advantage of new investment opportunities (Almeida and Wolfenzon, 2005; Eisfeldt and Rampini, 2008; Cui, 2014) and the cyclicality of within-firm capital reallocation (Ramey and Shapiro,1998; Eisfeldt and Rampini, 2006). I show that the extensive-margin decision on whether or not to reallocate capital is also of economic significance.

This paper also relates closely to the literature on the allocation of talent. Murphy, Shleifer, and Vishny (1991) propose that some social reward structures may result in more talented specializing in unproductive rent-seeking activities that leads to to stagnation. More related to my paper, Legros and Newman (2002) argue that financial imperfections can lead to the non-monotonic specialization of entrepreneurs, as evidenced in my empirical observations. I take their arguments one step further to show that financial market imperfections can also lead to an inefficient allocation of managerial talent. Moreover, certain policy tools can be used to correct for such inefficiency.

More generally, this paper makes a significant contribution to the literature studying misallocation and economic growth. Most of the existing work is about resource misallocation, which again focuses on the intensive margin. (Hsieh and Klenow, 2009; Song et al. 2011; Buera and Shin, 2013). A few papers document that capital entry barriers can prevent productive entrepreneurs from producing (Buera, Kaboski, and Shin, 2012; Midrigan and Xu, 2014). However, they do not explore the comparative advantage of entrepreneurs, and thus with idiosyncratic productivity shocks alone, there would only exist short-term misallocation of talent. This paper shows that financial imperfections can lead to a longer-run talent misallocation in the absence of idiosyncratic shocks. It also complements the literature by providing substantial empirical evidence on talent misallocation and jointly estimating managers' comparative advantage and sectoral entry barriers.

Broadly, this paper also relates to the literature on the relationship between house prices and the macroeconomy. Previous research outlines the collateral channel (Hurst and Lusardi, 2004; Chaney, Thesmar, and Sraer, 2012; Mian and Sufi, 2011; Mian, Sufi and Rao, 2013;Schmalz, Sraer and Thesmar, 2015; Kerr, Kerr, and Nanda,2015), and thus real estate booms are beneficial to the macroeconomy. The paper that is most similar in spirit to mine is Charles, Hurst, and Notowidigdo (2015). They argue that booming labor demand in the construction sector results in a decline in college attendance. This paper, in contrast, emphasizes the distortion on managers' choice to reallocate capital from their current sector to the booming sector, dampening the impact of a real estate boom on productivity.

Last but not least, this paper fits into the growing literature studying the Chinese real estate market. Fang et al. (2016) and Deng, Gyourko, and Wu (2015) document a rapid real estate price appreciation and substantial variation in city-level real estate prices in China. Chen et al. (2015), Chen and Wen (2014), and Shi et al. (2016) discuss the misallocation of capital and labor in this real estate under the assumption that the real estate boom is a bubble episode. Given that real estate prices in China are still climbing in the first-tier and second-tier cities, this paper suggests a framework in which inefficiency exists without assuming a bubble episode.

The rest of the paper is organized as follows: section 2 describes the institutional background of real estate market reform and the housing boom in China. Additionally, I provide a detailed description of firm-level data sets used in the analyses. Section 3 documents the empirical findings on the allocation of managerial talent in the real estate boom in China. Section 4 provides a structural estimation of the comparative advantage of managers and discusses the social efficiency in the setting of a two-period model. I also discuss several policy tools that can help improve the social efficiency of managerial talent allocation. Section 5 quantifies the impact of the misallocation using a dynamic general equilibrium model. Section 6 concludes the paper.

2 Institutional Background and Data

2.1 Institutional Background

The Chinese real estate sector has gone through a prolonged boom in the last two decades. In the residential property market, state-owned banks started issuing mortgage loans to households in the late 1990s. Local governments, SOEs, and private companies compensated workers on housing purchases made out-of-pocket. These major policy changes contributed to buoyant housing demand, leading to a 10% annual [6] growth in both the price and quantity of houses from 1999 to 2010.

[6] The housing quantity is measured as total floor space sold in square meters. This is because house prices are measured as price per square meter of floor and because that the National Bureau of Statistics only reports the quantity as total floor space sold but not in housing units.

In the land market, reform went hand-in-hand with the residential property market. According to legislation, the state has complete ownership of all urban land. In 2002, the central government started allocating the use rights of land[7] through public auctions, which marked the beginning of a fully privatized land market[8]. The execution of this reform was completed in 2004. City-level land bureaus were established between 2004 to 2006 to hold responsibility for city planning and the sales of urban land use rights. Private agents then actively engaged in residential land development[9] in response to the real estate boom.

Several of China's institutional features provide an ideal environment for examining the distortions of capital reallocation at the extensive margin. First, private firms in China are financially constrained (Allen, Qian, and Qian (2005); Dollar and Wei (2007); Riedel, Jin, and Gao (2007)). Second, local land bureaus require private agents to submit a cash deposit before participating in land auctions, creating a capital barrier to residential land development. No other sources of financing substitutes, such as bank loans or equities, are allowed. The cash deposit requirement varies from 10% to 50% of the reservation land value. With rising land prices, the average cash deposit[10] increased to 67.79 million RMB in 2012. Given that the annual median profit in the manufacturing sector is only 0.56 million RMB, the required cash deposit is an almost impossible hurdle for most private manufacturing firms in China. Finally, all residential land developers are required to register a real estate firm and obtain a land development license. The licensing requirement allows me to obtain a complete record of private agents participating in residential land development. Thus I document existing firms reallocating capital to the the real estate sector by looking at the enterprise registration information.

To summarize, I intend to convey that:

1. The real estate market in China experienced a massive privatization starting in early 2000s, which led to a prolonged boom and the expansion in land development industry. Most developers focus on residential real estate development.

2. The real estate sector faces a high capital entry barrier. Potential developers need to possess a large amount of capital and cash to enter the land market.

3. The licensing requirement helps identify capital reallocation of existing firms to the real estate sector.

[7]The length of owning the use rights is determined by the local government. Typically, land for industrial or commercial purposes rents for 40 or 50 years and land for residential purpose rents for 70 years.

[8]Between the late-1990's and 2002, some private real estate developers and industrial companies were able to purchase the usage rights of land from the state, but mostly through a hidden process called "negotiated sales". Only companies that had strong connections with local governments could acquire land use rights. As a result,

[9]I focus on real estate developers that specialize in land acquisition, construction, and sales for residential purpose. Very few real estate developers are involved in the post-sale property management. Other companies in the real estate sector, including property agencies and management companies, are not of interest for this paper and they consist of a small fraction of the real estate businesses in China.

[10]In 10 selected cities with detailed information on land market transactions.

2.2 Data

Firms are the key units of observation in my analysis. Two firm-level data sets provide information on operation and investment activities: the Annual Industrial Survey (hereafter AIS) conducted by the National Bureau of Statistics (hereafter NBS), and the Enterprise Registration Database (hereafter ERD). The AIS is a panel survey from 1995 to 2010[11] that covers all state-owned enterprises (SOE) and privately-owned enterprises with revenue above five million RMB[12]. It provides information on firm balance sheets, income statements, and cash-flow statements. I drop SOEs, publicly-owned firms, and foreign branches from the sample and focus only on privately-owned firms with a single CEO or executive manager. The SOEs are considered to be less financially constrained and more inefficiently operated[13], so they would not fit in my model. In the publicly-owned firms and foreign branches , managers have a less dominant role in making firm-level decisions, so I exluce listed firms and foreign branches from my sample. This then leaves me with a sample of 105,298 firms and 1,368,897 firm-year observations.

I rely on the AIS to construct firm-level variables on R&D expenditure, investment expenditure, and manufacturing productivity. The investment expenditure and R&D expenditure are normalized by one-year lagged value of fixed assets[14]. In this paper, I consider R&D expenditure as a specific type of investment that leads to new product variety, so I normalize it in the same way as I do for investment expenditure. My empirical results, however, are robust to alternative methods of normalizing the R&D expenditure, such as using one-year-lagged total output or one-year-lagged total asset value. Last but not least, I consider two measurements of firm-level productivity in producing manufactured goods: labor productivity and quality-based total factor productivity (TFPQ). The labor productivity is measured as value added per worker; the TFPQ is measured following Hsieh and Klenow (2009) who adjust for quality differences across manufacturing producers.

I control for firm-level heterogeneity with other accounting variables from the AIS. Firm debt dependence is proxied by the ratio of total debt outstanding to the one-year-lagged book value of total assets (the debt-to-asset ratio). The return on asset (ROA) is the ratio of operating income (after depreciation) to the one-year-lagged total asset value. I also include initial book value of asset as a proxy for wealth and the total value of fixed assets to control for capital input. The age of a firm sums up the active years since its registration. Table 1 provides summary statistics of investment and productivity of privately-owned firms in the AIS, as well as the summary of corporate financial variables used in

[11]The survey is still ongoing, but the revenue threshold for reporting increased to 20 million since 2010. I therefore drop observations after 2010 for consistency's sake.

[12]These firms control for over 80% of the total assets in the entire manufacturing industry. Five million RMB is approximately 750 thousands USD.

[13]Hsieh and Song (2015) compare SOEs and private firms using the AIS from 1998 to 2005. They found that the SOEs have a significantly lower capital productivity as compared to private firms. Song et al. (2011) also document that SOEs do not appear to follow a profit maximizing objective.

[14]The value of fixed assets is equivalent to the "plants, property, and equipment" item in commonly-used corporate-level Compustat data

the empirical analysis. The AIS also includes the location of each firm's headquarters. None of the firms in the sample moved their headquarters between 1995 to 2010. I utilize this property to explore the variation in local real estate markets in predicting business owners' incentives to enter the real estate sector.

I then pair the AIS with my second data set, the ERD, which covers all enterprises in China. The main purposes of using the ERD are to identify existing private firms moving to the real estate sector and to construct measures of manager characteristics. At the date of registration, all firms are required to disclose their legal representative, shareholders, board members, executives, and other basic information to the China State Administration for Industry and Commerce. Each firm then has a unique record in the ERD. I consider an existing manufacturing firm as entering the real estate sector when the firm becomes the major shareholder of a newly established real estate company. Until 2010, 7,559 privately-owned manufacturing firms in the AIS have become real estate developers. These firms are not a neglectable group as they control for a large fraction of total assets in sample - 22%. They also gain absolute controls of their real estate subsidiaries by holding on average 66.27% of the total shares outstanding. The characteristics of managers include the level of education, birth date, Communist Party membership, home county[15], gender, and race. There are a total of 2,854 counties in China, each with an average population of 610,000[16], so that a county is comparable to an average U.S. city.

The ERD is matched to the AIS using the unique registered name of each company. The matching rate is more than 80% for the entire data sample. The matching is unlikely to induce a non-random error to my empirical analysis. I drop around 3% of the observations in which the shareholders and their real estate subsidiaries have the same legal representative. This is to ensure the complete separation of the manufacturing firms' real estate investments and their manufacturing investments. I further restrict the sample to firms active since 1997 to guarantee that pre-period controls exist. This leaves me with a sample of 25,513 firms and 382,695 firm-year observations.

[Table 1 about here]

In addition to firm-level data, I collect city-level demographic data from city yearbooks[17] and real estate data from the China Real Estate Index System[18] (CREIS). The cities are prefecture-level cities[19]. There are 333 prefecture-level cities in China, with an average geographical size comparable to the metropolitan statistical areas in the US. The CREIS provides monthly data of the residential

[15]The home counties, defined as the residence county at the age of 16, are identified from the first six digits of the executives' social identity numbers.

[16]Based on the 2010 Population Census.

[17]The city yearbooks are available from 1996 and 2013.

[18]The CREIS is constructed and maintained by Soufun.com, the Chinese equivalent of Zillow.

[19]Based on Chinese administrative divisions, each prefecture-level city must meet the following three criteria: an urban center with a non-rural population over 250,000; a total gross output value of more than 200 million RMB (US$32 million); and a tertiary industry output that contributes more than 35% of the GDP, superseding that of primary industry. For more details, see: http://www.china.org.cn/english/Political/28842.htm.

property market in 122 cities, including the total floor area and revenue of houses sold and property-specific characteristics, and transaction-level data of the land market in 145 cities since 2005. For each land transaction, the database records its location, total land area, desired floor space area, required cash deposit, reservation land value, and final price. For robustness, I supplement the CREIS with house price indices from Fang et al. (2014), who use mortgage data to construct quality-based price indices for 120 cities. The Chinese cities are officially divided into three tiers based on their economic activities. Table 2 provides a summary of the real estate data based on the regional location and three-tier divisions of the cities.

[Table 2 about here]

There are several advantages to using the Chinese data. First, the boundary of firms is determined based on legal dependency. Chinese corporate law requires each firm to have one legal representative responsible for all litigation against the firm. Two establishments with different legal representatives is considered as two separate firms. Thus, the return of a manufacturing firm as a real estate developer is reported separately as long as the two businesses are registered with different legal representatives. This appears to be a standard practice. 97.1% of manufacturing companies who entered the real estate sector registered their real estate subsidiaries as separate firms. This feature makes it possible to study the capital reallocation from the manufacturing sector to the real estate sector.

Second, the shareholding data in the ERD provides a near-complete documentation of private manufacturing firms' capital reallocation to the real estate market. Chinese regulation requires that only real estate development firms with a development license can participate in land auctions, with the exception that industrial companies can rent industrial land for factory buildings. Given that the boom happened mostly in the residential and commercial real estate market, and that industrial land prices did not increase during the housing boom[20], I consider the entries observed in the ERD as capturing manufacturing companies' significant real estate investments[21]. Such investment is also isolated from the standard structure investment in the manufacturing business. In fact, I do not want to take into account the property or land holdings on the balance sheet of the the manufacturing firms, given that these holdings can be used for manufacturing production later. As noted in Chaney, Thesmar, and Sraer (2012), cost-minimizing firms invest more in structures during real estate price run-ups. The entries into the real estate sector identified from the ERD are separated from the firms' businesses in the manufacturing sector.

Finally, most real estate developers in China are restricted to operating within their cities, except for those granted an A-class license. These A-class companies, which make up less than 1.3% of

[20] The average annual growth rate of industrial land price is 2.62%, which is higher than the average inflation rate by 0.15%.

[21] Gao (2014) matched the manufacturing companies to the final bidders of all land auctions using the 1998-2007 NBS Annual Industrial Survey and 1987-2012 land auction data. Less than 9 percentage points of the land transactions are associated with industrial firms purchasing commercial land. Chen et al.(2017) document firms speculating in land market by purchasing and holding commercial land for appreciation. However, such investment is not scaleable and also mostly restricted to listed companies, so it is less of a concern for my study.

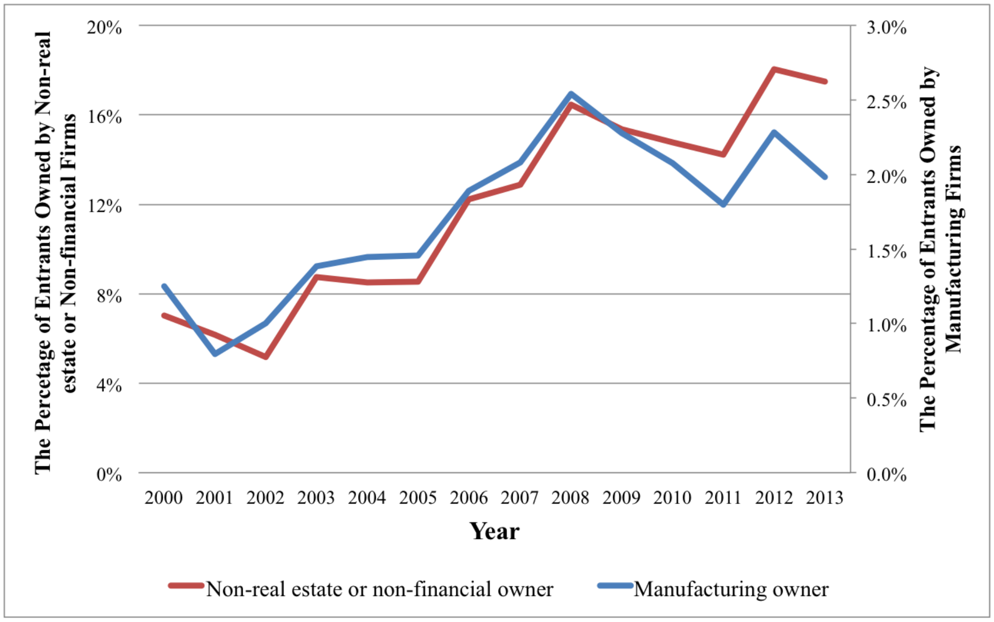
the total number of firms in the industry, are often stand-alone firms without a large institutional shareholder. I also verify from the ERD that over 90% of manufacturing firms choose to start up real estate businesses locally. Therefore, I can explore the city-level variation house prices and supply constraints to model the incentive to enter the real estate sector.

3 Capital Reallocation: A Reduced-Form Analysis

In this section, I present reduced-form evidence on existing private firms reallocating capital to the real estate sector in the Chinese real estate boom. Since early 2000s, the Chinese residential house prices persistently increased at an annual rate of more than 10% (Fang et al., 2016; Deng, Gyourko, and Wu, 2015). Meanwhile, a significant number of existing private firms started developing residential real estate properties. Figure 1 shows the decomposition of the entrants[22] in the real estate development industry. Until 2013, almost 18% of the newly established real estate firms were controlled by non-real estate and non-financial sectors. I focus on the 3% of the new entrants run by manufacturing firms so I can study their performance in the manufacturing sector before and after entering the real estate sector.

[22] Figure 1 uses the data from the ERD, which includes a complete documentation of all registered companies in China. The numbers are slightly different from later analysis, when I only use observations from the AIS to study the impact of entering the real estate sector on manufacturing production. In addition, the ERD thoroughly documents the entry pattern, but not the exit pattern; thus, some numbers do not match the cross-sectional summary statistics. This is due to the fact that the exit of a real estate development firm could happen in many forms, including M&A and revocation, which are not all observable in my data set.

Figure 1: The Entrants in the Real Estate Sector



Two main findings to be discussed later suggest that the real estate boom causes the more productive manufacturing businesses to reallocate capital to the real estate sector:

1. Firms that entered the real estate sector had substantially higher measured productivity, investment rate, manager education and manager experience prior to entry. Controlling for firm-specific pre-boom asset value and credit score, I find that the patterns are reversed — among private firms with similar credit market access, it is the ones with inferior performance or more inexperienced managers that are more likely to start up real estate businesses in the boom.

2. The real estate boom causes within-firm capital reallocation from the manufacturing sector to the real estate sector. Precisely, entering the real estate sector leads to a significant decline in the firm investment and R&D expenditure in the manufacturing sector. I establish the causal evidence using an instrumental variable approach and a propensity-score matching approach.

These two facts together characterize the extensive-margin decisions of private business owners and highlight the importance of financial market imperfections. Being financially constrained, a private manager would face the trade-off between real estate and manufacturing investment opportunities. Since the real estate sector has a substantial entry barrier, a manager's credit market access becomes a key determinant for starting up real estate businesses. Upon the manager entering the real estate sector, the costly land acquisitions might still result in declines in investment, R&D expenditures, and productivity in the manufacturing sector[23].

The reduced-form analysis, however, is inconclusive on the social optimality of the allocation of managerial talent. The entry pattern observed in data could be optimal only if these productive manufacturing firms are even more productive in the real estate sector. In section 4, I develop a structural model to estimate the comparative advantage of managers and draw a conclusion on the social optimality.

3.1 The extensive margin: did the better or worse managers move to real estate?

To find out the determinants of the allocation of managerial talent, I compare private firms that chose to enter the real estate sector in the boom and the ones that did not. Table 3 summarizes their differences in productivity, investment, profit margin, size, and other characteristics prior to the 2002 land privatization. Before entering the real estate sector, the private manufacturing firms that later entered the real estate sector controlled 29.6% of the total fixed assets in the entire manufacturing sector. They were 5.63 times larger in terms of total assets and twice as large in R&D expenditure and capital investment compared to firms that did not enter. These firms also had a 23.4% higher profit margin and a significantly higher credit score. Besides, older firms with larger asset values and larger workforce were more likely to enter the real estate sector.

[Table 3 about here]

Additional analysis at the manager level implies that firms with higher levels of manager education or more experienced managers tend to move into the real estate sector. Using the CEO information from the ERD, I divide the CEOs of private manufacturing firms into 20 groups based on their work experience and their education. Table 4 summarizes the fraction of managers who decided to enter the real estate sector in each group.

[Table 4 about here]

Next, I estimate a firm-specific propensity for entering the real estate sector using a probit model:

$$Prob(Enter_i) = \alpha_1 \Delta P_c + \alpha_2 \Delta w_c + \beta_1 Performance_i + controls_i \tag{1}$$

The cross-sectional regression uses the average firm characteristics from 1997 to 2002 as right-hand-side variables. $Enter_i$ is a dummy variable indicating whether or not private manufacturing firm i ever entered the real estate sector after 2004[24]; ΔP_c is the average house price growth of city c (where the headquarter of firm i is located) from 2004 to 2010; Δw_c is the average annual local

[23] The decline in productivity does not happen right after the firm enters the real estate sector, as shown in the event study plot in Figure 3. This is likely due to the internal capital market selection, which cleanses the relatively unproductive projects within the manufacturing sector, so labor productivity goes up temporarily.

[24] The land market reform was fully implemented at nationawide by 2004.

manufacturing wage growth after 2004; $Performance_i$ is a set of measures of firm i's performance in the manufacturing sector, including labor productivity, revenue-based TFP (TFPR), quality-based TFP (TFPQ[25]), profit margin, investment rate, and R&D intensity. Firm-level controls include pre-2002 average values of age, employment, debt-to-asset ratios, as well as the initial exporting status and two-digit industry. I exclude about 3% of the companies in sample that already invested in the real estate sector before the land market reform concluded in 2004. The results are summarized in column (1) of Table 5[26]: an average firm's probability of entering the real estate sector is positively correlated with local real estate price appreciation and firm-specific performance measurements.

[Table 5 about here]

Despite the somewhat surprising result, it yields no implications to the misallocation of talent, nor to the importance of financial market imperfections. Thus, I further included firm-level initial asset value in 1997 and credit scores in specification (1). The two controls serve as proxies for firm-specific credit market access. All else equal, a company with higher initial asset value and a higher credit score is more likely to be able to borrow more from the banking sector. Columns (2) in Table 5 present the results. While local house price appreciation still significantly predicts the likelihood of manufacturing firms entering the real estate sector, a firm with 1% higher pre-entry TFPQ has a 0.09% lower propensity to enter the real estate sector. Similar patterns can be found when replacing the performance measure with labor productivity and R&D expenditure.

These results suggest that firm credit constraint is an important determinant of private business owners' decisions to enter the real estate sector. As summarized in Table 1, existing business owners with a higher productivity in the manufacturing sector are larger and have higher credit scores. Therefore, the financial market imperfection increases the probability that more productive private manufacturing businesses move to the real estate sector in a real estate boom. With firm-specific financing ability controlled for, the pattern is reversed: the more productive private manufacturing businesses are more likely to stay in the manufacturing sector.

3.2 The intensive margin: what is the impact of moving to real estate?

This section establishes the causal effect between the real estate boom influencing capital reallocation within private manufacturing businesses. In other words, entering the real estate sector resulted in a significant decline in the investment and R&D expenditure in the manufacturing business. I examine the impact of moving to the real estate sector using the following panel specification:

$$Y_{it} = \alpha_i + \delta_t + \beta \cdot POST_{it} + \sum_k \eta_{kt} X_k^i + controls_{it} + \epsilon_{it} \tag{2}$$

[25]The TFPQ is computed following Hsieh and Klenow (2009): $A_{is} \propto (p_{is}y_{is})^{\frac{\sigma}{\sigma-1}} k_{is}^{-\alpha_s} (wl_{is})^{\alpha_s - 1}$

[26]The total number of firms is smaller because I am only able to collect house prices in 96 cities.

Y_{it} is the outcome of interest, including the R&D intensity, investment rate, and labor productivity of the manufacturing business of firm i in year t. $POST_{it} = 1$ if manufacturing firm i has already entered the real estate sector in year t, and $POST_{it} = 0$ otherwise. X_k^i are dummies indicating the categorization of firm i into group k. The groups are constructed based on initial conditions including exporting status, size class, two-digit industry, and five quantiles of age at 1997. η_{kt} is a group-year fixed effect, which control for average performance of initial control group k at year t. Local wages, industry-year specific capital-to-labor ratio, and other economic indicators are also added as controls in $controls_{it}$. β is the key coefficient of interest, measuring the average change of firm i's manufacturing production following its entry into the real estate sector. This sample includes the manufacturing firms in the AIS from 1997 to 2010. I identify $POST_{it}$ through observing manufacturing firms holding shares of a newly established real estate development company in the ERD data[27].

The OLS estimate $\hat{\beta}$ is subject to two omitted variable biases: manufacturing investment opportunities and credit constraints. The unobserved investment opportunities induce a self-selection bias: firms losing good opportunities in the manufacturing sector may reduce manufacturing investments and R&D activities and seek for opportunities in the real estate sector. Thus, the OLS estimate would be biased downward. On the other hand, both investment and R&D expenditures are sensitive to firm credit access, likewise the decision to enter the real estate sector. As is shown in Table 1, firms that entered the real estate sector had a higher asset value, higher investment, more active R&D action, and a higher credit score. The unobserved credit constraint then induces an upward bias on the OLS estimates.

I use an instrumental variable approach and a matching approach (see Appendix B for the matching approach) to deal with the omitted variable biases. Ideally, the instrument should be correlated with firm-specific likelihood of entering the real estate sector, but uncorrelated with either its manufacturing investment opportunities or its credit constraints. While I could not find such an ideal instrument, I explore cross-city and within-city variations to construct an instrument that is arguably orthogonal to firm manufacturing investment opportunities. Therefore, I consider the IV estimates as upper bounds of the actual effect of entering the real estate sector on private firms' manufacturing production.

The Instrumental Variable Approach

I instrument for firms' decisions to enter the real estate sector by exploring city-level land supply elasticity and managers' potential connections with the local land bureaus. Land supply elasticity is related to land appreciation during the construction period such that it predicts the return from developing real estate properties. Managers' potential connections with the local land bureaus exploit

[27]Unfortunately, the ERD only provides the most recent shareholding information. My sample excludes the manufacturing companies that modified the shareholdings of their real estate subsidiaries. This treatment on data does not affect the identification later, given that the validity of the instruments does not depend on the sample.

the institutional features of China, given that the land bureaus have absolute control of land sales access to information would be helpful for the firms.

I manually construct a land supply elasticity index[28] for 145 cities following Saiz (2010). A city with a land supply elasticity index of 1 means that all areas within 30 kilometers of the city center can be developed into residential or commercial properties. Land supply elasticity matters more through expected house price appreciation, but not the actual land acquisition. I explain in detail the construction of the elasticity index and its validity as part of my instrument in Appendix A.

One caveat of using the city land supply constraint alone is that it can pick up local equilibrium effects that are correlated with manufacturing investment opportunities (Davidoff (2016)). Therefore, I further explore the firm-level heterogeneity in managers' potential connections with the local land bureau ministers. I define the potential connection between the CEO of a firm and the local land bureau minister based on their ethnic enclaves - that is, whether or not they grew up in the same county. I collect the birthplaces of the CEOs from the ERD and the birthplaces of the local land bureau ministers from their official resumes[29]. Zhang, Xie (2013) and Edin et al. (2003) justified the significant economic impacts of ethnic enclaves in China. Given that most land bureaus were established after 2004 and that a random sample from the ERD suggested that fewer than 0.5% firms changed their CEOs, the potential connection variable is arguably not affected by the investment opportunities of firms[30].

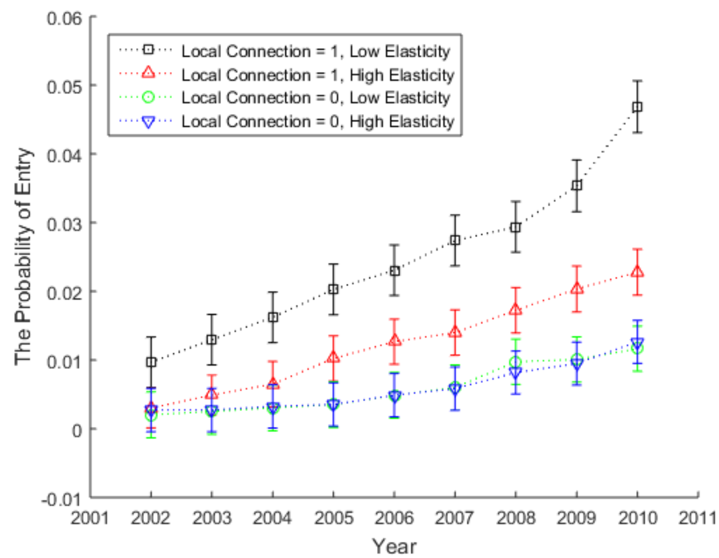
Figure 2 illustrates the significance of the land supply elasticity and the CEO's potential connection with local land bureaus in predicting entry into the real estate sector. I divide the private manufacturing firms into four groups based on their connections with the local land bureau and whether their home city has an elastic land supply. I then plot the fraction of firms that entered the real estate sector in each group. Over time, the group of firms with local connections and inelastic city-level land supply is significantly more likely to participate in real estate development, as compared to the other three groups.

[28] The index is normalized to a 0 to 1 scale.

[29] The ERD contains the first six digits of the national identification number of the CEOs, which indicate their home county at the age of 16.

[30] The construction of this potential connection is inspired by the literature on the impact of social networks on investment (Shue, 2013; Haselmann et al., 2016), but avoids the endogeneity in the formation of social networks. One concern is that firms started locally may be more likely to have a connection with the local land bureau and may also have different investment opportunities compared to non-local firms. However, in order to violate the identifying assumption, local firms are required to have a larger disadvantage in cities where the house prices have been growing faster, which is unlikely to happen. For robustness, I include a local-firm time trend in addition to the fixed effects as a control. Appendix B provides more discussions on the exclusion restrictions.

Figure 2: The Predictive Power of the Two Variables



In further examinations, the land supply elasticity and the CEO's potential connection with local land bureaus also significantly predict local land supply. I discuss related evidence in Appendix B.

Identification. In the IV specification, I estimate the first stage as follows:

$$\begin{aligned} POST_{it} &= \alpha_i + \delta_t + \theta \cdot Connection_i \times (1 - LandElasticity_c) \times P_t + \kappa_1 (1 - LandElasticity_c) \times P_t \\ &\quad + \mu_1 Connection_i \times P_t + \sum_k \eta_{kt} X_k^i + controls_{it} + \epsilon_{it} \end{aligned} \tag{3}$$

$Connection_i$ is a dummy variable, which is equal to 1 if firm i's executive in 1997 is from the same county as the head of local land bureau and is equal to 0 otherwise; $1 - LandElasticity_c$ is the land supply inelasticity of city c, in which the headquarter of manufacturing firm i locates[31]; and P_t is the 3-year house price growth nationwide. Firm fixed effects, year fixed effects, group-year fixed effects, and other controls are also included in the first stage. I do not explore the time series variation of the CEO's connection variable, due to the low frequency of turnovers among local land bureau ministers[32]. Other controls are the same as in the OLS specification (2).

[31] The AIS shows that manufacturing firms in China almost never change the location of their headquarters.

[32] The average term of local land bureau is 4.6 years. Considering that the recent land reform started in 2004 and my sample ends in 2010, it is insufficient to explore the over-time variation of the political connection instrument.

The instrumental variable is the three-way interaction of the potential connection between the CEO of firm i and the head of local land bureau ($Connection_i$), the local land supply inelasticity[33] ($1 - LandElasticity_c$), and the national house price growth (P_t). The inclusion of P_t is to generate time series variations[34]. The core of this instrumental variable is triple differences between firms within the same city and the same year. I control for the individual terms $Connection_i$, $LandElasticity_c$, P_t, and all two-way interaction terms in both the first stage and the second stage. All non-time varying and firm-specific variables are absorbed by the firm fixed effects. $(1 - LandElasticity_c) \times P_t$ is essentially a proxy for the house price growth in city c in year t. The coefficient θ is expected to be positive because entry is expected to be positively correlated with the CEO's connection with local land bureau ministers, the inelasticity of land supply, and the growth in house prices.

The second stage is similar to the OLS specification in (2), except that the two-way interaction terms are controlled:

$$\begin{aligned} Y_{it} &= \alpha_i + \delta_t + \beta \cdot POST_{it} + \kappa_2(1 - LandElasticity_c) \times P_t \\ &\quad + \mu_2 Connection_i \times P_t + \sum_k \eta_{kt} X_k^i + controls_{it} + \epsilon_{it} \end{aligned} \tag{4}$$

My *identifying assumption* for using this instrumental variable is: when the national house price is appreciating, managers who get in touch with the local land bureau more easily should not gain more advantage in the manufacturing sector when located in cities with ample land supply. While I will show several exclusion restriction tests in Appendix B, I now discuss major challenges to my identifying assumption. First, connected managers may face lower production costs in the manufacturing sector and may have easier access to industrial land. However, the unit price of industrial land did not increase in the past decade, and that connection matters for only residential and commercial land auctions (Cai et al. (2013)). Thus, I consider the managers' connection with local land bureaus as having little impact on manufacturing production. Second, managers' connections with the local land bureau might affect their likelihood of owning residential land, which in turn affects their overall credit constraints. This channel, however, indicates a positive correlation between the instrument and the omitted manufacturing investment opportunities. Therefore, it would not overturn my results, given that I am estimating an upper bound of the effect of entering the real estate sector. Finally, there are two additional concerns about the potential connection variable: first, managers with potential connections with the head of local land bureaus may also have connections to

[33] The inelasticity of city-level land supply is equal to 1 minus the land supply elasticity index, which is constructed following Mian and Sufi (2011).

[34] In the literature, the national house prices P_t is often replaced by real interest rate in creating time series variations (Himmelberg, Mayer and Sinai, 2005; Mian and Sufi, 2011; Chaney, Thesmar and Saer, 2012). I found that the aggregate movements of house prices in China does not follow the fluctuations in real interest rates. From 2002 to 2013, the average increase in the real interest rate was -0.33 percentage points, while real house prices increased by 7.9-13.1 percent annually in most cities (Fang et al. 2014). Thus the national house price works as a better proxy for housing market cyclicality.

the city mayors; second, the variable could pick up managers and local land bureau ministers who were born locally. To address the first concern, I control for firm-specific political connections with city mayors and vice-mayors, also measured as whether or not they share the same home county. To address the second concern, I divide private firms in my sample into local firms and non-local firms, and added local-firm time fixed effects as controls.

Appendix B provides more discussions on the robustness, the exclusion restrictions, and the external validity of the instrumental variable approach.

Discussion of Results. Table 6 summarizes the empirical results in this subsection. The first stage of the baseline specification is reported in Column (1). For a manufacturing firm that has connections with the local land bureau, a 1% increase in instrumented local house price growth would lead to a 0.15% higher probability of entering the real estate sector.

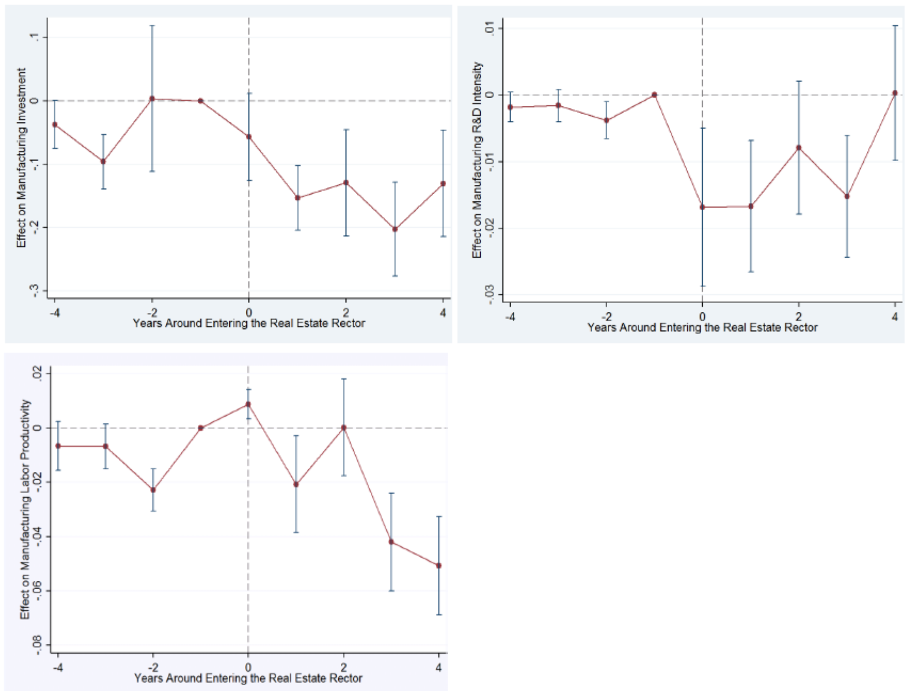
Column (2) of Table 6 summarizes the OLS estimates using the sample of privately-owned firms that have existed since 1997. After entering the real estate sector, manufacturing firms on average reduce their investment expenditure and R&D expenditure by 4.2% and 0.56% of their assets, respectively; and labor productivity declines by 6.4%. The effects on R&D intensity, investment rates, and labor productivity are equivalent to 7%, 25.4% and 5.2% of their respective standard deviation.

Column (3) shows the results from the instrumental variable approach. The entry decision of manufacturing firms is instrumented by connections with the land officials interacted with local land supply elasticity and national house price growth. Entering the real estate sector results in a reduction of manufacturing R&D by 0.012 and investment by 0.15 out of 1 RMB of total assets. These estimates are equivalent to a 0.15-standard-deviation drop in R&D intensity and a 0.95-standard-deviation drop in the investment rate, almost three times as large as the OLS estimates, respectively. Given that investment and R&D expenditures are both sensitive to credit constraints, unobserved firm credit access could lead to an upward bias of the OLS estimates. Besides, entering the real estate sector could relax firm-level credit constraints, so the IV estimates can still be upward-biased here. Average labor productivity of manufacturing firms declines by 3.98% following entry, which is smaller compared to the OLS estimate. Labor productivity could be more relevant to the unobserved investment opportunity so that the full-sample OLS estimates are likely to be downward biased. Column (4) and column (5) adds controls of the current political connection with city mayors and vice-mayors and local-firm time fixed effects, respectively. The estimates are slightly larger than the ones using the baseline IV approach, but they are statistically indifferent.

[Table 6 about here]

Figure 3 provides the event study analyses on entering the real estate sector. The decline in labor productivity does not happen immediately after entering the real estate sector. This is likely due to the internal capital market selection, which cleanses the relatively unproductive projects within the manufacturing sector causing labor productivity to go up temporarily. No pre-trends are detected in either outcome variable of interest.

Figure 3: The Event Study Plots



4 Misallocation and Social Inefficiency: A Structural Approach

In the previous section, I presented evidence suggesting that firm credit access relates to the decision of moving to the real estate sector. The observed empirical patterns thus may deviate from the first-best scenario in which talent allocation only follows the comparative advantage of managers. To conclude social optimality, this section discusses a theoretical model and the structural estimation of the comparative advantage of managers. The theoretical framework follows the literature of comparative advantage estimation (Costinot et al., 2012; Adao, 2015; Hurst et al., 2018) and the literature studying financial frictions and misallocation (Buera, Kaboski, and Shin, 2012; Buera and Shin, 2013; Midrigan and Xu, 2014).

There are two parts in this section. In the first part, I model the optimization problem of private-manufacturing-firm managers and use firm-level data to structurally estimate their comparative advantage in the real estate sector. The structural estimation verifies the existence of talent misallocation in the Chinese real estate market. In the second part of the section, I move on to a general equilibrium setting by adding the optimization problem of workers, households, and the market clearing conditions. The general equilibrium model then allows us to assess the social efficiency of the allocation of talent. For tractability, I focus on a two-period model in this section. Section 5 provide quantitative results based on an infinite-horizon version of the general equilibrium model.

4.1 Structural Estimation of Comparative Advantage

4.1.1 Theoretical Framework

The theoretical model considers an economy with two sectors: the manufacturing sector and the real estate (hereafter housing) sector. Each manager i produces manufactured goods and housing with different talent levels: z^M and z^H. Labor is perfectly mobile across sectors. Manufactured goods are produced with capital (k) and labor (l); housing is produced with land (s) and labor (l).

Technology. Manufactured goods and housing are produced at constant returns to scale:

$$
\begin{aligned}
y(z_i^M, k, l) &= [\exp(z_i^M)k]^{\alpha^M} l^{1-\alpha^M}, \\
h(z_i^H, s, l) &= [\exp(z_i^H)s]^{\alpha^H} l^{1-\alpha^H},
\end{aligned}
$$

where z_i^M, $z_i^H > 0$ and α^H, $\alpha^M \in (0,1)$.[35]

The structure of comparative advantage. Another important feature is a flexible structure of comparative advantage. Following Hsieh et al. (2018), I divide managers into groups based on their experience and education[36]. At time t, the talents of manger i in group g is assumed to be:

$$
\begin{aligned}
z_{it}^M &= \bar{z}_g^M + \xi_t^M + \omega_{it} \\
z_{it}^H &= \bar{z}_g^H + \xi_t^H + \epsilon_{it} \\
\bar{z}_g^H &= c + b\bar{z}_g^M
\end{aligned}
\tag{5}
$$

[35]The constant returns to scale assumption is reasonable from two aspects: housing (Epple, Gordon, and Seig, 2009; Combes, Duranton, and Gobillon, 2016), manufacturing (the production function and manufacturing talent is estimated in groups). For more details, please read Appendix C.

[36]Given that the sample covers only the first six years of the real estate boom, I consider the education and work experience of each manager as stable and pre-determined within this period. Studying the behavior of private business owners across groups further alleviates the concern on the constant-returns-to-scale assumption. In the structural model, although each business owner only specializes in one sector, there would exist partial specialization at the group level. Thus the model could better match the data.

$\bar{z}_g^M$ and $\bar{z}_g^H$ are constant average productivity of group g in the manufacturing sector and the housing sector; ξ_t^M, ξ_t^H are aggregate productivity shocks to the two sectors; and ω_{it}, ν_{it} are idiosyncratic productivity shocks. The structural parameter b governs the correlation between the group-specific comparative advantage and absolute advantage. When $b > 1$, the groups with an absolute advantage in the manufacturing sector (high $\bar{z}_g^M$) should specialize more in the real estate sector in the event of a real estate boom; when $b < 1$, a larger fraction of business owners with high $\bar{z}_g^M$ should stay in the manufacturing sector.

Other works studying financial imperfections and misallocation (Burea, Kaboski, and Shin, 2012; Midrigan and Xu, 2014) mostly assume that b equals 1. In such scenario, managers only differ in their idiosyncratic productivity shocks. There would be no misallocation of talent ex-ante, nor would we observe the strong correlation between manufacturing productivity and entry into the real estate sector as in section 3. In ex-post, adding the ex-ante heterogeneity in talents would lead to a negative ($b < 1$) or a positive ($b > 1$) correlation between wealth and housing comparative advantage[37]. As a result, financial imperfections yield a larger ($b < 1$) or a smaller ($b > 1$) welfare loss compared to the benchmark case with no ex-ante heterogeneity in talents.

Manager profit-maximizing problem. In each period t, manager i solves a profit-maximizing problem given initial wealth a_{it} and prices: wage w_t, house price p_t, land price q_t, and interest rate R_t. The price of manufactured goods is normalized to 1. Each manager faces a *borrowing constraint*, which is specified as a maximum leverage ratio of λ[38]. In the housing sector, there is a minimum operating scale, $\underline{s}$. The profit-maximizing problem of manager i can be written as:

$$\max_{s_{it},k_{it},l_{it}^H,l_{it}^M} p_t h(z_{it}^H, s_{it}, l_{it}^H) + y(z_{it}^M, k_{it}, l_{it}^M) - R_t(k_{it} + q_t s_{it} - a_{it}) - w_t(l_{it}^H + l_{it}^M) \tag{6}$$

$$s.t. k_{it} + q_t s_{it} \leq \lambda a_{it} \tag{7}$$

$$s_{it} \geq \underline{s}, \forall s_{it} > 0. \tag{8}$$

The key to modeling the *borrowing constraint* (7) is to allow the borrowing capacity to increase in wealth and non-decrease in talent, which ensures a positive correlation between wealth and talent (Table 1, Buera and Shin, 2013, Moll, 2014). The assumption can be micro-founded with limited enforcement of borrowing contracts among private managers and banks (Townsend, 1979; Holmstrom and Tirole, 1998). In other words, no one can delegate his or her funding entirely to a more efficient manager. Such financial imperfection implies that self-financing is the primary mechanism for

[37]The correlation between wealth and comparative advantage is a result of the talent structure and the self-financing mechanism.

[38]By varying λ, I can trace out all degrees of depth in the financial market: $\lambda = \infty$ implies a perfect financial market, while $\lambda = 1$ indicates that no firms can finance from external sources.

privately-owned firms to accumulate capital, which is well rooted in the literature. Song et al. (2011) and Hsieh and Klenow (2009) show that Chinese private firms rely heavily on self-financing and receive only limited funding from banks and insignificant equity funding. By varying λ, I can trace out all degrees of depth in the financial market: $\lambda = \infty$ implies a perfect financial market, while $\lambda = 1$ indicates that no firms can finance from external sources. The exact form of the borrowing constraint is not important here as long as the maximum investment is increasing in firm net worth a and non-decreasing in manager talent z. I assume a constant λ across all groups for analytical convenience.

The constraint (8) is the *minimum operating scale constraint* in the housing sector. This assumption intends to model the inflexible land input and also plays the role of an entry barrier in the housing sector[39]. If there is no such a constraint, i.e., $\underline{s} \to 0$, the borrowing constraint (7) only determines land and capital input at the intensive margin (the scale) but not at the extensive margin.

Given that the production functions are constant returns to scale, manager i specializes in either manufacturing or housing. The solution to the manager's problem is:

$$k_{it} = \lambda a_{it},\ l^M_{it} = \exp(z^M_{it}) \cdot (\frac{1-\alpha^M}{w_t})^{1/\alpha^M} \cdot \lambda a_{it},\ s_{it} = l^H_{it} = 0; \quad if\ a_{it} < \frac{q_t \underline{s}}{\lambda} \,|\, z^M_{it} \geq z^H_{it} + c_t$$

$$k_{it} = l^M_{it} = 0,\ s_{it} = \frac{\lambda a_{it}}{q_{it}},\ l^H_{it} = \exp(z^H_{it}) \cdot [\frac{p_t(1-\alpha^H)}{w_t}]^{1/\alpha^H} \frac{\lambda a_{it}}{q}; \quad if\ a_{it} \geq \frac{q_t \underline{s}}{\lambda}\ \&\ z^M_{it} < z^H_{it} + c_t,$$

where $c_t = \frac{1-\alpha^H}{\alpha^H} \log \frac{p_t(1-\alpha^H)}{w_t} + \log \alpha^H + \log \frac{p_t}{q_t} - \frac{1-\alpha^M}{\alpha^M} \log(\frac{1-\alpha^M}{w_t}) - \log \alpha^M$, which is a constant given market prices.

4.1.2 Structural Estimation

The solution of the manager's profit-maximizing problem implies the following expressions for return on asset:

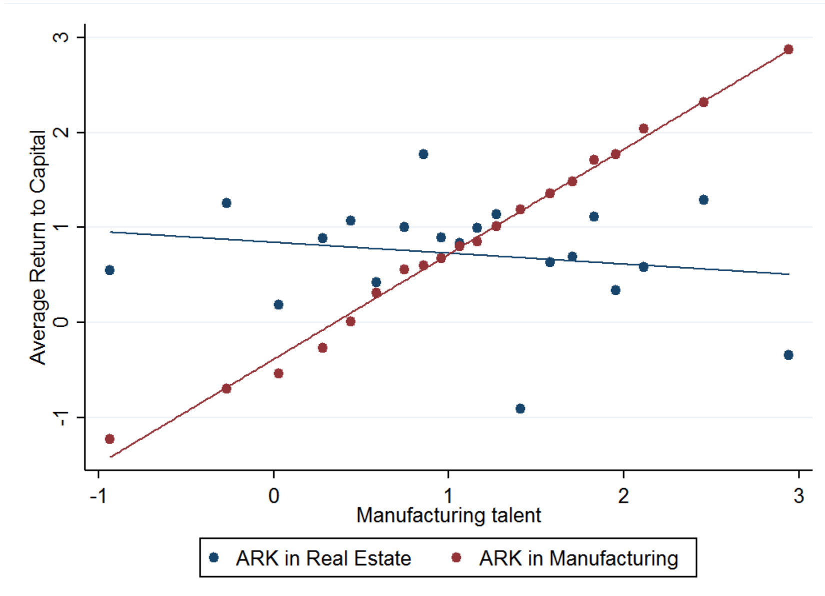
$$\begin{aligned} \log ROA^M_{it} &= z^M_{it} + \frac{1-\alpha^M}{\alpha^M} \log(\frac{1-\alpha^M}{w_t}) + \log \lambda \alpha^M \\ \log ROA^H_{it} &= z^H_{it} + \frac{1-\alpha^H}{\alpha^H} \log \frac{p_t(1-\alpha^H)}{w_t} + \log \lambda \alpha^H \frac{p_t}{q_t} \end{aligned} \tag{9}$$

Using the correspondence between ROA and managerial talents, I estimate the structural parameter b which governs the relationship between group-average comparative advantage and absolute advantage of private business owners. Figure 4[40] plots the group-average return on asset in the two

[39]The cash deposit requirement in the Chinese land market provides micro-underpinnings for this assumption.
[40]This figure is generated using the "binscatter" function in Stata.

sectors against the estimated manufacturing talent. Clearly, well-performing manufacturing business owners do not necessarily generate a higher return to capital in the real estate sector.

Figure 4: Average Return to Capital in Two Sectors



Following the literature of comparative advantage estimation (Eaton and Kortum, 2002; Costinot et al. 2012; Adao, 2015; Hurst et al. 2016), I add two additional assumptions to ensure the identification of b. First, the group-average talent levels $(\bar{z}_g^M, \bar{z}_g^H)$ do not vary over time. Second, idiosyncratic productivity shocks ω_{it} and ϵ_{it} are independent, and their distribution only depends on $\bar{z}_g^M$[41].

The firm-level dataset for this structural estimation combines the AIS, the ERD, and the 2004 and 2008 National Economic Census. I first use the ERD to match manufacturing firms in the AIS to their real estate subsidiaries. I then estimate the manufacturing production function and group average manufacturing talent from the AIS. The National Economic Census provides information on the return on asset of the real estate subsidiaries[42]. The 2004 and 2008 census covered more than 7,099,000 enterprises in China's secondary and tertiary industries, containing information on production, management, investment, and corporate structure at the firm level. Table 1 provides a summary of the variables from the National Economic Census. 1,299 real estate firms are found to be subsidiaries of manufacturing firms in the AIS.

[41]This assumption on idiosyncratic productivity distribution is more generalized than the standard in the literature, where people usually assume identical idiosyncratic productivity distribution within groups.

[42]There have been three rounds of censuses conducted in 2004, 2008, and 2013. Given that the micro-level data of the 2013 census is still not available, I use the 2004 and 2008 National Economic Census to estimate the production function of real estate firms.

The ERD further provides managers' levels of education and work experiences, which are predetermined characteristics used to classify these private firm managers. There are 20 groups based on five levels of education and four quartiles of managers' work experience. The five education levels include graduate, undergraduate and post-high school, high school and vocational high school, middle school, and elementary school and below. The work experience of managers varies from 1 to 48 years.

Methodology. Re-writing the two equations in (9), we obtain the following equilibrium condition:

$$\begin{aligned} \log ROA_{it}^{H} &= z_{it}^{H} + \frac{1-\alpha^{H}}{\alpha^{H}} \log \frac{p_t(1-\alpha^{H})}{w_t} + \log \lambda \alpha^{H} \frac{p_t}{q_t} \\ &= c + b\bar{z}_{g}^{M} + \xi_{t}^{H} + (1-\alpha^{H}) \log(\frac{1-\alpha^{H}}{\alpha^{H}} \cdot \frac{q_t R_t}{w_t}) + \epsilon_{it} \\ &= c + b\bar{z}_{g}^{M} + \delta_{t}^{H} + \epsilon_{it} \end{aligned} \tag{10}$$

In the *first step*, I estimate the group-average talent in the manufacturing sector, $\bar{z}_g^M$, using data before 2002. Until the complete privatization in both property market and land market, privately-owned companies had neither the ability nor the incentive to develop real estate properties. Therefore, manufacturing business owners focused only on manufacturing production during the pre-boom era. I estimate the manufacturing talent of private business owners following Basu and Fernald (1997)[43] as a residual from the production function:

$$\begin{aligned} \log y_{it} &= \alpha^{M}(z_{it}^{M} + \log k_{it}) + (1-\alpha^{M}) \log l_{it} \\ \Rightarrow \frac{1}{\alpha_{Ind_i}^{M}} \log y_{it} - \log k_{it} - \frac{1-\alpha_{Ind_i}^{M}}{\alpha_{Ind_i}^{M}} \log l_{it} &= z_{it}^{M} = \alpha_0 + \alpha_g + \delta_t + e_{it}, \end{aligned}$$

where $\alpha_{Ind_i}^{M}$ is the average capital share of the 4-digit industry to which business owner i belongs to and $\hat{\alpha}_g$ is an estimate of the group-specific manufacturing talent, $\bar{z}_g^M$. The estimation is conducted with the unbalanced sample of firms from 1997 to 2002.

In the *second step*, I correct for the sample selection bias given that we only observe the *ROA* of firms that chose to enter the real estate sector. The error term ϵ_{it} conditional on self-selection into housing ($i \in H_{g,t}$[44]) is then centered around 0 if and only if $b = 1$[45]. Therefore, to proxy for the

[43] The estimation in this paper is a simplified version of Basu and Fernald (1997). First, I assume that the markets are perfectly competitive so the markups in both the manufacturing and housing sector are equal to 1. Second, I assume that firms produce with only capital and labor so the factor shares for value added is the same as the factor shares for total output.

[44] $H_{g,t}$ indicates the group of private managers in group g that choose to enter the real estate sector in year t.

[45] When $b > 1$, more productive manufacturing businesses should specialize in the real estate sector. The probability of entry

sample selection bias, I estimate firm-specific propensity score for entering the real estate sector non-parametrically, following Das, Newey, and Vella (2003). The approach is similar to the Heckman two-step correction except that it does not require a normality assumption. Due to data limitations, the propensity score is estimated semi-parametrically using the 2004 census and the 2008 census:

$$\begin{aligned} Entry_{i,2008} = \gamma_0 + \gamma_1 \log w_{c,2004} + \gamma_2 \log p_{c,2008} + \gamma_3 \log q_{c,2004} + F(\hat{\bar{z}}_g^M, a_{i,2004}, CreditScore_{i,2004}) \\ + \gamma_4 PolConnection_i + \gamma_5 (1 - Elasticity_c) + \gamma_6 PolConnection_i (1 - Elasticity_c), \quad (11) \end{aligned}$$

where $F(\hat{\bar{z}}_g^M, a_{i,2004}, CreditScore_{i,2004})$ is a fractional polynomial function of $\hat{\bar{z}}_g^M$, firm i's total asset value in 2004 – $a_{i,2004}$, firm i's credit score in 2004, and their interaction terms. $PolConnection_i$ and $Elasticity_c$ are instruments that ensure the estimated propensity score as a valid proxy. w, p, q are the wage, house price, land price, respectively. The fitted value $\hat{Entry}_{i,2008} \equiv \hat{P}_i$ is the estimated propensity score for entry.

In the *last step*, I plug $\hat{\bar{z}}_g^M$ in equation (10) to estimate the structural parameter b. The identifying assumption is that conditional on $\hat{\bar{z}}_g^M$, the propensity score $\hat{P}_i$, and other observables, the unobserved ϵ_{it} has a mean of 0[46]:

$$E(\epsilon_{it} | (\epsilon_{it}, \omega_{it}) \in H_{g,t}, w_t, p_t, q_t, a_{it}, \hat{\bar{z}}_g^M, \hat{P}_i) = 0$$

The selection bias in equation (10) is proxied using a non-parametric function of $\hat{P}_i$:

$$\log \frac{p_{2008}^H h_i}{k_i} = \alpha_c + b\hat{\bar{z}}_g^M + \Lambda(\hat{P}_i) + \epsilon_{i,2008},$$

where α_c is city fixed effect that controls for local prices in city c; $\Lambda(\hat{P}_i)$ is a fractional polynomial function of the estimated propensity score $\hat{P}_i$, which works as a proxy for the selection bias $E(\epsilon_{it} | (\epsilon_{it}, \omega_{it}) \in H_{g,t})$. Under the identifying assumption, $\hat{b}$ is a consistent estimator of b[47]. To find out if more productive manufacturing managers should have stayed in the manufacturing sector, I test the null hypothesis $H_0 : b \geq 1$ with a sample bootstrapped at the manager level. In the case that $\hat{\bar{z}}_g^M$'s are estimated with errors, the third-step estimate b will have a bias towards 0. I include in esti-

into the real estate sector is increasing in $\bar{z}_g^M$, so the correlation between $E(\epsilon_{it} | (\epsilon_{it}, \omega_{it}) \in H_{g,t})$ and $\bar{z}_g^M$ is negative. Therefore, the self-selection of managers induces a downward bias. When $b < 1$, more productive manufacturing managers should specialize more in the manufacturing sector, so that the probability of entry into the real estate sector is decreasing in $\bar{z}_g^M$. In this case, the correlation between $E(\epsilon_{it} | (\epsilon_{it}, \omega_{it}) \in H_{g,t})$ and $\bar{z}_g^M$ becomes positive and the self-selection introduces an upward bias. In other words, endogenous selection tends to equalize the return to capital in both sectors, so that the selection bias would result in b to be biased towards 1.

[46] This methodology would still be valid if we generalize z_i^H to be a time-varying Markov process: $z_{it}^H = f(z_{i,t-1}^H) + \varepsilon_{it}$. In this case, the identifying assumption is valid as long as managers make their occupation choices for period t before z_{it}^H is realized. The non-parametric propensity score controls for the variation in $z_{i,t-1}^H$ that can be explained by $\bar{z}_g^M$. The remaining component , together with unexpected shocks ϵ_{it} and ε_{it}, would still be orthogonal to $\bar{z}_g^M$.

[47] A proof and related discussion can be found in Das, Newey and Vella (2003).

mate with the Empirical Bayes approach (the control function approach) to control for the estimation error. Appendix B discusses the details of the empirical Bayes approach.

Discussion of Results.

Table 7 summarizes the estimation results. Columns (1) to (3) report the coefficients estimated using firm-specific talent, group-specific talent, and the group-level talent adjusted with the Empirical Bayes approach, respectively. The coefficients in columns (1) and (2) are subject to attenuation bias due to measurement errors in the first step. The null hypothesis of $b \geq 1$ is rejected in all three estimations, indicating that there is likely a negative correlation between the managers' comparative advantage in real estate and their absolute advantage in the manufacturing sector. Therefore, the fact that more productive manufacturing managers are more likely to move to the real estate sector implies a misallocation of talent.

[Table 7 about here]

4.2 The Social Efficiency

From the analyses above, there exists a misallocation of talent when $b < 1$. Managers with a comparative advantage in the real estate sector were forced to stay outside due to financial imperfections. Given that the actual size of the entry barrier varies with land prices, the minimum-operating-scale constraint creates a pecuniary externality, which leads the competitive equilibrium to deviate from the second-best scenario. Next, I illustrate the social inefficiency in the scenario of $b < 1$ using a two-period model, which emphasizes the inefficient talent allocation at the cross-section. Section 5 generalizes the two-period model into over-lapping generations and provides quantitative estimates for the social inefficiency.

4.2.1 The Two-period Model

I model an economy with L workers and private business owners of a measure of 1. The private business owners have heterogeneous talents, $z^M \in [0,1]$ and $z^H = c + bz^M$ ($b < 1$), in producing manufactured goods and housing respectively. There are five private markets: the labor market, the capital market, the land market, the goods market, and the housing market. The first three markets are used to allocate production factors to business owners; business owners then sell their products through the goods market and the housing market. Without loss of generality, I fix the price of manufactured goods at 1.

Preference. All agents (private business owners and workers) in the economy consume only manufactured goods in period 1, and they consume both manufactured goods and housing in period 2. Given that the housing sector privatization is unexpected, a representative agent maximizes her utility in the first period without taking into account the housing sector. The period-1 utility criterion is thus:

$$U_1 = \log c_1 + \beta \log c_2,$$

where c_1 is the consumption in the first period and c_2 is the expected consumption in the second period.

In the second period, after the housing sector is privatized, workers and private business owners maximize their total utility from consuming housing and manufactured goods:

$$U_2 = \sigma \log c_2 + (1 - \sigma) \log h,$$

where h is consumption of housing and $1 - \sigma$ is the housing consumption share in the second period. The elasticity of substitution between manufacturing goods and housing is assumed to be 1.

First period. In the first period, all private business owners only operate in the manufacturing sector, which reflects the years before the real estate market privatization[48]. The private business owners choose optimal consumption and production input as in (6) except that land s and housing labor input l^H are fixed at 0. For simplicity, I further assume that all firms have the same wealth a_0 at the beginning of period 1. This assumption then allows the model to emphasize the importance of manufacturing talent on wealth accumulation[49].

Lemma 1:
The private business owner's wealth at the end of the first period, $a_1(z^M)$, is non-decreasing in z^M.

(*Proofs and more details of the optimization problem are provided in Appendix C*). Lemma 1 is a direct result of the self-financing mechanism[50], given the initial wealth, private business owners with a higher talent in the manufacturing sector accumulate capital at a faster speed.

[48] In a more general setting, the model targets the private mangers who operate in other industries prior to a real estate boom. Some of these managers reallocated their capital to the real estate sector during the real estate boom. Therefore, it is reasonable to assume that they do not specialize in the real estate sector in the first stage.

[49] In a more general setting, more talented private business owners accumulate more wealth over time regardless of initial wealth distributions. I also present evidence in section 3 that more productive private firms in China on average own more assets. Therefore, the assumption is not crucial but simplifies the two-period model.

[50] The self-financing mechanism can be easily generalized into a model with infinite horizons: in a world without the financial frictions, only the most productive private business owner will participate in manufacturing production. However, when there is a maximum leverage ratio and the initial wealth of entrepreneurs is not too dispersed, firms with heterogeneous productivity would co-exist in the market. Although productive entrepreneurs can generate a higher return than unproductive entrepreneurs, its growth in each period is limited by the maximum borrowing constraint. Over time, the productive private firms occupy a larger and larger wealth share and eventually produce for all agents in the economy.

Second period. In the second period, the economy experiences unexpected privatization in the housing sector, and manufacturing business owners face the option of becoming a real estate developer[51]. The total land supply S is determined exogenously by the geographical constraint of land development. Denoting p^H and q as the house price and land price in period 2, the profit-maximizing problem of the private business owner with talent z^M becomes:

$$\begin{aligned}
\max_{k(z^M),s(z^M),l_M(z^M),l_H(z^M)} \quad & [\exp(z^M)k(z^M)]^{\alpha^M} l_M(z^M)^{1-\alpha^M} + p^H[\exp(z^H)s(z^M)]^{\alpha^H} l_H(z^M)^{1-\alpha} \\
& -w_2[l_M(z^M) + l_H(z^M)] - R_2[k(z^M) + qs(z^M) - a_1(z^M)] \\
s.t. \quad & k(z^M) + qs(z^M) \leq \lambda a_1(z^M) \\
& s(z^M) \geq \underline{s} \qquad \forall s(z^M) > 0,
\end{aligned}$$

where $k(z^M)$ and $l_M(z^M)$ refer to the capital and labor input of z^M in the manufacturing sector; and $s(z^M)$ and $l_H(z^M)$ refer to the land and labor input of z^M in the housing sector.

Appendix C provides a full description of the rest of the competitive equilibrium, including the worker's problem, the private business owner's utility maximization problem, and other equilibrium conditions.

Proposition 1:
There exists a unique competitive equilibrium in the economy. When the initial endowment of the representative worker is large enough, the allocation of managerial talent in the second period can be characterized using three cutoffs: $\underline{z}^M$, z_l^M and z_h^M. Private business owners with talent $z^M \in (\underline{z}^M, z_l^M] \bigcup (z_h^M, 1]$ operate in the manufacturing sector; private business owners with talent $z^M \in (z_l^M, z_h^M]$ operate in the housing sector; and private business owners with talent $z^M \in [0, \underline{z}^M]$ exit production and only save in the capital market.

(*Proofs are provided in Appendix C*).

The planner's problem. The second-best benchmark in this economy is the social planner's optimal solution under the same production frictions: the firm-level borrowing constraint and the minimum operating scale constraint in the housing sector. With these constraints, the social planner cannot arbitrarily assign production factors to business owners.

In the first period, the social planner's solution aligns with the competitive equilibrium, given that the housing market privatization is unanticipated. This result is implied directly by the second welfare theorem. In the second period, the social planner maximizes aggregate utility following the Gorman's Aggregation Theorem:

[51] The main reason for modeling an unexpected real estate boom is to derive closed-form solutions for policy discussions. The efficiency argument will hold when agents anticipate the real estate boom and adjust their savings for the cost barrier in the housing sector.

$$\mathcal{U} = \chi \log C + \log H,$$

where C is the total consumption of manufactured goods, and H is the total housing consumption. $\chi = \frac{\sigma}{1-\sigma}$ is the Pareto weight that corresponds to the competitive equilibrium.

The crucial difference between the social planner's solution and the competitive equilibrium is that the social planner internalizes the land price as a function of the allocation of private business owners. There are also private markets for land, capital, labor, and housing. Solving the social planner's problem is thus equivalent to solving for the three cutoffs described in Proposition 1: one for producing, $\underline{z}^M$, and two for operating in the housing sector: z_l^M, z_h^M. The social planner's problem in the second period can be written as:

$$\max_{\{\underline{z}^M, z_l^M, z_h^M, l(z^M)\}} \quad \chi \log C + \log H$$

$$s.t. \quad C = \int_{[\underline{z}^M, z_l^M) \cup (z_h^M, 1]} [\exp(z^M) k(z^M)]^{\alpha^M} l(z^M)^{1-\alpha^M} dF(z^M) \tag{12}$$

$$H = \int_{z_l^M}^{z_h^M} [\exp(z^H) s(z^M)]^{\alpha^H} l(z^M)^{1-\alpha^H} dF(z^M) \tag{13}$$

$$\lambda\left(\int_{[\underline{z}^M, z_l^M) \cup (z_h^M, 1]} a_1(z^M) dF(z^M)\right) = \int_0^1 a_1(z^M) dF(z^M) + a_1^L \quad (\mu_k) \tag{14}$$

$$\lambda a_1(z_l^M) \geq \frac{\lambda \int_{z_l^M}^{z_h^M} a_1(z^M) dF(z^M)}{S} \underline{s} \quad (\mu_e) \tag{15}$$

$$\int_{\underline{z}^M}^1 l(z^M) dF(z^M) = L \quad (\mu_l) \tag{16}$$

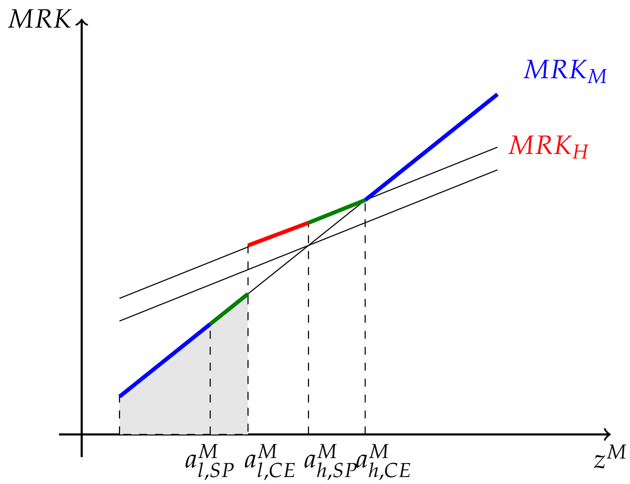
Similar to the first case, equations (12), (13), (14) and (16) refer to the market clearing conditions on the manufactured goods market, the housing market, the capital market, and the labor market, respectively. The constraint (15) combines the market clearing condition on the land market and the minimum operating scale constraint.

Proposition 2:

When the least talented manufacturer $\underline{z}^M$ is constrained from entering the housing sector, the competitive equilibrium is constrained inefficient. Both z_l^M and z_h^M are higher in the competitive equilibrium than in the social planner's problem.

The socially optimal allocation of managerial talent should be solely pinned down by the comparative advantage of private business owners in the housing and the manufacturing sectors. The comparative advantage of housing production is then the marginal social return on capital in the housing sector relative to the marginal return in the manufacturing sector. With a monotonic transformation, it is equivalent to $z^H - z^M$ in this model. In the case of $b < 1$, the comparative advantage is decreas-

Figure 5: The Allocation of Managerial Talent ($b < 1$)



ing in z^M, so that the private business owners with low z^M's should operate in housing production in the optimal situation. Figure 5 compares the competitive equilibrium with the social planner's solution in such scenario. The thresholds labeled with "CE" refer to the competitive equilibrium, and the thresholds labeled with "SP" refer to the planner's solution (the second-best scenario). The competitive equilibrium inefficiently allocates two groups of private business owners. First, the entry barrier results in a lack of competition in the land market, which extracts monopolistic rents to the landowners. The monopolistic rents attract business owners with talent in $(z^M_{h,SP}, z^M_{h,CE}]$ to enter the housing sector. Given that the more talented manufacturing business owners also own more wealth, the land price is higher in the competitive equilibrium than in the planner's solution. Therefore, a larger fraction of private business owners who have a higher comparative advantage in housing is constrained from entry. This group has manufacturing talent in $(z^M_{l,SP}, z^M_{l,CE}]$. Endogenizing the land prices allows the social planner to allocate the private business owners efficiently at the extensive margin.

4.2.2 Discussion of Policy Tools

To deal with the social inefficiency, I examine three policy tools that have the potential to improve social welfare: liberalizing the financial market, a more flexible schedule for land supply (or a reduced entry barrier), and taxation on the return on capital in the real estate sector.

The first two policy tools relax the borrowing constraint and the minimum operating scale constraint, respectively. These changes not only affect the competitive equilibrium but also relax the constraints in the planner's problem. Financial market liberalization and increasing land supply might improve welfare but would not help with alleviating inefficiency. The taxation on returns in the real estate sector, on the other hand, directly reduces the excess return due to the lack of entry, so that it partly solves for the inefficiency in the managerial talent allocation.

In practice, financial market liberalization could affect both firm borrowing counstraint and the entry barrier in the real estate sector. For example, real estate developers can raise funds through REITs and thus their individual wealth is less crucial to entry into the land market. In terms of taxing the returns on real estate businesses, China is now imposing a 1% stamp tax and considering further implementing a recurrent property tax. These tax policies would help correct the incentives of real estate developers, and also prevent overheating from the demand side of the housing market.

Financial market liberalization:
A more liberalized financial market (a higher λ) increases $\underline{z}^M$ and lowers z_l^M and z_h^M, resulting in higher social welfare but larger inefficiency at the extensive margin.

In theory, financial market liberalization can be modeled as an increase in the maximum leverage ratio λ. A higher λ is welfare-improving from two aspects. First, it directly reduces the resource misallocation in the economy, given that more productive private business owners are allowed to borrow more. Second, the constrained manufacturing business owners who have the comparative advantage in the housing sector are more capable of acquiring capital, so that they are more likely to overcome the entry barrier in the housing sector. Given existing constraints in the real estate sector, an economy with a more developed financial market would achieve higher social welfare as compared to a developing economy.

This finding is consistent with the literature, which argues that a more liberalized financial market improves resource misallocation. However, the inefficiency (the discrepancy between the competitive equilibrium and the second-best scenario) at the extensive margin becomes exacerbated. The already wealthy business owners are now able to borrow more, which further increases the land prices. As a result, more manufacturing business owners with low wealth (and therefore comparative advantages in the housing sector) are constrained by the entry barrier in the housing sector. A detailed proof is provided in Appendix C.

A lower cost barrier to entry:
A smaller entry barrier in the real estate sector (a smaller $\frac{s}{S}$) lowers $\underline{z}^M$, z_l^M, z_h^M, and lowers inefficiency at the extensive margin. The welfare consequence is ambiguous.

An increase in land supply is equivalent to a decline in the minimum operating scale, which lowers $\frac{s}{S}$[52]. All else equal, all private business owners are less constrained by the entry barrier in the housing sector. However, lowering the entry barrier in the housing sector has an ambiguous impact on aggregate welfare. When the minimum operating scale is lower, more firms decide to enter the

[52] In reality, the flexibility of land supply is often subject to geographical or political constraints.

housing sector. Unproductive manufacturing business owners, who might have become savers when the entry barrier is high, now produce actively. The aggregate productivity is thus lower with a lower entry barrier in the housing sector.

Taxation on land use:
Taxing the land use lowers the return on capital in the real estate sector, and thus lowers $\underline{z}^M, z_l^M$ *and* z_h^M*, resulting in higher social welfare and a lower inefficiency at the extensive margin.*

This policy tool is equivalent to imposing a wedge on the returns from building and selling houses. Instead of paying a unit price of q for land acquisition, the real estate developers now face cost $q(1+\tau)$. The land tax lowers the return from producing housing so that the more talented business owners in the manufacturing sector lose the incentive to move to the housing sector. Due to the lack of entry for wealthy business owners, the land price is also lower, which alleviates the pecuniary externality. In summary, this policy tool deals with both groups of private business owners who were inefficiently allocated in the competitive equilibrium by correcting their incentives.

5 Quantitative Analysis

In the quantitative analysis, I generalize the two-period model to the infinite horizon, and quantify the productivity loss due to the liberalization of the real estate market. The quantitative exercise generalizes the model in Song et al. (2011) to multiple groups of entrepreneurs with heterogeneous talent and two sectors: the manufacturing sector and the housing sector.

In the infinite horizon model, the economy consists of L workers and N groups of entrepreneurs. Each agent in the economy works for 30 years and saves for 20 years after retiring[53]. Entrepreneurs work as managers when young; after retirement, they invest either in the capital market or in their family firms. In the latter case, old entrepreneurs hire other young entrepreneurs to manage their family firms. Having entrepreneurs saving in their family firms guarantees that the self-financing mechanism will continue to exist. Therefore, the positive correlation between wealth and talent holds in this infinite horizon model. While young, both workers and entrepreneurs can only save in the capital market. Young workers earn labor compensation, and young entrepreneurs earn manager compensation as a fraction of old entrepreneur's investment return. In each period, each old entrepreneur (business owner) makes decisions on the capital investment into the family firm, while the young entrepreneur (manager) decides the allocation of capital. Each family firm still faces the borrowing constraint and the minimum operating scale constraint explored in section 4. The technology and preferences are the same as in the two-period model.

The question at the core of this quantitative analysis is to jointly identify the comparative advantage parameter and the entry barrier in the housing sector. In the literature, people have estimated

[53]The parametrization follows Song et al. (2011)

Roy-like models with a flexible comparative advantage structure with no other production frictions, or models with a fixed cost of entry but independent productivity draws. They use the observed selection into different sectors to pin down either the talent distribution or the entry barrier. In this model, given that both b and $\underline{s}$ are unknown, the observed selection does not provide enough degrees of freedom to identify the two parameters together. Therefore, I take the parameter b estimated in section 4 using the micro-level data, and I calibrate the entry barrier $\underline{s}$ and other parameters of the model by matching empirical moments in the years between 1997 to 2010. Based on the calibration, I conduct policy counterfactual analyses that focus on the three policy tools discussed in section 4.

5.1 Calibration and Counterfactual Policy Analyses

To calibrate the model, I match the equilibrium outcome of the life-cycle model with overlapping generations with data. Given that a series of deregulation led to the real estate boom in China, I model them as permanent shocks. The Chinese economy was transitioning to a balanced growth path for the sample period. Therefore, the value function of each agent depends on the entire path of prices, including wage, interest rate, house price, and land price. The set of state variables contain talent (z_{it}^M, z_{it}^H), wealth, age, and year. To simplify the computation process, I calibrate the entrepreneurs' decisions at the group level and assume that both ϵ_{it} and ω_{it} are zero. In doing so, I replace the state variable (z_{it}^M, z_{it}^H) with exogenously fixed average productivity $(\bar{z}_g^M, \bar{z}_g^H)$. The talent distribution of group-specific talent, $\bar{z}_g^M$, follows a truncated Zeta distribution, which is a discrete approximation to the Pareto distribution[54]. The probability density function of $\bar{z}_g^M$ is:

$$\Pr(\bar{z}_g^M) = \frac{1/g^\zeta}{\sum_{i=1}^N 1/i^\zeta}, \zeta > 1$$

The old entrepreneurs' savings decisions determine the total asset value available for each firm. I assume a competitive market for hiring young entrepreneurs as managers. Within the manufacturing sector, the group with a higher $\bar{z}_g^M$ generates a larger return on capital, and the manager compensation is increasing in g. The expected wage of each group $m_{g,t}$ is determined such that the incentive compatibility constraint for each young entrepreneur is binding. The parameter determining the manager's compensation is assumed to be ψ, which is the minimum fraction of capital return that managers can steal. The size of ψ determines the overall growth rate of the economy. When ψ is higher, the income dispersion is more significant in younger generations; thus, the group of productive firms in manufacturing accumulates wealth at a faster speed.

To more closely model the Chinese economy, I add the SOEs in the quantitative analysis. Following Song et al. (2011), I assume that the SOEs are neither financially constrained nor managed by any entrepreneurs. Their role in the model is to clear the capital market at the beginning of the transition

[54]The Pareto distribution is commonly used in studies assuming heterogeneous firm-level productivity.

when entrepreneurs have not accumulated enough wealth. The productivity of SOEs is assumed to be a κ fraction of the average productivity of privately-owned firms.

There are two stages in the calibration. The first stage, the pre-boom stage, corresponds to the first period in section 4. The second stage models liberalization in the real estate market. I consider the real estate boom as driven by a permanent preference shock, such that agents increase the housing consumption share from 0 to ρ. I estimate parameters on manufacturing talent distribution, manager compensation, and initial wealth using in the first stage and parameters that determine average housing talent and entry barrier in the second stage. The rest of the parameters are set exogenously. Table 8 describes the exogenously determined parameters.

Table 8: Exogenously Determined Parameters

Parameter	Description	Value	Source
β	The utility discount factor	0.99	Song et al. (2011)
λ	Maximum leverage ratio	1.35	Buera ans Shin (2013)
N	Total groups of entrepreneurs	5	Education levels in data
α^M	Capital input share in manufacturing	0.5	Bai, Hsieh, and Qian (2006), Song et al. (2011)
α^H	Capital input share in housing	0.85	China input-output table
b	Comparative advantage parameter	- 0.21	Point estimates from section 5.1
δ^M	Capital depreciation rate in manufacturing	0.1	Song et al. (2011)
δ^H	Land depreciation rate in housing	0.5	2-year construction period
T_1	Working age for workers and entrepreneurs	30	Song et al. (2011)
T_2	Average years between retirement and death	20	Song et al. (2011)

I assume that the first stage starts from 1992[55] and lasts for ten years until the 2002 land market liberalization. I calibrate the talent distribution using the estimated firm-level productivity between 1997 and 2002. Given the shape parameter ζ=2, the distance parameter is estimated to be d^M=0.15. The SOE productivity is set as κ=0.397 to match the relative capital-to-output ratio of SOEs and private companies, 2.65. Last but not least, the initial wealth level of workers and entrepreneurs is calibrated such that the average share of total fixed assets of private companies during 1997-2002 is close to 31.75% as observed in the data. The initial wealth distribution over each agent's life cycle is similar to a scaled-up version of their life-cycle wealth distribution in the balanced growth path. Entrepreneurs with different talent groups are assumed to start with the same wealth level. The minimum fraction of capital return a manager can steal (ψ) is estimated as 0.2, which matches the growth rate of the average share of total fixed assets owned by private companies. The model-based share in 1992 is 17.36%, which is close to 15.12% in the data.

[55]The beginning of the first stage follows the assumption in Song et al. (2011).

In the second stage, I take the model-based wealth distribution in 2002 as the initial wealth and calibrate three parameters: $\underline{s}$, c, and housing consumption share ρ. I calibrate the housing consumption share ρ=0.4. Assuming that an average worker works for 30 years, this yields a price-to-income ratio of 10.41, which matches the average price-to-income ratio of 10.2 in the data. Based on the proofs in Appendix C, the entry decisions of entrepreneurs depend jointly on the entry barrier and the comparative advantage of these entrepreneurs. I calibrate the entry barrier using the average difference in log productivity between entrepreneurs who entered the real estate sector and the ones who did not. In the data, the average difference is estimated to be 0.25, which leaves me with an estimate of $\underline{s}$=0.046. I interpret the estimate as follows: in an average city in China, the average startup cost for a real estate project is 4.6% of the total value of land supplied in the city. The parameter c indicates the average log productivity in the housing sector. I estimate c to match the relative firm size in the manufacturing sector and the real estate sector. In the data, an average manufacturing firm hires 7.54 times more employees than an average real estate development firm. The average housing talent c is then estimated to be 0.31. Table 8 summarizes the calibrated parameters and relevant moments in the data.

Table 9: Calibrated Parameters

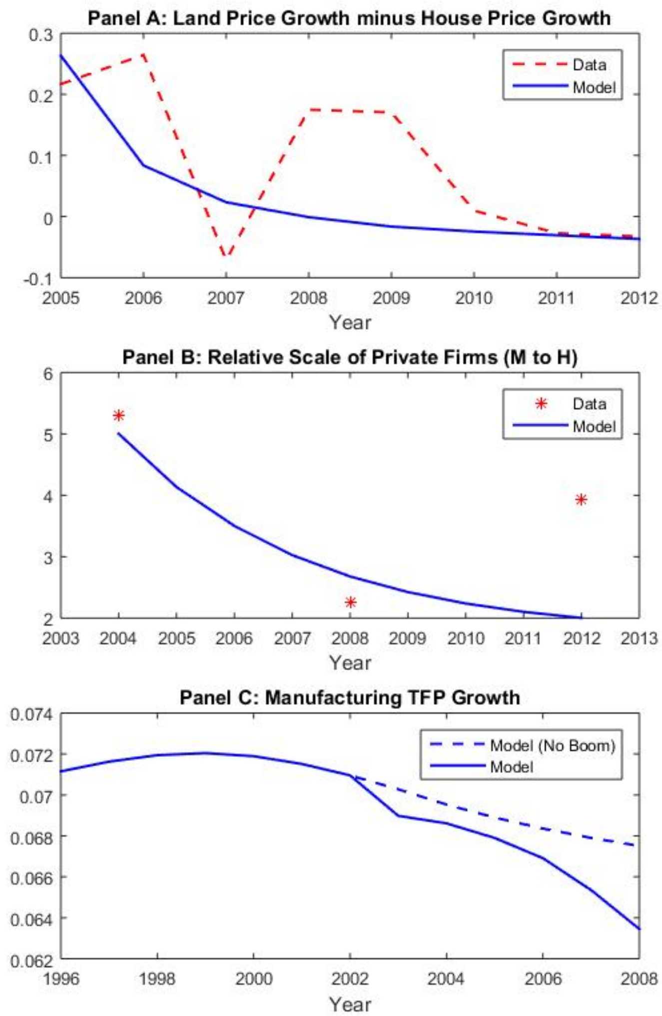
Target Moments	Data	Model	Parameter	Description
Variance of group-level log productivity	0.022	0.022	$\zeta = 6.07$	Scale parameter for manufacturing talent
Relative K/Y of SOEs and private firms	2.65	2.38	$\kappa = 0.397$	SOE productivity
Growth rate of private capital share	7.87%	8.89%	$\psi = 0.20$	Manager IC parameter
Share of capital held by private firms	31.75%	35.44%	Initial wealth	
House price to income ratio	10.2	10.41	$\rho = 0.40$	Housing consumption share
The difference in manufacturing productivity between real estate entrants and other firms	0.25	0.23	$\frac{\underline{s}}{S} = 0.046$	Entry barrier in real estate
Relative scale in manufacturing and real estate	8.54	8.06	$c = 0.31$	Average housing productivity

Panels A-C of Figure 9 compare several macroeconomic outcomes of the model and data. The most crucial untargeted moment is the relative growth rate of land prices to house prices. At the beginning of the real estate boom, the positive housing demand shock induces a high return on capital in the real estate sector. The unproductive and poor manufacturing entrepreneurs, who have the comparative advantage in the housing sector, are initially constrained from participating in the land market. The initial land price must be low when compared to the house price, so that talented manufacturing entrepreneurs have the incentive to move to the real estate sector. Over time, more entrepreneurs save out of the entry barrier which makes the land market more competitive. Real estate entrepreneurs with the highest manufacturing talents then move back to the manufacturing sector. The increasing competitiveness in the land market results in the faster growth of land prices relative to house prices. I find a similar pattern in the data. In the first three years following the land market liberalization, the land price in China increased by more than 20% per year compared to the increase in house price. After 2009, however, the annual growth rate of land price has remained mostly the same as the annual growth rate of the house price.

Panel B compares the average scale of private firms in the manufacturing sector relative to the real estate sector. Given that land prices increase faster than house prices (and thus total output), more unproductive and poor manufacturing entrepreneurs are constrained from entering the real estate sector. The constraint leads to a larger average scale of real estate firms and a smaller average scale of manufacturing firms. Given data limitations, I am only able to recover the relative scale from the three rounds of National Economic Census in 2004, 2008, and 2013. There is a rough pattern indicating that an average manufacturing firm is becoming smaller compared to an average real estate firm.

Panel C compares the manufacturing TFP growth with and without a real estate boom. An economy experiencing a real estate boom has a smaller manufacturing TFP growth. The land market liberalization changes the composition of entrepreneurs in the manufacturing sector, imposing an adverse effect on the productivity growth in the manufacturing sector.

Figure 6: Calibration Results



Policy Counterfactual Analyses

In analyzing the effects of the policy tools, I conduct three counterfactual analyses. The manufacturing TFP growth and land price in the model and the counterfactual cases are presented in Figure 7.

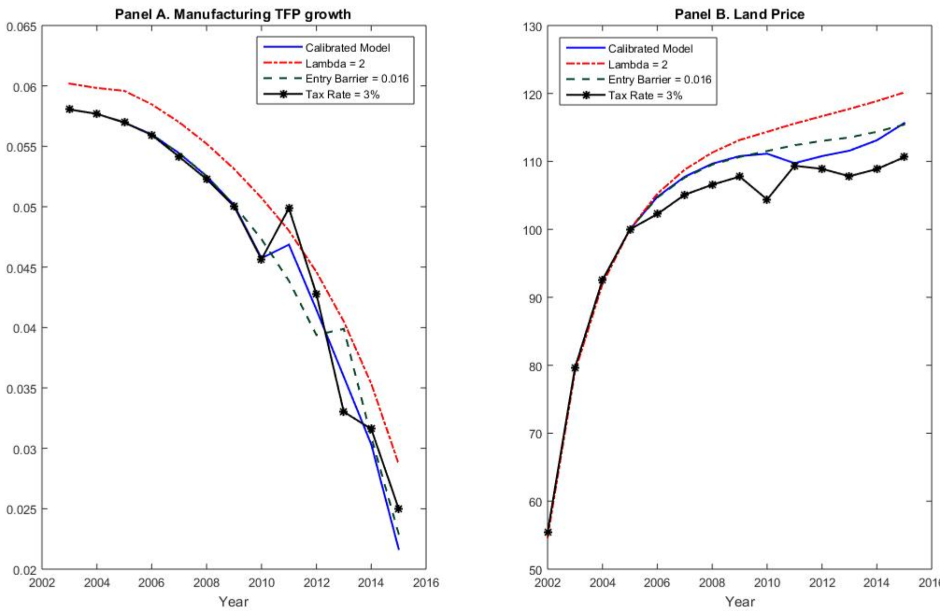
I first increase the maximum leverage ratio, λ, from 1.35 to 2 to understand the effect of liberalizing the financial market. A 48% larger borrowing constraint leads to a higher manufacturing TFP growth, as shown in panel A of Figure 7. This policy works indirectly by reallocating more resources to entrepreneurs with more talent in manufacturing, as is also discussed in related works in the literature (Hsieh and Klenow, 2009; Buera and Shin, 2013). Given the composition of entrepreneurs in the manufacturing sector, the productivity growth is higher as productive entrepreneurs accumulate wealth at a faster speed. A more relaxed borrowing constraint, however, also increases land prices so more entrepreneurs are constrained from entering the real estate sector. The larger inefficiency in the allocation of entrepreneurial talent then dampens the effect of liberalizing t he financial market.

Second, I study the effect of a smaller entry barrier. In reality, a lower entry barrier can be achieved by increasing the total land supply or improving corporate laws so several entrepreneurs can jointly operate a real estate firm without additional principle-agent frictions. As discussed in section 4, the welfare consequences are ambiguous. Given prices, a lower entry barrier allows more unproductive entrepreneurs to enter the land market. However, more entries also increase the land price such that a larger fraction of entrepreneurs is needed to clear the land market. As shown in panel B of Figure 7, the land price with a lower entry barrier is strictly higher than the one in the calibrated model. This imposes an adverse effect on manufacturing productivity. Overall, the impact of reducing the entry barrier on manufacturing TFP growth is ambiguous.

My last policy counterfactual focuses on the effect of taxing the return from property sales. In many countries, it is implemented as tax on land use or property stamp tax. When real estate developers sell houses, the buyer or the developers pay a 5% - 15% one-time stamp tax. This policy lowers the ROA from operating in the real estate sector without affecting land prices. Therefore, it prevents productive manufacturing entrepreneurs from operating in the real estate sector. Panel A in Figure 7 shows that a 3% property stamp tax increases manufacturing TFP growth in most years. The land price under this regulation is also always lower than the price in my calibrated model. Without changing the resource constraints, it improves social welfare by lowering land prices.

Regarding the welfare consequences, increasing λ from 1.35 to 2 results in a welfare increase of 6%, while a 3% property stamp tax increases the social welfare by 0.5%. The welfare is higher by less than 0.1% when the entry barrier is reduced from 0.046 to 0.016. Liberalizing the financial market is often costly and requires improving other related regulations. Collecting a property stamp tax, however, can be easily implemented as all properties on sale are already listed publicly. Policy makers then need to take into account the welfare benefits of the policy tools and their costs.

Figure 7: Policy Counterfactuals



5.2 Limitations and Future Works

The quantitative evaluation in this section is mainly used to evaluate the efficiency of entrepreneurial talent allocation in China and to conduct policy analyses. The calibrated life-cycle model with overlapping generations matches the price dynamics on the land market, as well as the average scale in the manufacturing sector relative to the real estate sector. There are several aspects of this quantitative model that can be improved in future works.

First, a larger efficiency loss could occur if idiosyncratic productivity shocks are added back to the model. In this case, the wealth of entrepreneurs depends not only on their talent group but also on their productivity shocks throughout history. On the other hand, their comparative advantage only depends on the talent group and current productivity shocks. Therefore, adding back the idiosyncratic productivity shocks creates a larger gap between the incentive to entry (the comparative advantage) and the ability to entry (wealth). I am working on estimating a model that includes within-group mean-reverting productivity shocks for additional policy evaluations.

Second, the size and nature of the real estate boom also matter for my inefficiency argument. Imagine that China did not experience a large real estate boom following the deregulation. The talented manufacturing entrepreneurs would not be incentivized to enter the real estate sector. The land price would also remain at a relatively low level, such that unproductive manufacturing entrepreneurs with the comparative advantage in real estate are not constrained from entry into the land market. However, if a real estate bubble exists in addition to the increasing demand for housing, the entry barrier in real estate creates a larger distortion on the allocation of entrepreneurial talent. Moreover, the growing investment in bubble assets yields an additional loss in social welfare, as these investments produce neither more housing nor more manufactured goods.

Finally, I do not model the occupation choice of workers, so that the impact of real estate prices on entrepreneurship via the collateral channel is not considered here. Several empirical works (Hurst and Lusardi, 2004; Schmalz, Sraer and Thesmar, 2015; Kerr, Kerr, and Nanda, 2015) document that rising real estate prices may help alleviate the credit constraints of potential entrepreneurs. While my focus is on the business choices of existing entrepreneurs, I also argue that this is unlikely to matter for the Chinese real estate boom. Prior to the housing market reform, most households in China were not homeowners. Therefore, the increasing house prices do not help households to start up new businesses. The effect of the collateral channel also depends on the correlation between home-ownership and workers' comparative advantage in operating a firm. If the two factors are independent, the collateral channel should not have a sizable impact on welfare at the aggregate level.

6 Concluding Remarks

In this paper, I have proposed a new channel that links sectoral booms and aggregate inefficiency from the decisions of private business owners. I focus on the recent Chinese real estate boom and show that an inefficient allocation of managerial talent could exist in an economy with ex-ante heterogeneous talent, an imperfect financial market, and a cost barrier to entry in the real estate sector. The model is consistent with new empirical data on Chinese firms; more productive manufacturing firms diverted their resources to the real estate sector, resulting in a decline in R&D, investment, and productivity growth in their manufacturing businesses. The positive correlation between manufacturing productivity and entering the real estate sector can be adequately explained by more productive manufacturing businesses having more wealth. My data also suggests that more productive manufacturing business owners do not have the comparative advantage in the real estate sector. Therefore, the imperfect financial market, together with the entry barrier in real estate, creates an inefficient allocation of managerial talent, resulting in an inefficient loss of productivity.

The new channel highlighted in my paper adds new insights on the role of real estate booms. I argue that productivity loss may exist even without a real estate bubble, which differs from related works (Charles, Hurst, and Notowidigdo, 2015; Chen and Wen, 2014; Mian, Sufi, and Rao, 2013). In addition, the key feature of the real estate sector is that production of properties uses a scarce and inflexible factor - land. As an economy grows, the supply of capital is increasing while the supply of land is fixed. Eventually, the entry barrier only exists in the real estate sector. The real estate sector, however, is not the only sector that produces with scarce factors. The model can be used to study other booming sectors, as long as they also require both a costly barrier to entry and that existing business owners reallocate from other sectors to the booming sectors. For instance, my model can help examine the natural resource booms (the "Dutch disease") observed when countries with abundant natural resources experience a significant productivity slowdown following a positive shock to commodity prices.

I have also discussed three policy tools that may improve social welfare in real estate booms: relaxing firm borrowing constraint, reducing the entry barrier in real estate, and taxation on real estate returns. These policy tools are specific to alleviating the misallocation of manageral talent. An ideal policy should provide subsidies to managers constrained by the entry barrier in real estate and tax the ones with no comparative advantage in the real estate sector. Taxation on real estate returns appears to play a similar role to the ideal policy without the requirement in identifying the talent of individual managers. Relaxing firm borrowing constraint is also welfare improving, but it changes the planner's problem without directly targeting at the inefficiency. In fact, it would result in a large efficiency loss. Reducing the entry barrier in the real estate sector yields an ambiguous welfare consequence. A calibrated version of the model has been provided to evaluate the manufaturing TFP gains of the three policy tools.

Tables:

Table 1: Firm-level Summary Statistics

	Mean	Median	Std. Dev	25th Percentile	75th Percentile	Observations
Investment and Productivity:						
R&D Intensity	0.025	0	0.080	0	0.011	355,562
Investment Rate	0.07	0	0.16	0	0.02	294,262
Log(Labor Productivity)	3.69	3.63	1.23	2.96	4.37	382,031
Firm Accounting Data:						
Age	12.63	12	6.28	8	17	358,241
Net Long-term Debt Outstanding	0.43	0.24	0.53	0.05	0.60	293,759
Net Debt Outstanding	0.67	0.66	0.41	0.41	0.09	379,507
Log (Total Asset Value)	9.05	9.01	1.28	8.27	9.81	382,369
Log (Total Fixed Assets)	7.85	7.86	1.57	6.88	8.82	382,693
Employment	403.98	195	905.2	99	400	382,690
Net Cash Inflows	40.23	0	889.09	0	3.04	102,005
Return on Asset	0.10	0.03	0.27	0.00	0.13	382,675
Property Development Firm Data:						
Operation Income	8.18	8.34	2.56	6.48	10.07	77,186
Employment	21.66	12	53.63	5	23	82,047
Log (Total Asset Value)	9.77	9.95	2.32	8.52	11.38	78,291
Manager Data:						
Schooling Years	9.91	9	5.76	6	15	19,432
Experience	25.53	25	10.49	18	29	12,867
Minority	38.94%					14,704
Male	86.12%					21,359
Communist Party Member	14.98%					12,243

Notes: This table summarizes the main variables used in the empirical exercises. The data are from the NBS Annual Industrial Survey, the Enterprise Registration Database, and the 2008 National Economic Census. The R&D intensity is measured as R&D expenses normalized by the lagged value of total fixed asset (including properties, plant and equipment), following OECD measurement on relative degree of investment in generating new knowledge. The labor productivity is defined as the logarithm of value added per worker, and the investment rate is capital investment normalized by total fixed assets in the previous year. The age of a firm is the number of years since registration. The debt issuance variable is computed as the ratio of outstanding debt to total asset value. The net cash inflows is defined as the net cash inflows from financing, operation, and investment, normalized by the lagged book value of total fixed asset. Return on asset is measured as operation income (after depreciation) of the total book value of assets. For variables in the manager data, minority, male, and Communist party member are three 0-1 dummy variables, so I only report their mean values.

Table 2: Summary Statistics of the Real Estate Data

	# of Cities	House Price			Land Price			Land Supply Elasticity Index		
		Mean	Median	Std. Dev	Mean	Median	Std. Dev	Mean	Median	Std. Dev
City Tier:										
First Tier	4	10.93	10.75	2.22	10.02	9.01	3.86	0.720	0.815	0.286
Second Tier	35	4.77	3.97	1.97	3.96	3.28	2.95	0.717	0.819	0.295
Third Tier	105	3.40	2.83	1.51	2.17	1.84	1.11	0.770	0.852	0.254
Economic Region:										
Northeast	10	3.31	2.98	1.01	1.68	1.52	1.01	0.810	0.925	0.334
Coastal	70	5.03	4.23	2.50	4.79	3.58	3.65	0.661	0.753	0.309
Middle	45	2.73	2.67	0.70	2.37	2.07	0.77	0.847	0.880	0.134
West	18	3.14	3.10	0.58	2.25	2.12	1.20	0.853	0.899	0.161

Notes: This table summarizes the real estate data of the four economic regions and three tiers of cities in China. The house price, in thousands of Yuan, is the average price per square meter floor. The city-level average house price is computed by dividing total home value by the total floor area sold using National Bureau of Statistics (NBS) published from 2003 to 2013. The land price, in thousands of Yuan, is the average price per square meters of land area. The land market data is obtained from China Real Estate Index System (CREIS). The land supply elasticity index is constructed manually by the author, following Saiz (2010). The range of the land supply elasticity is from 0 to 1 .

Table 3: Comparison Between Real Estate Entrants and Other Firms

	Real Estate Development Entrants			Others		
	Mean	Median	Std. Dev	Mean	Median	Std. Dev
R&D Intensity	0.011	0.000	0.047	0.006	0.000	0.040
Log (Labor Productivity)	3.62	3.65	1.23	3.49	3.42	1.53
Investment Rate	0.14	0.03	0.22	0.07	0.00	0.18
Profit Margin	0.19	0.17	0.15	0.16	0.13	0.14
Log (Total Fixed Assets)	10.29	10.22	1.84	8.36	8.32	1.69
Log (Total Asset Value)	11.43	11.30	1.78	9.51	9.39	1.37
Employment	1,198	495	2,496	376	190	781
Net Cash Inflow	29.76	0.00	421.48	5.35	0.00	500.51
Credit Score	634.02	641	590	575.98	583	522
Age	14.46	14	6	11.78	11	6.18
Fraction of Firms	5.24%			94.76%		
Fraction of Fixed Assets	29.96%			70.01%		
Fraction of Asset Value	22.19%			77.81%		

Notes: This table compares the manufacturing firms that entered the real estate development industry with firms that did not. The total fixed assets and asset value are presented in millions of Yuan. The fraction of firms is computed as a ratio of the total number of firms in the sample. The fraction of fixed assets (asset value) are also computed as a ratio of the summation of the total fixed assets (total asset value) of all firms in sample.

Table 4: The Fractions of Managers that Moved to Real Estate

		Work experience			
		(1)	(2)	(3)	(4)
		1-12 years	13-24 years	25-36 years	37-48 years
Education	Graduate-level	0.052	0.094	0.086	0.05
	Undergraduate	0.045	0.054	0.046	0.024
	High school	0.037	0.041	0.043	0.034
	Elementary	0.024	0.020	0.018	0.024
	No schooling	0.017	0.027	0.016	0.020

Table 5: Determinants of Entering the Real Estate Sector

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
TFPQ	0.06***	-0.09**								
	(3.89)	(3.06)								
Log (Labor Productivity)			0.078***	-0.094***					0.066***	-0.097***
			(4.11)	(3.73)					(3.41)	(3.81)
Investment Rate					1.21***	0.64***			1.17***	0.63**
					(13.67)	(5.66)			(13.08)	(5.54)
R&D Intensity							0.89**	0.44	0.75**	0.38
							(2.25)	(1.06)	(2.25)	(0.85)
Log (Pre-boom Asset Value)		0.21***		0.25***		0.20***		0.21***		0.23***
		(6.36)		(9.12)		(7.87)		(8.51)		(8.50)
Log (Credit Score)		1.38***		1.60***		1.42***		1.47***		1.53***
		(6.46)		(9.94)		(9.03)		(9.36)		(9.46)
Number of Firms	11,062	9,291	16,055	15,171	15,810	15,257	15,958	15,257	15,694	15,169
Pseudo R-squared	0.089	0.126	0.109	0.152	0.106	0.153	0.106	0.147	0.113	0.158
City FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
2-digit Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: This table presents the determinants of entering the real estate development industry. Columns (1), (3), (5), (7) report the correlations between entry and investment and productivity without controlling for firm-specific financing ability. Columns (2), (4), (6) and (8) add the average pre-period total asset value and credit score as proxies for firm-specific financing ability. Control variables include five quantiles of employment, age, and exporting status. City fixed effects and 2-digit industry fixed effects are also included in all specifications. T-stats are reported in parentheses.

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

Table 6: The Effect of Entry into Real Estate on Manufacturing Production

	First Stage	OLS	IV		
	(1)	(2)	(3)	(4)	(5)
		Panel A: Dependent Variable: R&D Intensity			
Potential Connection with Local Land Bureau * (1-Land Supply Elasticity) * 3-year National House Price Growth	0.157***				
	(5.79)				
Post-entry Effect		-0.0056*	-0.0119*	-0.0234**	-0.132*
		(1.76)	(1.67)	(2.01)	(1.79)
F-Value	33.03				
		Panel B: Dependent Variable: Labor Productivity			
Post-entry Effect		-0.064***	-0.0398**	-0.0507*	-0.0445**
		(3.87)	(2.36)	(1.90)	(2.10)
		Panel C: Dependent Variable: Investment Rate			
Post-entry Effect		-0.042***	-0.151**	-0.177**	-0.155**
		(7.63)	(2.04)	(1.95)	(2.08)
Number of Observations		58,961	53,212	42,690	53,212
Current Linkage with Mayor	NO	NO	NO	YES	NO
Local Firm Dummy × Year FE	NO	NO	NO	NO	YES
Initial Controls × Year FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES

Notes: This table tests the effects of entering the real estate development industry on manufacturing production at the firm level. Columns (2) reports the estimates with ordinary least squares using the full sample of the balanced panel of private manufacturing firms. Column (3) reports the estimates using a three-way interaction instrument: local land inelasticity interacts with firm-specific potential connection with the local land bureau and the national house price growth. All two-way interactions are controlled in the regressions. The relevant first stage is reported in column (1). Column (4) and column (5) control for firm-specific connection with city mayor and vice mayors and local firm time fixed effects, respectively. All specifications control for age, local wage, year fixed effects, firm fixed effects, and firm-level initial conditions (exporter dummy, size classified according to employment, two-digit industry, economic region of location and credit rating) interacted with year fixed effects. T-stats are reported in parentheses with standard errors clustered at the firm level.
*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

Table 7: Quantitative Evaluation - Comparative Advantage on Absolute Advantage

	(1) Firm-specific	(2) Group-specific Estimation	(3) Empirical Bayes-adjusted-specific Estimation
b	-0.163	-0.199	-0.214
	(0.25)	(0.68)	(0.66)
P-Value ($H_0 : b \geq 1$)	<0.001	0.039	0.034

Notes: This table reports the structural estimators of b and the T-test statistics for the sufficient and necessary condition in proposition 2. Columns (1) to (3) report the coefficients estimated using the three-step approach. The entrepreneurial talent in the manufacturing sector is estimated at firm-level, group-level, and by applying an empirical Bayes adjustment at the group level, respectively.

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Appendix

Appendix A: The Land Supply Elasticity of Chinese Cities

Employing Geography Information System (GIS), we precisely calculated exogenously undevelopable land within 30 kilometer radii from the central point of each city. Eliminating area lost to steep slope, bodies of water, territory boundaries, and special district boundaries which prohibit urban sprawl, we built a comprehensive measurement of urban land flexibility for all major Chinese cities.

Steep slope significantly constrains residential development. Utilizing GIS software, we calculated areas exhibiting slope over 10% within 30km meter radii of each city's central point. Based on national contour lines map, we generated a national-wide slope map at a resolution of 1000 by 1000 meters. The data source of the contour lines map is the "1:1 Million Topographic Map of China" compiled by the National Bureau of Surveying and Mapping (NBSM, PRC). Considering that most residential construction projects take more than 1 square kilometer of land and small pieces of flat land within mountain area are expensive to develop, we choose 1000-meter resolution as the grid size for calculating slope.

There are several classifications regarding slope and urban construction suitability, and we set slope over 10% as unsuitable for urban housing development. The most popular standard for slope and urban construction suitability is set by Urban Planning Theory (third edition), which is the national textbook for urban planning majors. In this textbook, slopes between 0.3% - 10% are considered to be suitable for residential land use. However, according to the Code for Vertical Planning on Urban Field published in 1999, the maximum slope allowed to be used for residential land use is 25% (P.6). The threshold is increased to cover most land in China[56]. Considering construction and maintenance costs will increase significantly for residential development on land with slope over 8%, and most Chinese cities are built upon plains, we choose to use the general guideline of slope below 10% instead of the maximum limit of 25% as the threshold for land considered suitable for housing development.

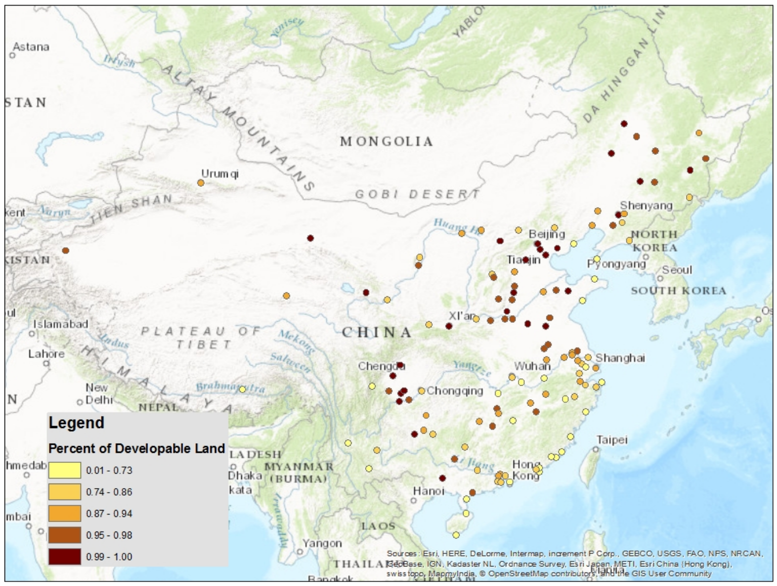
Residential development is also constrained by bodies of water, country territory boundaries, and special district administration boundaries. For example, Shenzhen housing development cannot cross the border with Hong Kong. By intersecting the polygon of coastline, inner water body, country territory boundary and special district administration boundary within the 30 km radii circle of each city, we can eliminate all undevelopable area caused by these factors. Data for coastline, territory

[56] Code for Vertical Planning on Urban Field(CJJ 83-99): http://wenku.baidu.com/view/504c9a10227916888486d79a.html

boundaries and special district boundaries comes from the "Administrative Division Map of China" compiled by China Cartographic Publishing House and ESRI. Data for inner bodies of water comes from the hydro-graphic map, "1:1 Million Topographic Map of China" compiled by the National Bureau of Surveying and Mapping (NBSM, PRC).

Figure A.1 below illustrates the city-specific land supply elasticity index for 129 Chinese cities.

Figure A.1: The Land Supply Elasticity Index in China



Appendix B: Additional Empirical Analyses

The Matching Approach

To account for the two omitted variable biases, I first select the sample using a semi-parametric matching procedure (Abadie and Imbens, 2006, 2012). I divide my sample into two groups: the treatment group and the control group. The treatment group includes companies that entered the real estate sector together with the comparison sets of all firms that did not. The control group includes companies that did not enter the real estate sector and the comparison sets of companies that entered. The exact matching procedure is as follows: for a given manufacturing firm i entered in the real estate development sector in year t, its matched comparison firms are restricted to operate in the same two-digit industry with the same exporting status, $G_i(Ind, E)$. The set of matched comparison firms is then selected as the closest four matches to firm i from $G_i(Ind,\ E)$:

$$\mathcal{J}_4(i) = \{l \in G_i(Ind,\ E) | W_l = 0,\ \|\boldsymbol{X} - \boldsymbol{X}_i\| \leq d_4(i)\}$$

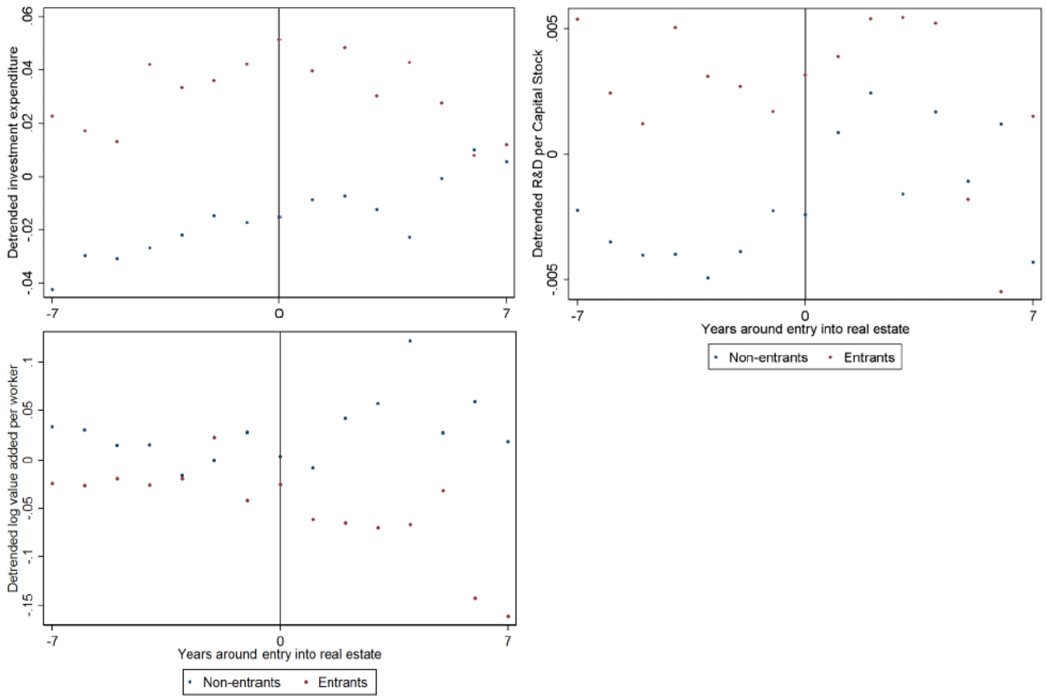
W_l and W_i are the treatment indicators of firm l and firm i, where $W = 1$ indicates the firm entered the real estate in year t; $d_4(i)$ is the distance between firm i and its fourth closest match. The matching variables include registered capital, firm age, total asset value, fixed asset value, employment, debt-to-asset ratio, and profit margin at time $t-3$. I drop observations whose fourth closest match has a distance larger than 20% of that to the origin.

Firm i's potential outcome in year t is computed as:

$$\begin{aligned}
\hat{Y}_i(0) &= \begin{cases} Y_i & \text{if } W_i = 0 \\ \frac{1}{4}\sum_{i \in \mathcal{J}_4(i)} Y_j & \text{if } W_i = 1 \end{cases} \\
\hat{Y}_i(1) &= \begin{cases} \frac{1}{4}\sum_{i \in \mathcal{J}_4(i)} Y_j & \text{if } W_i = 0 \\ Y_i & \text{if } W_i = 1 \end{cases}
\end{aligned}$$

Figure A.2 plots the average R&D intensity, investment rate, and labor productivity of the two groups around the time when firms in the treatment group entered the real estate development industry. Time trends are taken out by controlling for year-specific effects.

Figure A.2: The Effects of Entering the Real Estate Sector



Prior to entering the real estate sector, the treatment and control groups have similar trends in R&D intensity, investment rate, and labor productivity. After treatment firms participated in real estate activities, I observed a sharp decline in production in their original manufacturing businesses.

Table B.1 column (2) repeats the OLS analysis using firms that are selected using the nearest-neighbor matching estimator in Abadie and Imbens (2006, 2012). With the real estate entrants matched to similar firms that stayed outside of the real estate sector, the average effect of entry on labor productivity drops from 6.4% to 3.83% and the decline in R&D intensity becomes 0.0106 out of a unit of fixed asset, which is nearly twice as much as the full-sample estimates. The estimate of the coefficient of the investment rate changes the most. The average reduction of the firm-level investment rate is 0.125, as opposed to 0.042 when estimated with the full sample. This is consistent with our previous conjecture; because labor productivity is more relevant to unobserved investment opportunity, the full-sample OLS estimates are likely to be downward biased. The bias in investment estimates depends on whether they are more sensitive to credit constraints or the unobserved labor productivity. Column (3) reports the IV estimates as in Table 6, which are close to the matching-approach estimates.

Table B.1: Real Estate Investment and Manufacturing Productivity, Investment, R&D Expenditures

	OLS Estimates		IV Estimates
	(1)	(2)	(3)
	Full Sample	Matched Sample	Full Sample
	Panel A: Dependent Variable: R&D Intensity		
Post-entry into real estate	-0.0056*	-0.0107**	-0.0119*
	(1.76)	(1.98)	(1.67)
	Panel B: Dependent Variable: Labor Productivity		
Post-entry into real estate	-0.064***	-0.0383*	-0.0398**
	(3.87)	(1.80)	(2.36)
	Panel C: Dependent Variable: Investment Rate		
Post-entry into real estate	-0.042***	-0.1246***	-0.151**
	(7.63)	(2.43)	(2.04)
Number of Observations	58,961	39,000	53,212
Initial Controls * Year FE	YES	YES	YES
Year FE	YES	YES	YES
Firm FE	YES	YES	YES

Notes: This table displays the estimated effects of entering the real estate development industry on manufacturing production using the matching approach. Columns (1) and (2) report the estimates with ordinary least squares, using the full sample and the sample selected by matching firms on observables, respectively. Column (3) reports the estimates using a three-way interaction instrument: local land inelasticity interacts with firm-specific potential connection with the local land bureau and the national house price growth. All two-way interactions are controlled in the regressions. All specifications control for age, local wages, year fixed effects, firm fixed effects, and firm-level initial conditions (exporter dummy, size classified according to employment, two-digit industry, economic region of location and credit rating) interacted with year fixed effects. T-stats are reported in parentheses with standard errors clustered at the firm level.
*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

The Strength of the Instruments

I argue for the strength of the land supply elasticity index in predicting entries into the real estate sector by looking into how it correlates with the movements of land prices and house prices. Column (1) in Table B.2 tests the correlation between residential home price appreciation and the land supply elasticity index. When national house prices appreciate by 100%, a city with 1% lower land supply elasticity would have a 0.78% faster three-year house price growth. The corresponding estimate with

2-year lagged land prices[57] being controlled for is 0.84%, reported in column (2), which indicates that the land supply elasticity index can predict returns in the real estate sector. In addition, as discussed in section 2, most real estate companies are restricted to operating locally except for the less than 2% firms with an A-class license. Therefore, I consider the local real estate market return as a key determinant for manufacturing firms' decision to enter the real estate sector[58].

Table B.2: Land Supply Elasticity and Local Economic Activities

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variables	House Price Growth		GDP per capita Growth	Wage Growth	Employment Growth	Export Intensity
Land Supply Elasticity * 3-Year National House Price Growth	-0.776**	-0.843***	-0.057	-1.544	-0.643	0.009
	(0.440)	(0.313)	(0.604)	(1.961)	(0.546)	(0.011)
Land Price Growth		0.106***				
		(0.038)				
Observations	1,213	808	810	1,285	1,299	1,460
R-squared	0.194	0.425	0.014	0.033	0.035	0.0188
Number of Cities	138	87	125	137	137	146
Year FE	YES	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES	YES

Notes: This table presents evidence that supports the validity of using the land supply elasticity index for IV analysis. Columns (4) - (7) examine whether cities with different land supply elasticities experience significantly different economic activities in the national housing cycle. The local economic conditions are obtained from China city statistical yearbooks (2002-2013). Columns (1) and (2) test whether house prices in cities with lower land supply elasticities grow faster than house prices in other cities. Column (1) uses the average house price from the NBS; column (2) adds average land price as controls. All specifications control for year and city fixed effects. Standard errors are reported in parentheses and are clustered at city level.
*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

I argue that the city land supply elasticity matters more through expected house price appreciation, but not the actual land supplies. First, the licensing records speak more to firms' intention to

[57]Deng, Gyourko, Wu (2015) documents that the average period of housing development is two years and that the construction costs in China remained almost constant during the housing boom.

[58]In data, I also found almost no manufacturing companies starting a real estate firm in other cities.

build and sell residential properties, but not their actual land development projects. In fact, local land supplies are in general constrained. From 2005 to 2015, an average of 6,713 pieces of land were sold per year, but there are a total of 83,913 real estate development companies on average[59]. Assuming a standard development period of two years, more than 80% of the real estate companies could not always have a real estate project in development. Second, SOEs also control a significant part of the land market, so private firms' land acquisition is largely dependent on SOE participation in the real estate sector too.

Table B.3 shows the strength of the land supply elasticity index and the political connection by examining their correlations with local land supply. Columns (1) and (2) report how reservation land value depends on local land supply elasticity and private firms' connections with the local land bureau. On average, a city with 1% higher land supply elasticity has a 0.72% lower reservation land value when normalized by the total land area, or a 0.89% lower reservation land value when normalized by the total floor area. The land reservation value is also positively correlated with the fraction of private companies that have a connection with the local land bureau. The land reservation value declines by 0.13% (normalized by total land area) or 0.4% (normalized by total floor area) when 1% more private firms are politically connected with the local land bureau. Column (3) and (4) present the correlation between the two instruments and the total area supplied on the land market. The total land area and total floor area can be significantly predicted by the local land supply elasticity. A city with 1% more developable land has 0.5% more land supply in terms of the total land area, and 0.55% more land supply in terms of the total floor area. The political connection variable is insignificant in predicting the quantity of land transaction. These results match the institutional features of the Chinese land market. Given that the urban land planning is conducted by an independent committee, the land supply relies more on the geographical constraints rather than the political constraints. On the other hand, the local land bureau is involved in land sales, so both the geographical constraints and the political environment matter for land reservation values.

[59]These numbers are calculated based on the CREIS statistics.

Table B.3: The Instruments and Government Land Supply

Dependent Variables:	(1) Unit Land Area Reservation Price	(2) Unit Floor Area Reservation Price	(3) Total Land Area Supplied	(4) Total Floor Area Supplied
Land Supply Elasticity	-0a .723***	-0.887***	0.499**	0.550***
	(4.00)	(4.84)	(0.04)	(2.90)
Fraction of Firms with	-0.126*	-0.403*	-0.24	-0.284
Potential Connection	(1.65)	(1.77)	(0.98)	(0.12)
Observations	348	344	348	334
R-squared	0.25	0.45	0.39	0.45
Year FE	YES	YES	YES	YES

Notes: This table presents the correlation between local government land supply and the two instruments, land supply elasticity index and the political connection with the local land bureaus. The unit reservation prices are computed by dividing the reservation land value by total land area and total desired floor area, respectively. All prices and quantities are analyzed in log terms. All specifications control for year fixed effects. Standard errors are reported in parentheses and standard errors are clustered at city level.

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

The Exclusion Restrictions

My key identification assumption is that when real estate prices are appreciating, the firms with potential connections to the local land bureau in a city with a more flexible land supply do not necessarily gain more advantage in the manufacturing sector. To test this exclusion restriction, I argue that the two instruments are uncorrelated with local economic trends, so that firms with different exposures to them should not be subject to different aggregate shocks in the real estate business cycle.

The land availability of a city is pre-determined by geographical constraints. Given the large population in China and political considerations, cities are spread relatively evenly across the country[60]. Table B.4 presents the economic activities and spatial distribution of cities in four quartiles of the land supply elasticity measure. The cities in the four quartiles are distributed almost evenly across economic regions and different city-tier divisions, except that the east region has more cities in

[60] Figure A.1 in Appendix A provides an overview of the land supply elasticity index across China. Most cities that are short of land are located on the east coast or in the hilly areas in the west. The coastal region is considered the most economically active in China, while the western region has the least growth potential.

the lowest land supply elasticity category. The average rates of population growth, GDP per capita growth, and employment growth are also very similar in the different quartiles. Columns (3) to (5) in Table B.2 show that the city-level land supply elasticity interacted with national house price growth cannot significantly predict the growth rate of population, wages, and overall employment at the city level[61]. Column (6) estimates the correlation between local export growth (measured as the ratio of the growth in total exports relative to total output) and land supply elasticity times the national house price growth. Controlling for city and industry fixed effects, the foreign demand for local manufacturing firms does not correlate with the instrumented local house price growth. Some inland cities, which are non-export intensive and experience less economic development than their coastal counterparts, also have a relatively inelastic supply of land due to geographical restrictions.

Table B.4: Land Supply Elasticity and Economic Activities, Cont'd

	1st Quartile	2nd Quartile	3rd Quartile	4th Quartile
First Tier	2.7%	2.8%	5.6%	0.0%
Second Tier	24.3%	30.6%	27.8%	13.9%
Third Tier	73.0%	66.7%	66.7%	86.1%
Total	100%	100%	100%	100%
Northeast Region	2.7%	5.6%	8.6%	10.8%
Coastal Region	78.4%	41.7%	34.3%	37.8%
Central Region	16.2%	36.1%	40.0%	35.1%
West Region	2.7%	16.7%	17.1%	16.2%
Total	100%	100%	100%	100%
Population Growth	1.26%	0.57%	1.02%	1.02%
GDP per capita Growth	13.72%	13.94%	14.01%	12.95%
Employment Growth	7.68%	7.04%	6.59%	6.06%

Notes: For this table, I divide cities into four quartiles according to their land supply elasticities and compare the geographical location and the economic activities of the four quartiles. The population, GDP, and employment data are from China city statistical yearbooks from 2002 to 2013.

To show that local land supply elasticity does not correlate with housing demand, so that it does not affect manufacturing demand via a substitution channel, I repeat the analyses in Davidoff (2016) by looking at the correlation between the elasticity index and the quantity growth of newly constructed residential properties. The results in Table B.5 show that a 1% higher land supply elasticity

[61] The local economic variables are computed with both SOEs and private firms in all industries.

is associated with a 6.49-percentage-points increase in the total floor space purchased per year. These estimates stay statistically the same after controlling for local population growth and GDP per capita growth (in columns (2) and (3)), which implies that the land supply elasticity index does not correlate with shifts in the housing demand curve.

Table B.5: Land Supply Elasticity and Quantity Growth

	(1)	(2)	(3)
	The Growth Rate of Total Residential Floor Space		
Land Supply Elasticity	0.0649***	0.0620***	0.0668***
	(0.023)	(0.024)	(0.024)
Population Growth		-0.132	0.279
		(0.408)	(0.418)
GDP per capita Growth		0.16	0.137
		(0.232)	(0.250)
Second Tier			0.124***
			(0.038)
Third Tier			0.118***
			(0.037)
Coastal			-0.0572**
			(0.025)
Middle			-0.0686***
			(0.025)
West			-0.0722**
			(0.028)
Number of Cities	138	138	138
R-squared	0.054	0.059	0.182

Notes: This table reports the correlation between the land supply elasticity of cities and the quantity growth in the housing market. The table replicates Table 6 in Davidoff (2016).
*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

The potential connections between firm executives and local land bureau ministers are arguably exogenous to economic trends by construction. Table B.6 compares the performance of manufacturing firms with and without a potential connection with the local land bureau between 1998-2002. Regardless of city-specific constraints in land supply, firms with and without possible connections were similar in size, productivity, investment rate, profit margin, credit score, and age prior to the real estate boom.

Table B.6: The Validity of Instruments - Local Connection with Land Bureau

	With Potential Connections with Land Bureau			No Potential Connections with Bureau		
	Mean	Median	Std. Dev	Mean	Median	Std. Dev
R&D Intensity	0.006	0.000	0.034	0.007	0.000	0.040
Log (Labor Productivity)	3.53	3.49	1.08litical	3.53	3.48	1.01
Investment Rate	0.042	0.000	0.128	0.039	0.000	0.131
Profit Margin	0.175	0.150	0.150	0.181	0.157	0.183
Total Fixed Assets	20.56	5.22	12.84	22.79	5.91	9.55
Total Asset Value	113.35	20.66	862.46	138.23	27.60	662.64
Employment	732	487	1,126	803	540	1,254
Credit Score	576.37	583	103	578.93	590	108
Age	8.78	7.00	5.88	8.32	7.00	5.27
Fraction of Firms	25.83%			74.17%		

Notes: This table compares the firms with and without a potential connection with the local land bureau in my sample, depending on the value of the PolConnection dummy. The total asset value and the total fixed asset is in millions of Yuan.

Robustness Tests

As a robustness check of the IV specification, I estimate the first stage equation (equation (2)) allowing year-specific responses to the investment opportunity in the real estate market:

$$\begin{aligned} POST_{it} =& \alpha_i + \delta_t + \theta_t \cdot Connection_i \times (-LandElasticity_c) + \kappa_{1t}(1 - LandElasticity_c) \\ &+ \mu_{1t} Connection_i + \sum_k \eta_{kt} X_k^i + controls_{it} + \epsilon_{it} \end{aligned}$$

This specification controls for the heterogeneous effects of entry on a year-to-year basis, which requires no modeling of the aggregate housing cycle. The corresponding second-stage regression is modified as:

$$Y_{it} = \alpha_i + \delta_t + \beta \cdot POST_{it} + \kappa_{2t}(1 - LandElasticity_c) + \mu_{2t}Connection_i + \sum_k \eta_{kt} X_k^i + controls_{it} + \epsilon_{it}$$

In addition to the two linear specifications, I estimate the first stage non-parametrically by including in the second-order fractional polynomials of the two instruments and their interaction termsa . Because adding the polynomial controls is equivalent to imposing multiple instruments, I also conduct the Hausman overidentification test. The outcomes of the robustness checks using nonlinear first-stage controls are reported in Table B.7. Panel A of Table B.7 reports the results of estimating heterogeneous year-specific responses to the real estate investment opportunity. The propensity of manufacturing firms to enter the real estate industry increases over time, except for 2008 when the Chinese economy underwent a severe slowdown. Panel B of Table B.7 reports the results of adding non-parametric controls into the first stage regressions. The estimates are comparable with the baseline IV estimates, and the over-identification tests are not violated (with a p-value of 0.11). In the first stage, only the first- and second-order interaction terms are significant, so that the high-order controls do not impose many differences on the estimates.

Table B.7: Real Estate Investment and Manufacturing Productivity, Investment - Robust Specifications

	(1) First Stage	(2) R&D Intensity	(3) Investment Rate	(4) Log(Labor Productivity)
	Panel A: Heterogeneous Response to Real Estate Investment Opportunity			
Past Local Land Bureau Connection *	0.0263***			
Land Supply Elasticity (2004)	(4.95)			
~ (2005)	0.0287***			
	(5.40)			
~ (2006)	0.0316***			
	(5.94)			
~ (2007)	0.0377***			
	(7.09)			
~ (2008)	0.0309***			
	(5.89)			
~ (2009)	0.0406***			
	(7.72)			
Average Post-entry Effect		-0.048**	-0.179*	-0.0563*
		(2.08)	(1.70)	(1.89)
First-stage F-Value	42.89			
Number of Observations		34,734	34,734	34,734
	Panel B: High-order Polynomial First-stage Specification			
First-stage F-Value	27.34			
Post-entry Dummy		-0.0113**	-0.1104*	-0.0598**
		(1.96)	(1.84)	(2.10)
Hausman Test Statistic	2.49			
Number of Observations		38,598	38,598	38,598
Initial Controls * Year FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES

Notes: This table tests the relationship between entering the real estate development sector and manufacturing production using alternative IV specifications. Panel A instruments for the entry decision with year-specific responses to the real estate investment opportunity. Panel B employs a high-order polynomial (up to the second orders) to estimate the first-stage probability of entry. The F-values of the first stage and the Hausman Test statistic is reported in Column (1). All specifications control for age, local wage, firm fixed effects, year fixed effects, and firm-level initial conditions (exporter dummy, size classified according to employment, two-digit industry, economic region of location, and credit rating) interacted with year fixed effects. T-stats are reported in parentheses with standard errors clustered at the firm level.

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

External Validity

The causal effects estimated using the instrumental variable approach are local average treatment effects (LATE). In a general framework, the relative return on real estate investment and the cost of entry are two key factors determining whether a manufacturing entrepreneur would enter the real estate sector. Therefore, the estimation of average treatment effect would require a random entry assignment that is independent of these two factors. In other words, the LATE estimate of this paper is the effect of entry for firms with a connection with the local land bureau located in cities with constrained land supply. If such relationships appear in land markets with higher return and lower entry cost, the IV specification estimates the causal effect with more weights on these land markets.]

Tests of Alternative Hypotheses

The reduced-from estimates document that entering the real estate market will lead to a slowdown on R&D, investment and labor productivity growth. The empirical findings in this section seem to indicate that a real estate boom leads to the diversion of resources from productive entrepreneurs in the manufacturing sector. These productive entrepreneurs with large capital stocks allocate their capital to real estate development, therefore tightening capital constraints on their manufacturing business. As a result, the investment, R&D and productivity growth in their manufacturing segment experienced a reduction. Before proposing a dynamic framework to assess the inefficiencies associated with such behavior, I would first rule out several alternative hypotheses.

One alternative hypothesis is reverse causality, which is the major threat to my empirical results. It stipulates that manufacturing firms enter the real estate industry because they lack opportunities in the manufacturing industry. More specifically, the future investment opportunities of already productive firms can be limited due to a mean reversion of productivity or these firms reaching to the technological frontier. Their investment activities and productivity growth will slowdown irrespective of their entrance to the real estate market. Despite there being no perfect way to control for unobserved manufacturing investment opportunities, I dealt with the concern of reverse causality using the matching estimators and the instrumental variable estimator. The matching estimators imply that manufacturing firms that entered the real estate industry exhibit declines in investment, R&D and productivity, in comparison with their ex-ante similar comparison firms. The instrumental variable estimators show that, for two firms otherwise similar, the firm located in a city with less elastic land supply and have closer connections with the local land bureaus is more likely to enter the real estate market. The productivity and investment for these firms declines more during the housing boom. I argue that my two instruments, local land supply elasticity and firms' ex-ante potential connections with the local land bureaus, are uncorrelated with aggregate economic shocks. Therefore, firms with different loading on the two instruments are unlikely to be differentially affected by the housing cycle. At the least, if the ex-ante potential connections of local land bureau would have an impact on manufacturing investment opportunities, such impact would by no means be a negative one. In other words, the IV approach estimate a lower bound of the negative impact of entering the real estate sector on the manufacturing companies' production in their original businesses.

A second alternative hypothesis is the bank-lending channel. The bank-lending channel implies that in regions with a booming real estate sector, the manufacturing borrowings could be crowded out by real estate borrowings, so that investment of manufacturing firms would decline. As a result, manufacturing firms in regions with inelastic land supply might have experienced a larger decline in investment. However, this channel will dampen my theory only if the firms entered the real estate sector are more affected than nearby firms that did not enter. Columns (1) - (4) in Table B.8 compare the debt growth of the real estate entrants and others. Both OLS and IV estimates indicate that firms entering the real estate sector had a larger increase in long-term debt (normalized by total fixed asset), in comparison with other firms. These results suggest that the bank-lending channel is less of a concern for my empirical analysis.

Table B.8: Testing the Alternative Hypotheses - the Bank Lending Channel

	Long Term Debt-to-asset Ratio			
	OLS		IV	
	(1)	(2)	(3)	(4)
Post-entry Dummy	0.033***	0.015	0.110*	0.090
	(2.42)	(1.10)	(1.69)	(0.80)
Lagged Debt-to-asset	0.230	0.211	0.284	-0.390
	(1.13)	(1.04)	(0.78)	(0.45)
Number of Firms	19,896	19,893	17,830	17,830
Year FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
2-digit Industry * Year FE	NO	YES	NO	YES
Region * Year FE	NO	YES	NO	YES

Notes: This table presents evidence that rules out the effect of local equilibrium feedback on manufacturing production. Column (1) - (4) provide evidence against the bank-lending channel, i.e. the decline in manufacturing innovation results from a decline in bank lending to the manufacturing industry. My estimates show that long-term debt-to-asset ratio does not decline after a manufacturing firm entered into real estate. Columns (5) - (8) show that employment at original establishments does not decline after a manufacturing firm entered into real estate. All specifications controlled for year and city fixed effects. Standard errors in parentheses are clustered at city level.
*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

Last but not least, I rule out the alternative hypothesis of decreasing return to scale. One may suspect that larger firms are more likely to invest in the real estate market as they suffer more from decreasing return to scale in their manufacturing businesses. I argue that decreasing return to scale could not solely explain my findings from the following two aspects: firstly, the firms that entered the real estate development industry on average have a higher investment rate, a higher R&D intensity, and also a higher profit-to-sales ratio than firms that did not. It is difficult to argue that firms with higher investment rates and R&D intensities are the ones reaching their optimal scales rather than firms with lower investment rates. Secondly, I look at the external investment of manufacturing firms using the Enterprise Registration Database. This data set records the shareholders of all registered firms in China, which can be transformed into firm-level investment portfolio. Burnstein (2015) argues that a more mature company is more likely to involve in mergers and acquisitions rather than internal investment activities. By this standard, we should observe firms which entered the real estate development industry by investing more in other companies, in order to argue that these firms are reaching beyond their optimal operating scales. I do not find such evidence from the Enterprise

Registration Database. Table B.9 presents results from regressing the total external investment expenditure of each company on whether or not they entered the real estate industry. The estimates show that companies involved in real estate development do not spend more capital on external investment activities. Therefore, the decreasing return to scale should not be an explanation for my empirical findings.

Table B.9: Testing the Alternative Hypotheses - Decreasing Return to Scale

	(1)	(2)
Dependent Variables:	Total External Investment	External Investment Rate
Entrants in the Real Estate	-2.889	-0.0415
Development Industry	(0.82)	(1.01)
Net Debt Issuance	0.475	0.003
	(1.61)	(1.49)
Credit Score	9.52*	0.314
	(1.65)	(1.39)
Observations	94,109	94,438
R-squared	0.0212	0.002
Size FE	YES	YES
Region FE	YES	YES

Notes: This table presents the evidence that rules out the decreasing return to scale hypotheses by looking at the external investment of manufacturing firms. The total external investment is measured as the total capital investment in other companies from the Enterprise Registration Database. The investment share is the external investment normalized by the lagged book value of total fixed assets. All specifications controlled for firm size and region fixed effects. Standard errors in parentheses are clustered at firm level.

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

The Empirical Bayes Approach

The estimation of manufacturing talent inevitably generates measurement errors, which induces an attenuation bias in step 3 in Section 4.1. This bias is largely alleviated when I estimate the group average manufacturing talent. In addition, I also apply an empirical Bayes approach to further correct for the attenuation bias. The group-specific talent, $\bar{z}_g^M$, is assumed to be drawn from a higher-level distribution:

$$\bar{z}_g^M \sim G_0(z_0, \sigma_0^2),$$

where z_0 and σ_0^2 are the mean and variance of the higher-level distribution. The estimated group-specific talent, $\hat{\alpha_g}$, then follows a lower-level distribution that is centered around $\bar{z}_g^M$:

$$\hat{\alpha_g} \sim G_1(\bar{z}_g^M, \sigma_1^2),$$

where σ_1^2 represents the measurement error. The empirical Bayes estimate of $\bar{z}_g^M$ is thus:

$$\hat{\bar{z}}_g^M = \frac{\hat{\sigma_1^2}}{\hat{\sigma_0^2} + \hat{\sigma_1^2}} \hat{z}_0 + \frac{\hat{\sigma_0^2}}{\hat{\sigma_0^2} + \hat{\sigma_1^2}} \hat{\alpha_g},$$

where $\hat{z}_0$ is estimated as the constant $\hat{\alpha_0}$ from regression (ref1); $\hat{\sigma_0^2} + \hat{\sigma_1^2}$ is estimated as the variance of $\hat{\alpha}_g$, and $\hat{\sigma_1^2}$ is estimated as the average within-group variance of each $\hat{\alpha_g}$.]

Appendix C: Model Discussions and Proofs

Discussions of additional assumptions

In section 4.1.1, I discuss the theoretical framework which assumes a constant-returns-to-scale production function in both the manufacturing and the housing sector. For each entrepreneur, the marginal ROA is independent from her total capital input. As a result, entrepreneurs will specialize either in the manufacturing sector or in the housing sector, except for the knife-edge case when an entrepreneur has the same marginal ROA in both sectors. In the empirical analysis in section 3, I argue that decreasing returns to scale is less likely to be the reason for more productive manufacturing firms to enter the real estate industry. The entrants do not have a declining internal investment rate or a significantly larger external investment rate. Besides, it is not intuitive to discuss the entrepreneurial talent allocation with a decreasing-returns-to-scale production function. Buera, Kaboski, and Shin (2012) relax the assumption of constant returns to scale, but they impose an additional assumption of a unique occupation for each entrepreneur. Therefore, I argue that the assumption of constant returns to scale provides a tractable framework to discuss the allocation of entrepreneurial talent without violating the empirical findings.

In addition, I do not model a per-period fixed cost in the manufacturing sector. This is not to propose that establishing a factory is less costly than building new homes. Instead, this assumption is motivated by the large differences in the value and depreciation rate of residential land and industrial land. The unit price of residential land is typically 7-10 times larger than the unit price of industrial land; as of 2012, the average fixed capital depreciation rate in the real estate sector is 50.04%, as opposed to the 12.68% capital depreciation rate in the manufacturing sector[62]. Once new houses are developed and sold to households, the real estate developers cannot re-use the land to build more houses, nor collateralize against their residential land holdings to build additional investments.In the context of China, the minimum land requirement together with the imperfect financial market creates an entry barrier in the real estate sector, which arises because of the scarcity of land. In a growing economy, the cost of land use increases with total output. Therefore, industries using inflexible land as an input face a larger entry barrier compared to industries that use a flexible input (capital). Besides, for existing private businesses in the manufacturing sector, the price of residential land way exceeded the rents of industrial land in the recent boom in China. Therefore, I consider these private manufacturing firms as facing a capital entry barrier when moving to the real estate sector.

Last but not least, in the theoretical framework I shut down the entry and exit of private firms.

[62] The statistics are from the 2012 China Input-Output Table of 122 3-digit industries.

The rest of the competitive equilibrium

In the first period, the private business owner with talent z^M makes decisions on consumption and savings in order to maximize her total expected utility in the two periods:

$$\begin{aligned} \max_{a_1(z^M)} U^1(z^M) &= \log c_1(z^M) + \beta \log c_2(z^M) \\ s.t.\ c_1(z^M) + a_1(z^M) &\leq \Gamma(\lambda, w_1, R_1, \exp(z^M)) \cdot a_0 \quad (17) \\ c_2(z^M) &\leq \Gamma(\lambda, \bar{w}_2, \bar{R}_2, \exp(z^M)) \cdot a_1(z^M), \quad (18) \end{aligned}$$

where w_1 and R_1 are the real wage and cost of capital in the first period, respectively; $\bar{w}_2$ and $\bar{R}_2$ are under the expectation of no privatization in the real estate sector in period 2. These prices are not realized, but they matter for investment decisions in the first period. The two budget constraints (17) and (18) are obtained by solving the profit-maximizing problem of private business owner z^M.

The worker's problem The representative worker in the economy has an endowment of e_0 in the beginning of period 1. Like the business owners, the representative worker consumes only the manufacturing goods in the first period without expecting the housing privatization in the second period. Therefore, the savings of the representative worker are determined by her utility maximization problem:

$$\begin{aligned} \max_{c_1^L, a_1^L} \quad & \log c_1^L + \beta \log c_2^L \\ s.t. \quad & c_1^L + a_1^L \leq R_1 e_0 + w_1 L \\ & c_2^L \leq \bar{R}_2 a_1^L + \bar{w}_2 L \end{aligned}$$

Again, $(\bar{w}_2, \bar{R}_2)$ are under the expectation of no privatization in the real estate sector. In the second period, the workers spend a $1-\sigma$ fraction of their total income from labor compensation and savings to purchase housing, and a σ fraction on purchasing manufacturing goods.

The competitive equilibrium The competitive equilibrium in this economy can be characterized with prices $\{w_1, R_1, w_2, R_2, p^H, q\}$ such that the following conditions are satisfied:

1. Given prices $\{w_1, R_1, w_2, R_2, p^H, q\}$, private business owners optimize on savings in the first period, factor inputs in the second period, and consumption of housing and manufacturing goods in the second period to maximize their total utility.

2. Given prices $\{w_1, R_1, w_2, R_2, p^H, q\}$, the representative worker optimizes on savings in the first period and consumption of housing and manufacturing goods in the second period to maximize her total utility.

3. The labor market clears in the both periods, such that the total labor input in the economy is equal to L.

4. The capital market clears in both periods. Savers in the capital market include workers and business owners whose return on capital from production are lower than R_t; borrowers in the capital market are private business owners whose return on capital from production are higher than R_t.

5. The land market clears in the second period. The total land used in production in the housing sector is equal to the exogenous land supply S.

6. The housing market clears in the second period. The total supply of housing is equal to the total housing demand of business owners and workers.

Proof of Lemma 1:The entrepreneur with talent z^M solves for the following utility-maximizing problem in the first period:

$$\begin{aligned} \max_{a_1(z^M)} U^1(z^M) &= \log c_1(z^M) + \beta \log c_2(z^M) \\ s.t.\ c_1(z^M) + a_1(z^M) &\le \Gamma(\lambda, w_1, R_1, \exp(z^M)) \cdot a_0 \qquad (19) \\ c_2(z^M) &\le \Gamma(\lambda, w_2, R_2, \exp(z^M)) \cdot a_1(z^M) \qquad (20) \end{aligned}$$

The first-order condition satisfies:

$$\begin{aligned} \frac{1}{c_1(z^M)} &= \frac{\beta\Gamma(\lambda, w_2, R_2, \exp(z^M))}{\Gamma(\lambda, w_2, R_2, \exp(z^M))a_1(z^M)} \\ &= \frac{\beta\Gamma(\lambda, w_2, R_2, \exp(z^M))}{\Gamma(\lambda, w_2, R_2, \exp(z^M))a_1(z^M)} = \frac{\beta}{a_1(z^M)} \end{aligned}$$

Therefore, we solve for $a_1(z^M)$ as:

$$a_1(z^M) = \frac{\beta}{1+\beta}\Gamma(\lambda, w_1, R_1, \exp(z^M)) \cdot a_0$$

Given that $\Gamma(\lambda, w_1, R_1, \exp(z^M))$ is non-decreasing in z^M, $a_1(z^M)$ is non-decreasing in z^M.

Proof of Proposition 1:

The competitive equilibrium in the second period is characterized by price $\{w_2, p^h, q, R_2\}$ such that each entrepreneur z maximizes its total consumption:

$$\begin{aligned} \max_{k(z^M), s(z^M), l_M(z^M), l_H(z^M)} \quad & [\exp(z^M)k(z^M)]^{\alpha^M} l_M(z^M)^{1-\alpha^M} + p^H[\exp(z^H)s(z^M)]^{\alpha^H} l_H(z^M)^{1-\alpha} \\ & -w_2[l_M(z^M) + l_H(z^M)] - R_2[k(z^M) + qs(z^M) - a_1(z^M)] \\ s.t. \quad & k(z^M) + qs(z^M) \leq \lambda a_1(z^M) \qquad (\eta(z^M)) \\ & s(z^M) \cdot [s(z^M) - \underline{s}] \geq 0 \qquad (\delta(z^M)) \end{aligned}$$

where $\eta(z^M)$, $\delta(z^M)$ are the Lagrangian multipliers for the two constraints.
The first-order conditions of entrepreneur z^M's problem are:

$$(1-\alpha^M)[\frac{\exp(z^M)k(z^M)}{l_M(z^M)}]^{\alpha^M} = w_2 \tag{21}$$

$$(1-\alpha^H)p^h[\frac{\exp(z^H)s(z^M)}{l_H(z^M)}]^{\alpha^H} = w_2 \tag{22}$$

$$\alpha^M \exp(\alpha^M z^M)[\frac{l_M(z^M)}{k(z^M)}]^{1-\alpha^M} - R_2 = \eta(z^M) \tag{23}$$

$$\alpha^H p^h \exp(\alpha^H z^H)[\frac{s(z^M)}{l_H(z^M)}]^{1-\alpha^H} - qR_2 - (2s(z^M) - \underline{s})\delta(z^M) = q\eta(z^M) \tag{24}$$

Combining with equation (21) and (22), equation (23) and (24) can be written as:

$$\begin{aligned} \alpha^M \exp(z^M)(\frac{1-\alpha^M}{w_2})^{\frac{1-\alpha^M}{\alpha^M}} - R_2 &= \eta(z^M) \\ \alpha^H p^h \exp(z^H)(\frac{1-\alpha^H}{w_2})^{\frac{1-\alpha^H}{\alpha^H}} - qR_2 - (2s(z^M) - \underline{s})\delta(z^M) &= q\eta(z^M) \end{aligned}$$

$\eta(z^M)$, $\delta(z^M)$ in equilibrium indicate the marginal return to capital and the marginal return to land of entrepreneur z^M, respectively. Therefore, $\eta(z^M)$ is increasing in z^M. Although without the exact functional form of $a_1(\cdot)$, the closed-form of this new equation is not available, we can still prove the uniqueness of the equilibrium and derive policy implications. We discuss the solution to the competitive equilibrium in the two cases, $b > 1$ and $b < 1$. Recall that b governs the relationship between the comparative advantage in housing, $z^H - z^M$, and the absolute advantage in manufacturing z^M.

In the case of $b < 1$, when the representative worker's endowment is large so that all entrepreneurs produce in the first period, there are three cutoffs $\underline{z}^M$, z_l^M *and* z_h^M. $\delta(z^M) > 0$ for all $z \leq z_l^M$, so that:

$$\lambda a_1(z_l^M) = q\underline{s} \tag{25}$$

Two free entry conditions determine the other two cutoffs $\underline{z}^M$, z_h^M:

$$\begin{aligned} \alpha^M \exp(\underline{z}^M)(\frac{1-\alpha^M}{w_2})^{\frac{1-\alpha^M}{\alpha^M}} &= R & (26) \\ \alpha^M \exp(z_h^M)(\frac{1-\alpha^M}{w_2})^{\frac{1-\alpha^M}{\alpha^M}} &= \alpha^H \exp(z_h^H)\frac{p^H}{q}(\frac{p^H(1-\alpha^H)}{w_2})^{\frac{1-\alpha^H}{\alpha^H}} & (27) \end{aligned}$$

$\underline{z}^M$ is the entrepreneur indifferent from saving and producing, and z_h^M is the entrepreneur indifferent from producing in the real estate sector and producing in the manufacturing sector.

The land market clearing condition implies that:

$$\lambda \int_{z_l^M}^{z_h^M} a_1(z^M)dF(z^M) = qS \tag{28}$$

Combining equation (25) and (28), the least talented entrepreneur and the most talented entrepreneur in the real estate sector follow:

$$\frac{\underline{s}}{S}\int_{z_l^M}^{z_h^M} a_1(z^M)dF(z^M) = a_1(z_l^M) \tag{29}$$

The capital market clearing condition implies that all capital used for manufacturing production should be the same as the total wealth of the economy. So that:

$$\begin{aligned} \lambda[\int_{\underline{z}^M}^{z_l^M} a_1(z^M)dF(z^M) + \int_{z_h^M}^{1} a_1(z^M)dF(z^M)] &= \int_0^1 a_1(z^M)dF(z^M) + a_1^L \\ \Rightarrow \lambda[\int_{\underline{z}^M}^{1} a_1(z^M)dF(z^M) - \int_{z_l^M}^{z_h^M} a_1(z^M)dF(z^M)] &= \int_0^1 a_1(z^M)dF(z^M) + a_1^L \\ \Rightarrow \lambda[\int_{\underline{z}^M}^{1} a_1(z^M)dF(z^M) - \frac{S}{\underline{s}}a_1(z_l^M)] &= \int_0^1 a_1(z^M)dF(z^M) + a_1^L & (30) \end{aligned}$$

Since the left hand side of the equation is increasing in both $\underline{z}^M$ and z_l^M, (30) indicates that z_l^M is decreasing in $\underline{z}^M$.

The housing market clearing condition imply that

$$
\begin{aligned}
p^h H &= \frac{\sigma}{1-\sigma} C \\
\Rightarrow w_2 L &= (1-\alpha^M)Y + (1-\alpha^H)p^H H = (1-\alpha^M + (1-\alpha^H)\frac{\sigma}{1-\sigma})C
\end{aligned}
$$

Where ρ is the housing consumption share of workers. Therefore, we can re-write the prices w and p^h as functions of manufacturing output Y and housing output H:

$$
p^H = \frac{\sigma}{1-\sigma} \cdot \frac{C}{H} \tag{31}
$$

$$
w_2 = (1-\alpha^M + (1-\alpha^H)\frac{\sigma}{1-\sigma}) \cdot \frac{C}{L} \tag{32}
$$

The free-entry condition of equation (27) can then be written as:

$$
\begin{aligned}
\alpha^M \exp(z_h^M)(\frac{1-\alpha^M}{w_2})^{\frac{1-\alpha^M}{\alpha^M}} &= \alpha^H \exp(c + b z_h^M)\frac{p^H}{q}(\frac{p^H(1-\alpha^H)}{w_2})^{\frac{1-\alpha^H}{\alpha^H}} \\
&= \alpha^H \exp(c + b z_h^M)\frac{1}{q} \cdot \frac{\sigma}{1-\sigma} \cdot \frac{Y}{H}(\frac{p^H(1-\alpha^H)}{w_2})^{\frac{1-\alpha^H}{\alpha^H}}
\end{aligned}
$$

Re-writing the total output in manufacturing and housing sector, we get:

$$
\begin{aligned}
C &= \int_{[\underline{z}^M, z_l^M) \cup (z_h^M, 1]} \exp(z^M)(\frac{1-\alpha^M}{w_2})^{\frac{1-\alpha^M}{\alpha^M}} k_1(z^M) dF(z^M) \\
\Rightarrow C \cdot (\frac{w_2}{1-\alpha^M})^{\frac{1-\alpha^M}{\alpha^M}} &= \lambda \int_{[\underline{z}^M, z_l^M) \cup (z_h^M, 1]} \exp(z^M) a_1(z^M) dF(z^M)
\end{aligned} \tag{33}
$$

$$
\begin{aligned}
p^H H &= \int_{z_l^M}^{z_h^M} \exp(c + b z_h^M) p^H (\frac{p^H(1-\alpha^H)}{w_2})^{\frac{1-\alpha^H}{\alpha^H}} s(z) dF(z) \\
\Rightarrow qH \cdot (\frac{w_2}{p^H(1-\alpha^H)})^{\frac{1-\alpha^H}{\alpha^H}} &= \lambda \int_{z_l^M}^{z_h^M} \exp(c + b z^M) a_1(z^M) dF(z^M)
\end{aligned} \tag{34}
$$

Plugging the two equations back to (27), we can further derive the free entry condition as:

$$
\begin{aligned}
\frac{1-\sigma}{\sigma}\cdot\frac{\alpha^M\exp(z_h^M)}{\lambda\int_{[\underline{z}^M,z_l^M)\cup(z_h^M,1]}\exp(z^M)a_1(z^M)dF(z^M)} &= \frac{\alpha^H\exp(c+bz_h^M)}{\lambda\int_{z_l^M}^{z_h^M}\exp(c+bz^M)a_1(z^M)dF(z^M)} \\
\int_{z_l^M}^{z_h^M}[\frac{1-\sigma}{\sigma}\cdot\frac{\alpha^M}{\alpha^H}\cdot e^{(1-b)z_h^M}\exp(bz^M)+\exp(z^M)]a_1(z^M)dF(z^M) &= \int_{\underline{z}^M}^{1}\exp(z^M)a_1(z^M)dF(z^M) \qquad (35)
\end{aligned}
$$

Recall that equation (29) specifies z_h^M as a function of z_l^M:

$$
\frac{s}{S}\int_{z_l^M}^{z_h^M}a_1(z^M)dF(z^M)=a_1(z_l^M)
$$

From the above equation above, it's easy to see that z_h^M is increasing in z_l^M. In addition, using the Implicit Function Theorem, we can calculate the derivative of $\partial z_h^M/\partial z_l^M$:

$$
\begin{aligned}
\frac{\partial z_h^M}{\partial z_l^M} &= -\frac{\partial I_1/\partial z_l^M}{\partial I_1/\partial z_h^M} \\
&= \frac{a_1(z_l^M)f(z_l^M)+\frac{S}{s}a_1'(z_l^M)}{a_1(z_h^M)f(z_h^M)}
\end{aligned}
$$

where $I_1=\frac{s}{S}\int_{z_l^M}^{z_h^M}a_1(z^M)dF(z^M)-a_1(z_l^M)=0$ is the corresponding implicit function. Plugging the above relationship between z_h^M and z_l^M into equation (35), we can derive another equation between $\underline{z}^M$ and z_l^M. Writing the implicit function between $\underline{z}^M$ and z_l^M as:

$$
\begin{aligned}
I_2 &= \int_{z_l^M}^{z_h^M}[\frac{1-\sigma}{\sigma}\cdot\frac{\alpha^M}{\alpha^H}\cdot e^{(1-b)z_h^M}\exp(bz^M)+\exp(z^M)]a_1(z^M)dF(z^M)-\int_{\underline{z}^M}^{1}\exp(z^M)a_1(z^M)dF(z^M) \\
&\equiv \int_{z_l^M}^{z_h^M}[\chi\cdot\frac{\alpha^M}{\alpha^H}\cdot e^{(1-b)z_h^M}\exp(bz^M)+\exp(z^M)]a_1(z^M)dF(z^M)-\int_{\underline{z}^M}^{1}\exp(z^M)a_1(z^M)dF(z^M)
\end{aligned}
$$

The derivative of $\partial z_l^M/\partial \underline{z}^M$ can be obtained using again the Implicit Function Theorem:

$$
\begin{aligned}
\frac{\partial z_l^M}{\partial \underline{z}^M} &= -\frac{\partial I_2/\partial \underline{z}^M}{\partial I_2/\partial z_l^M} \\
&= -\frac{\exp(\underline{z}^M)a_1(\underline{z}^M)f(\underline{z}^M)}{\frac{\partial I_2}{\partial z_h^M}\cdot\frac{\partial z_h^M}{\partial z_l^M}+\frac{\partial I_2}{\partial z_l^M}}
\end{aligned}
$$

The denominator of this equation can be expressed as:

$$\begin{aligned}
\frac{\partial I_2}{\partial z_h^M}\cdot\frac{\partial z_h^M}{\partial z_l^M}+\frac{\partial I_2}{\partial z_l^M} &= [\chi\frac{\alpha^M}{\alpha^H}\cdot(1-b)\int_{z_l^M}^{z_h^M}\exp(bz^M)a_1(z^M)dF(z^M)+(\chi\frac{\alpha^M}{\alpha^H}+1)\exp(z_h^M)a_1(z_h^M)f(z_h^M)]\cdot\frac{\partial z_h^M}{\partial z_l^M} \\
&\quad -\chi\frac{\alpha^M}{\alpha^H}e^{(1-b)z_h^M+bz_l^M}a_1(z_l^M)f(z_l^M)-\exp(z_l^M)a_1(z_h^M)f(z_h^M) \\
&= \chi\frac{\alpha^M}{\alpha^H}\cdot(1-b)\int_{z_l^M}^{z_h^M}\exp(bz^M)a_1(z^M)dF(z^M)\frac{\partial z_h^M}{\partial z_l^M}+(\chi\frac{\alpha^M}{\alpha^H}+1)\exp(z_h^M)[a(z_l^M)f(z_l^M)+\frac{S}{\underline{s}}a_1'(z_l^M)] \\
&\quad -\chi\frac{\alpha^M}{\alpha^H}e^{(1-b)z_h^M+bz_l^M}a_1(z_l^M)f(z_l^M)-\exp(z_l^M)a_1(z_h^M)f(z_h^M) \\
&> \chi\frac{\alpha^M}{\alpha^H}\cdot(1-b)\int_{z_l^M}^{z_h^M}\exp(bz^M)a_1(z^M)dF(z^M)\frac{\partial z_h^M}{\partial z_l^M}+\exp(z_h^M)\frac{S}{\underline{s}}a_1'(z_l^M)>0
\end{aligned}$$

The last inequality utilizes the assumption that $z_h^M > z_l^M > \underline{z}^M$. Given the last line is strictly higher than 0, equation (35) specifies also z_l^M as decreasing in $\underline{z}^M$.

Next we show that upon the existence of an competitive equilibrium, the equilibrium must be unique. From equation (30),

$$\lambda[\int_{\underline{z}^M}^1 a_1(z^M)dF(z^M)-\frac{S}{\underline{s}}a_1(z_l^M)]=\int_0^1 a_1(z^M)dF(z^M)+a_1^L$$

By the Implicit Function Theorem,

$$\frac{\partial z_l^M}{\partial \underline{z}^M}=-\frac{a_1(\underline{z}^M)f(\underline{z}^M)}{\frac{S}{\underline{s}}a_1'(z_l^M)} \tag{36}$$

The slope is strictly increasing in $\underline{z}^M$ and decreasing in z_l^M.

For a given $(z_l^M,\underline{z}^M)$, the slope $\frac{\partial z_l^M}{\partial \underline{z}^M}$ from equation (35) can be computed as:

$$\begin{aligned}
\frac{\partial z_l^M}{\partial \underline{z}^M} &= -\frac{\exp(\underline{z}^M)a(\underline{z}^{cp})f(\underline{z}^{cp})}{\frac{\partial I_2}{\partial z_h^M}\cdot\frac{\partial z_h^M}{\partial z_l^M}+\frac{\partial I_2}{\partial z_l^M}} \\
&> -\frac{\exp(\underline{z}^M)a(\underline{z}^{cp})f(\underline{z}^{cp})}{\exp(z_h^M)\frac{S}{\underline{s}}a_1'(z_l^M)} > -\frac{a_1(\underline{z}^M)f(\underline{z}^M)}{\frac{S}{\underline{s}}a_1'(z_l^M)}
\end{aligned}$$

Therefore, z_l^M as a function of $\underline{z}^M$ specified from (30) is strictly flatter than the function specified from (35), which guarantees the uniqueness of the equilibrium upon existence.

The rest of the equilibrium can be solved as follows:

- The third cutoff z_l^M can be solved by plugging in z_h^M into equation (29).

- The land price q is determined by the land market clearing condition: $\lambda \int_{z_l^M}^{z_h^M} a_1(\underline{z}^M) dF(\underline{z}^M) = qS$
- The equilibrium wage w_2 and output Y are jointly determined by (32) and (33)
- The equilibrium interest rate R_2 is pinned down by equation (26)
- The equilibrium house price p^H and housing output H are jointly determined by (31) and (34).

Definition of Comparative Advantage:

The comparative advantage of an entrepreneur is defined as the ratio of the marginal returns on capital in the two sectors. With a monotonic transformation, it is equivalent to $z^H - z^M$.

*Proof:*The comparative advantage is defined through solving the planner's problem without the constraint at the extensive margin. Among the two firm-level constraints in production, the minimum operating scale constraint creates frictions at the extensive margin. Therefore, no matter $b > 1$ or $b < 1$, the solution to the planner's problem can be characterized with two thresholds. One is determined by the free-entry condition in producing, and the other is determined by the free-entry condition in switching between the real estate sector and the manufacturing sector. Here we walk though the case when $b > 1$, the proof to the other case follows the same logic.

When $b > 1$, there are two cutoffs that characterize the private-firm owners' business choices: $\underline{z}^M$ decides if an entrepreneur produces or saves in the capital market; z_h^M decides if an entrepreneur operates in the real estate sector or in the manufacturing sector. The planner's problem without the minimum operating scale constraint can be written as:

$$\max_{\{\underline{z}^M, z_h^M, l(z^M), k(z^M), s(z^M)\}} \quad \chi \log C + \log H$$

$$s.t. \quad C = \int_{\underline{z}^M}^{z_h^M} [e^{z^M} k(z^M)]^{\alpha^M} l(z^M)^{1-\alpha^M} dF(z^M)$$

$$H = \int_{z_h^M}^{1} [e^{z^H} s(z^M)]^{\alpha^H} l(z^M)^{1-\alpha^H} dF(z^M)$$

$$\int_{\underline{z}^M}^{z_h^M} k(z^M) dF(z^M) = \int_0^1 a_1(z^M) dF(z^M) + a_1^L \quad (\mu_k) \tag{37}$$

$$\int_{\underline{z}^M}^{1} l(z^M) dF(z^M) = L \quad (\mu_l) \tag{38}$$

$$\int_{z_h^M}^{1} s(z^M) dF(z^M) = S \quad (\mu_s) \tag{39}$$

The μ's in the parenthesis are the Lagrangian multipliers for the three factor market clearing conditions. The first-order condition with respect to z_h^M implies that:

$$\frac{\chi}{C}[\exp(z_h^M)k(z_h^M)]^{\alpha^M}l(z_h^M)^{1-\alpha^M} - \frac{1}{H}[\exp(z_h^M)s(z_h^M)]^{\alpha^H}l(z_h^M)^{1-\alpha^H} + \mu_k k(z_h^M) - \mu_s s(z_h^M) = 0$$

It is easy to show[63] that $[\exp(z_h^M)k(z_h^M)]^{\alpha^M}l(z_h^M)^{1-\alpha^M}$, $k(z_h^M) \propto \exp(z_h^M)a_1(z_h^M)$ and that $[\exp(z_h^M)s(z_h^M)]^{\alpha^H}l(z_h^M)^{1-\alpha^H}$, $\exp(z_h^H)a_1(z_h^M)$. Therefore, the above equation can be re-written ad:

$$const_1 \exp z_h^M - const_2 \exp z_h^H = 0$$

where $const_1$, $const_2$ are three constant numbers that depend on the exogenous parameters and the Lagrangian multipliers.

The social planner allocate entrepreneurs into different sectors according to the difference between $const_1 \exp z_h^M$ and $const_2 \exp z_h^H$. When $const_1 \exp z^M - const_2 \exp z^H > 0$, the entrepreneur z^M is allocated to the manufacturing sector; when $const_1 \exp z^M - const_2 \exp z^H < 0$, the entrepreneur z^M is allocated to the real estate sector.

$$\begin{aligned} const_1 \exp z^M - const_2 \exp z^H &< 0 \\ \Leftrightarrow const_1 \exp z^M &< const_2 \exp z^H \\ \Leftrightarrow \exp(z^H - z^M) &> const_1/const_2 \end{aligned}$$

With a monotonic transformation, we define an entrepreneur's comparative advantage in the real estate sector as:

$$z^H - z^M$$

Proof of Proposition 2:

In proving Proposition 2, we discuss the two scenarios that specify different correlation between business-owner comparative advantage and absolute advantage.

The social planner assign inputs (labor, land, capital) to private business owners to maximize a weighted average of their utilities and the workers' utilities:

$$\max_{k(z^M),l(z^M),s(z^M)} \chi \log C + \log H$$

Solving for the planner's problem is equivalent to solve for the allocation of entrepreneurs. From

[63] The detailed derivation can be found in the proof of Proposition 1.

the competitive equilibrium, we know that there exits three cutoffs: $\underline{z}^M$, z_l^M, z_h^M. $\underline{z}^M$is the threshold where entrepreneurs are indifferent from saving or producing; z_l^M is the threshold where the entrepreneurs are unconstrained from entering the real estate sector; z_h^M is the threshold such that entrepreneurs are indifferent from producing in the housing and the real estate sector. As a result, the planner's problem can be written as:

$$\max_{\{\underline{z}^M, z_l^M, z_h^M, l(z^M)\}} \quad \chi \log C + \log H$$

$$s.t. \quad Y = \int_{[\underline{z}^M, z_l^M) \bigcup (z_h^M, 1]} [\exp(z^M) k(z^M)]^{\alpha^M} l(z^M)^{1-\alpha^M} dF(z^M) \tag{40}$$

$$H = \int_{z_l^M}^{z_h^M} [\exp(c + bz^M) s(z^M)]^{\alpha^H} l(z^M)^{1-\alpha^H} dF(z^M) \tag{41}$$

$$\lambda\left(\int_{[\underline{z}^M, z_l^M) \bigcup (z_h^M, 1]} a_1(z^M) dF(z^M)\right) \leq \int_0^1 a_1(z^M) dF(z^M) + a_1^L \quad (\mu_k) \tag{42}$$

$$\lambda a_1(z_l^M) \geq \frac{\lambda \int_{z_l^M}^{z_h^M} a_1(z^M) dF(z^M)}{S} \underline{s} \quad (\mu_e) \tag{43}$$

$$\int_{\underline{z}^M}^1 l(z^M) dF(z^M) = L \quad (\mu_l) \tag{44}$$

Given the imperfect financial market, each entrepreneur participating in production would exhaust its borrowing capacity:

$$\begin{aligned} k(z^M) = & \quad \lambda a_1(z^M) & \forall z^M \in [\underline{z}^M, z_l^M) \bigcup (z_h^M, 1] \\ s(z^M) = & \quad \frac{\lambda a_1(z^M)}{\lambda \int_{z_l^M}^{z_h^M} a_1(z^M) dF(z^M)} S & \forall z^M \in [z_l^M, z_h^M] \end{aligned}$$

The Lagrangian equation of the planner's problem can be written as:

$$\begin{aligned} \mathcal{L} \quad = \quad & \chi \log C + \log H - \mu_k\left(\int_0^1 a_1(z^M) dF(z^M) + a_1^L - \lambda\left(\int_{[\underline{z}^M, z_l^M) \bigcup (z_h^M, 1]} a_1(z^M) dF(z^M)\right)\right) \\ & + \mu_e\left(\lambda a(z_l^M) - \frac{\lambda \int_{z_l^M}^{z_h^M} a_1(z^M) dF(z^M)}{S} \underline{s}\right) + \mu_l\left(L - \int_{\underline{z}^M}^1 l(z^M) dF(z^M)\right) \end{aligned}$$

The first-order conditions of the planner's problem are:

$$\frac{\partial \mathcal{L}}{\partial \underline{z}^M} = -\frac{\chi}{C}(\lambda \exp(\underline{z}^M)a_1(\underline{z}^M))^{\alpha^M} l(\underline{z}^M)^{1-\alpha^M} - \mu_k \lambda a_1(\underline{z}^M) + \mu_l l(\underline{z}^M) = 0$$

$$\frac{\partial \mathcal{L}}{\partial z_l^M} = \frac{\chi}{C}(\lambda \exp(z_l^M)a_1(z_l^M))^{\alpha^M} l(z_l^M)^{1-\alpha^M} - \frac{1}{H}(\frac{\exp(c+dz_l^M)a_1(z_l^M)S}{\int_{z_l^M}^{z_h^M} a_1(z^M)dF(z^M)})^{\alpha^H} l(z_l^M)^{1-\alpha^H} - \mu_k \lambda a_1(z_l^M)$$

$$+\mu_e \lambda a_1'(z_l^M) + \underbrace{\frac{(1-\chi)\alpha^H}{\int_{z_l^M}^{z_h^M} a_1(z^M)dF(z^M)} a_1(z_l^M) + \mu_e \lambda a_1(z_l^M)\frac{s}{S}}_{\text{general equilibrium feedback}} = 0$$

$$\frac{\partial \mathcal{L}}{\partial z_h^M} = -\frac{\chi}{C}(\lambda \exp(z_h^M)a_1(z_h^M))^{\alpha^M} l(z_h^M)^{1-\alpha^M} + \frac{1}{H}(\frac{\exp(c+dz_h^M)a_1(z_h^M)S}{\int_{z_l^M}^{z_h^M} a_1(z^M)dF(z^M)})^{\alpha^H} l(z_h^M)^{1-\alpha^H}$$

$$+\mu_k \lambda a_1(z_h^M) - \underbrace{\frac{(1-\chi)\alpha^H}{\int_{z_l^M}^{z_h^M} a_1(z^M)dF(z^M)} a_1(z_h^M) - \mu_e \lambda a(z_h^M)\frac{s}{S}}_{\text{general equilibrium feedback}} = 0$$

$$\frac{\partial \mathcal{L}}{\partial l(z^M)} = \frac{\chi}{C}(1-\alpha^M)(\frac{\lambda \exp(z^M)a(z^M)}{l(z^M)})^{\alpha^M} - \mu_l = 0 \quad \forall z^M \in [\underline{z}^M, z_l^M) \bigcup (z_h^M, 1]$$

$$\frac{\partial \mathcal{L}}{\partial l(z^M)} = \frac{1}{H}(1-\alpha^M)(\frac{\exp(c+bz^M)a(z^M)S}{\int_{z_l^M}^{z_h^M} a_1(z^M)dF(z^M)l(z)})^{\alpha^H} - \mu_l = 0 \quad \forall z^M \in [z_l^M, z_h^M]$$

In an environment with $b < 1$, the difference between the social product of capital in H and C is increasing as $z_l^M \downarrow$, and the difference between the social product of capital in C and H is increasing as $z_h^M \uparrow$. Therefore, the general equilibrium feedback result in lower z_l^M and z_h^M in the planner's problem:

$$\begin{aligned}
& \frac{1}{H}(\frac{\exp(c+dz_l^M)a_1(z_l^M)S}{\int_{z_l^M}^{z_h^M} a_1(z^M)dF(z^M)})^{\alpha^H} l(z_l^M)^{1-\alpha^H} - \frac{\chi}{C}(\lambda \exp(z_l^M)a_1(z_l^M))^{\alpha^M} l(z_l^M)^{1-\alpha^M} \\
= \; & \mu_e \lambda a_1'(z_l^M) - \mu_k \lambda a_1(z_l^M) + \frac{(1-\chi)\alpha^H}{\int_{z_l^M}^{z_h^M} a_1(z^M)dF(z^M)} a_1(z_l^M) \underbrace{+\mu_e \lambda a_1(z_l^M)\frac{s}{S}}_{\text{Externality}} \\
> \; & \mu_e \lambda a_1'(z_l^M) - \mu_k \lambda a_1(z_l^M) + \frac{(1-\chi)\alpha^H}{\int_{z_l^M}^{z_h^M} a_1(z^M)dF(z^M)} a_1(z_l^M)
\end{aligned} \tag{45}$$

$$
\begin{aligned}
& \frac{\chi}{C}(\lambda \exp(z_h^M)a_1(z_h^M))^{\alpha^M} l(z_h^M)^{1-\alpha^M} - \frac{1}{H}\left(\frac{\exp(c+dz_h^M)a_1(z_h^M)S}{\int_{z_l^M}^{z_h^M} a_1(z^M)dF(z^M)}\right)^{\alpha^H} l(z_h^M)^{1-\alpha^H} \\
= \quad & \mu_k \lambda a_1(z_h^M) - \frac{(1-\chi)\alpha^H}{\int_{z_l^M}^{z_h^M} a_1(z^M)dF(z^M)} a_1(z_h^M) \underbrace{-\mu_e \lambda a(z_h^M)\frac{\underline{S}}{S}}_{\text{Externality}} \\
< \quad & \mu_k \lambda a_1(z_h^M) - \frac{(1-\chi)\alpha^H}{\int_{z_l^M}^{z_h^M} a_1(z^M)dF(z^M)} a_1(z_h^M) \qquad (46)
\end{aligned}
$$

The competitive equilibrium inefficiently allocated more talented and wealthy entrepreneurs into the real estate sector, resulting a higher land price and a lower total welfare.

Combining the two cases, we show that the competitive equilibrium is constrained efficient if and only if $b \geq 1$.

Proof of Policy Discussions - Financial Market Liberalization:

Liberalizing the financial market is equivalent to increasing λ, therefore we compute the following comparative statics:

$$
\frac{\partial(\chi \log C + \log H)}{\partial \lambda}
$$

Holding the initial wealth distribution $a_1(\cdot)$ as fixed, the marginal increase in λ does not affect equation (35). Intuitively, equation (35) captures the business choice of unconstrained private business owners, which depends on the marginal product of capital in both the real estate and the manufacturing sector but not on wealth. The capital market clearing condition indicates that (30) is shifted to the right.

Given that equation (35) specifies a downward-sloping relationship between z_l^M and $\underline{z}^M$, the shift leads to a higher $\underline{z}^M$ and a lower z_l^M.

The manufacturing output follows (33) and (32):

$$
C^{\frac{1}{\alpha^M}} \propto \lambda \int_{[\underline{z}^M, z_l^M) \cup (z_h^M, 1]} \exp(z^M) a_1(z^M) dF(z^M) \equiv \lambda \tilde{C} \qquad (47)
$$

Similarly, the housing output follows (34), (32) and (**??**):

$$
qH^{\frac{1}{\alpha^H}} \propto \lambda \int_{z_l^M}^{z_h^M} \exp(c + bz^M) a_1(z^M) dF(z^M) \equiv \lambda \tilde{H} \qquad (48)
$$

Thus the comparative statics can be computed in two parts:

$$\begin{aligned}\frac{\partial \log C}{\partial \lambda} &= \frac{\alpha^M}{\lambda} + \frac{\alpha^M}{\tilde{C}} \cdot [-\exp(z_h^M)a_1(z_h^M)f(z_h^M)\frac{\partial z_h^M}{\partial z_l^M}\frac{\partial z_l^M}{\partial \lambda} + \exp(z_l^M)a_1(z_l^M)f(z_l^M)\frac{\partial z_l^M}{\partial \lambda} \\ &\quad - \exp(\underline{z}^M)a_1(\underline{z}^M)f(\underline{z}^M)\frac{\partial \underline{z}^M}{\partial \lambda}]\end{aligned}$$

$$\begin{aligned}\frac{\partial \log H}{\partial \lambda} = \frac{\alpha^H}{\lambda} + \frac{\alpha^H}{\tilde{H}} \cdot [\exp(c + bz_h^M)a_1(z_h^M)f(z_h^M)\frac{\partial z_h^M}{\partial z_l^M}\frac{\partial z_l^M}{\partial \lambda} - \exp(c + bz_l^M)a_1(z_l^M)f(z_l^M)\frac{\partial z_l^M}{\partial \lambda}] \\ - \frac{a_1'(z_l^M)}{a_1(z_l^M)}\frac{\partial z_l^M}{\partial \lambda}\end{aligned}$$

The optimization conditions in the competitive equilibrium imply that z_h^M has the same marginal return to capital in both sectors, so that:

$$\frac{\alpha^H}{\tilde{H}} \cdot \exp(c + bz_h^M)a_1(z_h^M)f(z_h^M) = \frac{\alpha^M}{\tilde{C}} \cdot \exp(z_h^M)a_1(z_h^M)f(z_h^M)$$

Given that the z_l^M is the marginal entrepreneur who is constrained from entering the housing sector,

$$\frac{\alpha^H}{\tilde{H}} \cdot \exp(c + bz_l^M)a_1(z_l^M)f(z_l^M) > \frac{\alpha^M}{\tilde{C}} \cdot \exp(z_l^M)a_1(z_l^M)f(z_l^M)$$

In addition, condition (30) implies that

$$\begin{aligned}\frac{\partial z_l^M}{\partial \underline{z}^M} &> -\frac{a_1(\underline{z}^M)f(\underline{z}^M)}{\frac{S}{\underline{s}}a_1'(z_l^M)} \\ \Rightarrow a_1(\underline{z}^M)f(\underline{z}^M)\frac{\partial \underline{z}^M}{\partial \lambda} &= a_1(\underline{z}^M)f(\underline{z}^M)\frac{\partial z_l^M/\partial \lambda}{\partial z_l^M/\partial \underline{z}^M} \\ &> -\frac{S}{\underline{s}}a_1'(z_l^M)\frac{\partial z_l^M}{\partial \lambda} = -a_1'(z_l^M)\frac{\int_{z_l^M}^{z_h^M} a_1(z^M)dF(z^M)}{a_1(z_l^M)}\frac{\partial z_l^M}{\partial \lambda}\end{aligned}$$

Taking into account that $\underline{z}^M$ is also constrained from entering the real estate sector, and that $\frac{\partial \underline{z}^M}{\partial \lambda} > 0$,

$$
\begin{aligned}
-\frac{\alpha^M}{\tilde{C}}\exp(\underline{z}^M)a_1(\underline{z}^M)f(\underline{z}^M)\frac{\partial \underline{z}^M}{\partial \lambda} &> \frac{\alpha^H}{\tilde{H}}\exp(c+b\underline{z}^M)a_1(\underline{z}^M)f(\underline{z}^M)\frac{\partial \underline{z}^M}{\partial \lambda} \\
&> \frac{\alpha^H}{\tilde{H}}\exp(c+b\underline{z}^M)\frac{\int_{z_l^M}^{z_h^M} a_1(z^M)dF(z^M)}{a_1(z_l^M)}\frac{\partial z_l^M}{\partial \lambda} \\
&> \frac{a_1'(z_l^M)}{a_1(z_l^M)}\frac{\partial z_l^M}{\partial \lambda}
\end{aligned}
$$

Therefore, the first-order derivative $\frac{\partial(\chi \log C + \log H)}{\partial \lambda}$ is strictly higher than 0. As a result, the social welfare is increasing in λ.

The discrepancy between the marginal return to increasing z_l^M, z_h^M are $\mu_e \lambda a_1(z_l^M)\frac{\underline{s}}{S}$ and $\mu_e \lambda a_1(z_h^M)\frac{\underline{s}}{S}$, respectively. Therefore, the inefficiency is worse off when λ is higher.

Proof of Policy Discussions - Reducing the Entry Barrier in the Real Estate Sector:

Reducing the entry barrier is equivalent to reducing the ratio of $\underline{s}$ to S. For given $\underline{z}$, both equation (30) and equation (35) requires a lower z_1, so that the two curves between $\underline{z}$ and z_1 are shifted to the left. In addition, for both curves, $\frac{\partial z_1}{\partial \underline{z}} < 1$ so that the shifts lead to a lower $\underline{z}$ and also a lower z_1 . It is also easy to see that z_2 increases as $\frac{\underline{s}}{S}$ decreases, otherwise the land price will be strictly lower and that the market clearing conditions will not hold.

Similar to our discussions in financial market liberalization, the policy impact can be written as:

$$
\chi\frac{\partial \log C}{\partial(\frac{\underline{s}}{S})} + \frac{\partial \log H}{\partial(\frac{\underline{s}}{S})}
$$

Looking at the manufacturing sector and the real estate sector separately,

$$
\frac{\partial \log C}{\partial(\frac{\underline{s}}{S})} = \frac{\alpha^M}{\tilde{C}}\cdot[-\exp(z_h^M)a_1(z_h^M)f(z_h^M)\frac{\partial z_h^M}{\partial(\frac{\underline{s}}{S})} + \exp(z_l^M)a_1(z_l^M)f(z_l^M)\frac{\partial z_l^M}{\partial(\frac{\underline{s}}{S})} - \exp(\underline{z}^M)a_1(\underline{z}^M)f(\underline{z}^M)\frac{\partial \underline{z}^M}{\partial(\frac{\underline{s}}{S})}]
$$

$$
\begin{aligned}
\frac{\partial \log H}{\partial(\frac{\underline{s}}{S})} \quad = \quad & \frac{1}{\tilde{H}}[\exp(c+bz_h^M)a_1(z_h^M)f(z_h^M)\frac{\partial z_h^M}{\partial(\frac{\underline{s}}{S})} - \exp(c+bz_l^M)a_1(z_l^M)f(z_l^M)\frac{\partial z_l^M}{\partial(\frac{\underline{s}}{S})}] \\
& -\frac{a'(z_l^M)}{a(z_l^M)}\frac{\partial z_l^M}{\partial(\frac{\underline{s}}{S})} + \frac{S}{\underline{s}}
\end{aligned}
$$

Similar to our discussions for the previous policy,

$$\frac{\alpha^H}{\tilde{H}} \cdot \exp(c + b z_h^M) a_1(z_h^M) f(z_h^M) = \frac{\alpha^M}{\tilde{C}} \cdot \exp(z_h^M) a_1(z_h^M) f(z_h^M)$$

$$\frac{\alpha^H}{\tilde{H}} \cdot \exp(c + b z_l^M) a_1(z_l^M) f(z_l^M) > \frac{\alpha^M}{\tilde{C}} \cdot \exp(z_l^M) a_1(z_l^M) f(z_l^M)$$

Given that $\frac{\partial z_l^M}{\partial(\underline{s}/S)} > 0$ and $\frac{\partial z_h^M}{\partial(\underline{s}/S)} > 0$, the welfare implication of reducing the entry barrier is ambiguous. If $\underline{s} \to 0$, it is welfare-improving to increase the entry barrier in the real estate sector.

In considering the differences between the planner's solution and the competitive equilibrium, both $\mu_e \lambda a_1(z_l^M)\frac{s}{S}$ and $\mu_e \lambda a_1(z_h^M)\frac{s}{S}$ are decreasing in $\frac{s}{S}$. Therefore, the inefficiency is better off when the entry barrier is lower.

Proof of Policy Discussions - Taxation on Real Estate Returns:

When the social planner imposes a tax τ on the return from operating in the real estate sector, the profit-maximizing problem of entrepreneur with talent z^M becomes:

$$\begin{aligned}
\max_{k(z^M), s(z^M), l_M(z^M), l_H(z^M)} \quad & [\exp(z^M) k(z^M)]^{\alpha^M} l_M(z^M)^{1-\alpha^M} + p^H(1-\tau)[\exp(z^H) s(z^M)]^{\alpha^H} l_H(z^M)^{1-\alpha} \\
& -w_2[l_M(z^M) + l_H(z^M)] - R_2[k(z^M) + q s(z^M) - a_1(z^M)] \\
s.t. \quad & k(z^M) + q s(z^M) \leq \lambda a_1(z^M) \\
& s(z^M) \geq \underline{s} \qquad \forall s(z^M) > 0
\end{aligned}$$

Thus the first-order conditions implies that for z_h^M who is indifferent from operating in the real estate or the manufacturing sector,

$$\alpha^M \exp(z_h^M) (\frac{1-\alpha^M}{w_2})^{\frac{1-\alpha^M}{\alpha^M}} = \alpha^H \exp(z_h^H) \frac{p^H(1-\tau)}{q} (\frac{p^H(1-\alpha^H)}{w_2})^{\frac{1-\alpha^H}{\alpha^H}}$$

With a small τ, both z_l^M and z_h^M become smaller so that the inefficiency is improved in the competitive equilibrium.