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# HASTE OR WASTE? THE ROLE OF PRESALE IN RESIDENTIAL HOUSING

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## ABSTRACT

This paper provides the first theoretical framework and empirical evidence on the impact of housing presale policies on unfinished buildings and developer behavior. We start with constructing a novel dataset of unfinished projects, presale policies, and land auction outcomes across 270 major cities in mainland China. We then identify 2,330 unfinished residential projects from 2010 to 2017 on a government-run citizen complaint portal. We find that both presale criterion (specifying when developers can initiate presale) and post-sale supervision of construction fund utilization relate to a lower probability of unfinished projects. However, only presale criterion relates negatively to the pace of new housing development, measured by developers' multitasking, annual new construction area, and land auction outcomes. A back-of-the-envelope estimation suggests that the current bundle of presale policies in our sampled cities is inferior to the Pareto frontier. By increasing the postsale supervision by 2 standard deviations, the occurrence of unfinished projects could be reduced by 58% without affecting the pace of housing development. Eliminating unfinished projects entirely would entail substantial tightening of both presale criteria and postsale supervision, which would likely slow the pace of housing development. Our findings are relevant to other developing economies where unfinished buildings are common due to insufficient government oversights.

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# 1 Introduction

Selling new residential properties before construction is completed is a common practice known as "presale." According to the US Census Bureau, 675,000 new single-family houses were sold in August 2023, of which 113,000 had not started and 298,000 were under construction at the time of sale.[1] This implies a presale rate close to 61%. Similarly, around 40% of residential units are sold by presale in the United Kingdom and over 70% in Hong Kong.[2]

While presale is prevalent around the world, it is remarkably high in mainland China: over 90% of residential units were sold through presale during the 2010s.[3] Meanwhile, the growth of residential housing in mainland China has been remarkable—average living space per urban resident increased dramatically from 7.1 $m^2$ in 1990 to 41.8 $m^2$ in 2020, alongside a significant rise in average housing prices.[4] The real estate sector contributes to 12.9% of mainland China's GDP, much higher than that of the US, UK and Hong Kong.[5] However, China has also witnessed a surge in unfinished projects, impacting millions of families and posing risks to system-wide financial and social stability (Xiong, 2023). In January 2023, *New York Times* reported that "infuriated homebuyers in over 100 cities rose up in a rare act of collective rebellion, refusing to repay loans on unfinished properties."[6] The problem of unfinished buildings associated with presale is

[1]Source: https://www.census.gov/construction/nrs/pdf/newressales.pdf

[2]UK:https://www.thetimes.co.uk/article/collapse-in-demand-for-off-plan-homes-hits-housebuilding-x6w3k89q8 (The Times); Hong Kong: Li and Chau (2019).

[3]Source: BJ News, retrieved on September 15, 2023; Sina Finance News, retrieved on September 30, 2024

[4]Source: http://www.news.cn/politics/2022-08/10/c_1128902945.htm, retrieved on December 2, 2023.

[5]World Bank "China Economic Report", June 22, 2022, available at https://thedocs.worldbank.org/en/doc/90cc1e4ce917be77d779609ef2dd8614-0070012022/original/CEU-June-2022-CN.pdf, retrieved on October 21, 2023.

[6]New York Times "They Poured Their Savings Into Homes That Were Never Built", January 24, 2023, available at https://www.nytimes.com/interactive/2023/01/24/world/asia/china-unfinished-apartments.html, retrieved on October 4, 2023.

widespread in other developing countries, such as India[7] and Russia[8], where insufficient government regulation is believed to be a primary cause.

The painful surge of unfinished projects necessitates a critical evaluation of the cost and benefit of presale practices, specifically concerning their role in rapid growth of housing development. To answer these questions, we compile two unique datasets that delineate the presale policies and document unfinished projects in 270 Chinese cities between 2010 and 2017. These cities account for 96.3% of the population and 99.1% of the GDP in mainland China.

For the first dataset on presale policies, we categorize a total of 792 government documents recorded by the China Law Database into two numerical variables.[9] One is *"presale criterion"*, which denotes the minimum percentage of construction progress that developers must achieve before initiating presale. This variable measures the role offinancial leverage that presale can play in housing development. By definition, presale criterion is between 0 and 1. The other presale policy variable, *"postsale supervision"*, describes how stringent the government supervises the construction progress after presale. A value of 1 indicates the highest level of supervision, while a value of 0 denotes the lowest level. In mainland China, laws protecting and compensating buyers for unfinished construction are relatively limited compared to those in the US and other regions. If buyers take out a mortgage, they are still required to make monthly payments to the lender even if the developer does not deliver the property as scheduled. This implies that presale criteria and postsale supervision serve as the primary, if not the sole, safeguards for individual buyers in mainland China.

We construct a novel dataset of unfinished residential projects based on comments posted on the Local Leaders' Message Board (LLMB). The LLMB, administered by China's central government, serves as a platform for citizens to express their grievances and con-

[7]There were nearly one million apartments, worth about $130 billion, in and around New Delhi, Mumbai and Bangalore, became unfinished in 2016. See Wall Street Journal article "Unfinished Apartments Haunt Home Buyers in Big Indian Cities", January 19, 2016, available at https://www.wsj.com/articles/unfinished-apartments-haunt-home-buyers-in-big-indian-cities-1453209061, retrieved on September 22, 2024

[8]A similar issue was reported in Russia, where the Ministry of Construction estimated that around 86,000 presold apartments were either unfinished or delayed in 2017. https://www.the-village.ru/business/stories/291282-dolschiki, retrieved on September 22, 2024

[9]This database (www.pkulaw.net) is maintained by the Legal Information Center of Peking University and comprehensively collects all local laws and regulations.

cerns. Local officials are obligated to promptly address these messages, making it a common avenue to lodge complaints regarding various issues, including unfinished residential projects. By analyzing individual messages on the LLMB, we identify a total of 2,330 unfinished residential projects through 7,478 related complaints from 2010 to 2017 (based on project starting year).[10] The dataset we assemble includes pertinent details such as project name, commencement year, and geographical location of each unfinished project. On average, they correspond to 0.8% of all land parcels sold for residential housing development per city-year. To the best of our knowledge, our study represents the first systematic collection of unfinished projects and city-year panels on presale policies in mainland China, and the first attempt to establish a theoretical and empirical linkage between these two aspects.

We develop a simple conceptual framework to highlight a crucial tradeoff associated with presale policies. On the one hand, presale enables developers to secure sales proceeds prior to project completion, effectively enhancing their cash flow and alleviating financial constraints. Depending on the extent to which the sales revenue exceeds the remaining construction costs, presale may even allow developers to initiate new projects before completing the ongoing ones, thereby promoting a rapid growth in the real estate sector. The financial leverage role of presale represents a significant extension of the prior research (Chan, Wang, and Yang, 2012; Edelstein, Liu, and Wu, 2012). On the other hand, presale carries potential risks for homebuyers if developers fail to fulfill their construction obligations within the initially specified timeframe. Inadequate postsale supervision may incentivize developers to divert construction funds for other purposes, leading to unfinished projects.

Our model predicts that both tightening the presale criterion and strengthening postsale supervision will reduce the probability of unfinished projects. A stricter presale criterion reduces the developer's benefits to halt construction, while a tighter supervision increases the costs associated with abandoning projects. However, the two policy levers have distinct influences on the pace of urban development. A more lenient presale criterion encourages developers to undertake multiple projects simultaneously and enables them to generate higher profits. Apparently, the more revenue a developer can obtain from presale of the current project (relative to its construction cost), the greater influence of presale criterion on their ability to pursue other projects concurrently. In contrast,

[10]Most unfinished projects receive multiple complaints in the LLMB.

postsale supervision has little impact on the probability of initiating a new project in parallel since supervision only affects how much funds the developer can retrieve from the government's escrow account after completing the current project.

Our primary empirical method utilizes a generalized Difference-in-Differences (DiD) approach with city fixed effects, year fixed effects, and observable city and mayor attributes. By incorporating city and year fixed effects, we account for potential variations in citizens' tendency to report unfinished projects on the LLMB across different cities, as well as common trends in reporting, construction speed, financing costs, and land supply at the national level.

A potential concern is that mayors who revise presale policies might also implement other measures in the real estate sector to mitigate the occurrence of unfinished projects, such as influencing developers' capacity to undertake multiple projects concurrently. To address this concern, we first conduct a placebo test to determine whether changes in presale policies correlate with other policies aimed at reducing unfinished projects or regulating the real estate market more broadly. We find an overall null effect, indicating that other related policies do not coincide with changes in presale policies during our sample period and are unlikely to influence the estimates of presale policy impacts. Furthermore, we adopt a donut DiD approach as in Baltrunaite, Giorgiantonio, Mocetti, and Orlando (2021), akin to donut RD estimators in Barreca, Guldi, Lindo, and Waddell (2011) and Michaels, Nigmatulina, Rauch, Regan, Baruah, and Dahlstrand (2021). Specifically, we exclude the city-year observations throughout the entire term of those mayors that have made policy revisions any time in their tenure. The rationale is that these city-year observations are more likely to be contaminated by the same mayor's unobservable actions that may also aim to reduce unfinished projects or regulate local developers. The event study analysis also suggests no significant differences in the pre-treatment period between cities with policy changes and those without, confirming the parallel trend assumption. These findings further confirm that the effects of presale policies are distinct from unobservable factors and alleviate concerns about reverse causality.

Our analysis yields two key findings. First, stricter postsale supervision leads to a significantly lower likelihood of unfinished projects, while the coefficient of presale criterion is also negative but weaker in statistical significance. These findings align with our theoretical framework, though the theory does not explicitly speak to the relative effectiveness of the two policy levers in addressing unfinished projects.

Second, our theoretical prediction suggests that a more lenient presale criterion allows developers to undertake a greater number of concurrent projects; this leniency also relates to a higher city-level new house construction area, and higher land auction success rates. In comparison, we find little correlation between postsale supervision and the indicators that reflect new house development speed, again consistent with the theory.

To facilitate a clear comparison of different presale policy sets, we conduct a back-of-the-envelope analysis by constructing an efficient frontier, with minimizing the occurrence of unfinished projects and maximizing the amount of new developments as the objective. This analysis demonstrates that the status quo lies within the interior of the Pareto frontier. Keeping the existing presale criterion and increasing postsale supervision by 2 standard deviation (from 0.22 to 0.8) yields a 58% reduction in unfinished projects, while keeping the pace of new housing development unchanged. To entirely eliminate the occurrence of unfinished projects, we would need to strengthen the presale criterion to 0.7 and postsale supervision to 0.8. Notably, this would simultaneously result in a slowdown of new housing development speed and reduced developer multitasking behavior. This strengthened policy set is also close to the presale policy framework currently in place in the U.S. and Hong Kong.

Our study contributes to the growing literature on presale practices in the residential housing market. Despite the widespread adoption of presale in major economies worldwide, there has been a limited focus on conducting comprehensive assessments on its costs and benefits. Most previous research approached presale from a theoretical standpoint (Buttimer, Clark, and Ott, 2008; Chan, Wang, and Yang, 2012; Edelstein, Liu, and Wu, 2012; Lai, Wang, and Zhou, 2004). However, these studies typically examine presale as a single-period problem, overlooking the fact that presale enables developers to secure sales proceeds at an early stage and jump on opportunities to engage in concurrent development projects. This could eventually accelerate the pace of urban development, as we have witnessed in mainland China. Empirical evidence on presale of residential housing predominantly focuses on Hong Kong, especially on the determinants of presale timing, price discounts (Gan, Hu, Shi, and Zhang, 2023; Li, Bao, and Chau, 2023), presale contract rescission (Gan, Hu, and Wan, 2022). This paper aims to fill this research gap, by conducting a comprehensive economic study that evaluates presale policies, both theoretically and empirically.

In doing so, our paper represents the first attempt to systematically collect and quan-

tify data on unfinished projects and presale policies in mainland China.[11] Despite the presence of unfinished projects since the 2000s, which coincides with the implementation and amendments of presale policies in mainland China and has received considerable media coverage, presale of residential housing has garnered limited attention in academic research.[12] As real estate accounts for 12.9% of China's GDP and presale applies to 90% of residential units sold in mainland China, these datasets and our findings shed light on this under-explored aspect of the Chinese real estate market and lay the foundation for future research in this area.

Moreover, this paper relates to a rich body of literature on optimal policy design in the housing market (Agarwal, Chau, Hu, and Wan, 2021; Agarwal, Hu, and Lee, 2023; Berger, Turner, and Zwick, 2020; He, Hu, Wang, and Yao, 2024; Lee, Ferdowsian, and Yap, 2023). While the literature focuses on the design of tax and housing assitance programs, we emphasize the importance of presale policies. More specifically, not only do we evaluate the adverse impacts of presale policies in terms of unfinished projects, we but also explore the potential benefits of presale policies in fostering rapid urban development. A narrower focus on the costs associated with presale policies may overlook local governments' incentives in implementing such policies, potentially leading to a misguided optimal policy design. By considering both the benefits and costs of presale policies, we demonstrate the potential of Pareto improvement for most cities. Though our data focuses on mainland China, our findings on the economic incentives behind presale policies are applicable to many other economies. For instance, 80% of houses in Russia are presold, and due to the lack of government supervision, 86 thousand households have purchased unfinished projects.[13] A similar scenario occurs in India: in 2019, there were around 1,132 unfinished projects due to a lack of regulations in the real estate market.[14]

[11]Some recent policy reports, such as the YiJu-Research (2022), attempt to measure the extent of unfinished buildings in mainland China. However, their estimates are primarily based on a limited sample of recent unfinished projects (around 300). They extrapolate data for the entire market assuming that if a developer is associated with these projects, 10-20% of their developed area becomes unfinished.. Additionally, the scope of these reports does not extend to unfinished projects from earlier years, nor can they ascertain the start year of these unfinished projects.

[12]See a Reuters report at https://www.reuters.com/markets/asia/china-home-buyers-occupy-their-rotting-unfinished-properties-2022-09-26/ and a New York Times article at https://www.nytimes.com/interactive/2023/01/24/world/asia/china-unfinished-apartments.html.

[13]https://www.the-village.ru/business/stories/291282-dolschiki

[14]https://timesofindia.indiatimes.com/blogs/toi-edit-page/no-homes-for-500000-homebuyers-what-should-be-done-jaypee-suraksha-deal-brings-focus-back-on-lakhs-of-unfinished-flats/

The rest of the paper is organized as follows: Section 2 discusses the background of the presale policy in mainland China. Section 3 presents a conceptual framework for analyzing the presale policy. Section 4 describes the data utilized in our empirical analysis. Section 5 outlines our empirical strategies, followed by the empirical results in Section 6. Section 7 delves into optimal policy design, drawing on both the model and the empirical results. Finally, Section 8 concludes the paper.

# 2 Institutional Background

## 2.1 Presale in the residential housing market

Presale, also known as off-plan sales or pre-construction sales, refers to the practice where property developers sell residential units before the construction is completed. This approach enables developers to secure funding in the early development process. Presale is widely adopted for selling new developments in many major economies. For instance, 61% of new single-family homes in the U.S. were sold through presale in August 2023. Similarly, presale accounts for approximately 70% of new home sales in Hong Kong and 40% in the United Kingdom.

The concept of presale emerged in mainland China's real estate market in the early 1990s. In 1994, the Ministry of Construction issued "Urban Commercial Housing Presale Management Measures", officially permitting presale in mainland China's housing market. Since then, presale has become a dominant practice, with over 90% of homes sold through presale during the 2010s.[15]

In practice, housing presale encompasses a *bundle* of policies, which comprises presale criterion, postsale supervision, and legal protections available to presale buyers.

First, presale criterion establishes the minimum construction progress required before a presale can take place. In mainland China, the central government mandates that all buildings must be at least 25% completed for presale. Local governments have the discretion to set higher standards. As shown in Section 4, the national average presale criterion in mainland China is 33%. Similarly, in Hong Kong, the presale process is reg-

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[15]The remaining 10% of the houses that are not presold are typically government-subsidized affordable houses.

ulated by the Land Department. Developers can commence presale no earlier than 20 months before the estimated completion time, and all foundation work must be completed. Together, these regulations in Hong Kong correspond to approximately 30% of a project's construction progress. In contrast, in the U.S., there are no strict federal-level regulations on presale criterion; in 2022, around 30% of residential projects were even sold before construction began.[16]

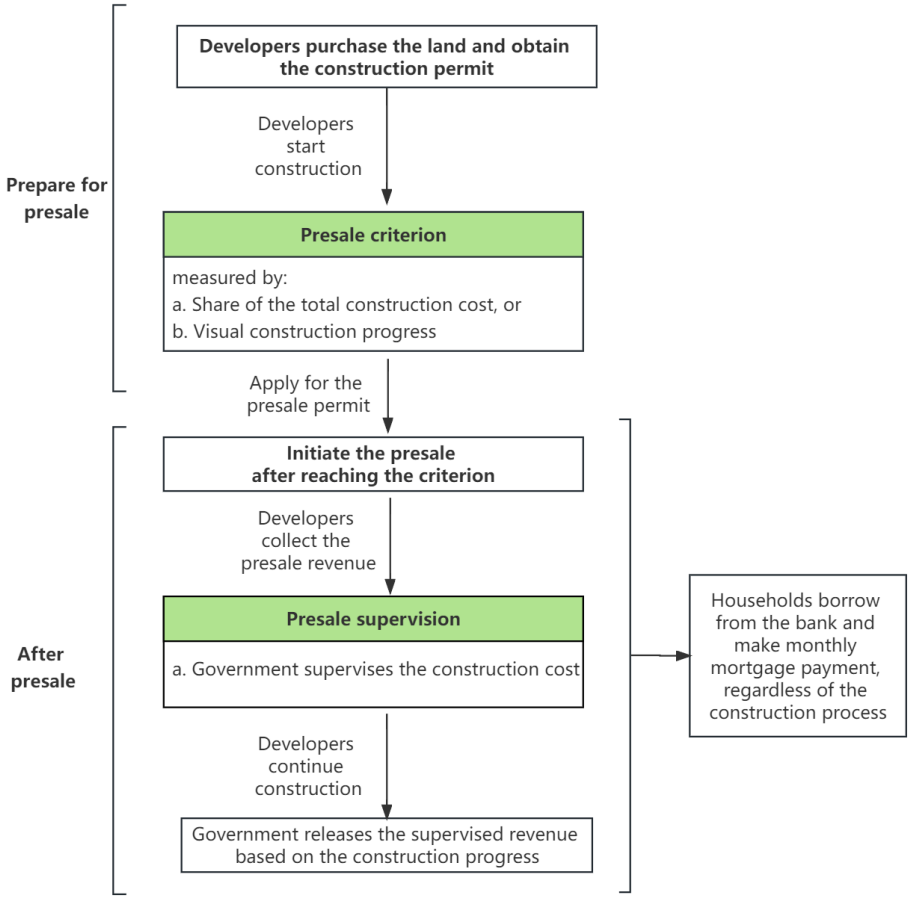
Second, postsale supervision describes how stringently the government supervises the construction progress after presale. There were no national regulations in mainland China governing this policy during our sample period from 2010 to 2017. In 2010, 78% of the cities in our sample did not have any postsale supervision. This number decreased to 36% in 2017. In cities with the strictest postsale supervision in mainland China, developers are obligated to deposit more than 110% of the expected remaining construction costs into a bank account overseen by a third-party monitoring system. Funds are released based on construction progress. In addition, more than 40% of the construction costs remain in the supervised account after the completion of the building's main structure. The postsale supervision in the U.S. and Hong Kong is more stringent. Unlike in mainland China, where buyers must pay the full housing price at the time of presale, buyers in the US and Hong Kong typically make progressive payments based on construction milestones. Developers are required to establish a separate sales proceeds account for each development project, subject to strict regulations. As discussed in Section 4, the national average of postsale supervision level in our sample period is around 0.22. By our definition, this number would be close to 1 (the highest possible level) in the US and Hong Kong.

Figure 1 illustrates the presale process in mainland China. Before initiating a presale, a developer must purchase land and incur a portion of the construction costs to ensure that the project meets the pregress requirement set by the government. These requirements can be measured either by the share of total construction costs or by the visible progress of construction. The specific stipulations are outlined in local laws or government administrative regulations, which local officials have the authority to modify.

Once the progress requirements are satisfied, developers can initiate presales and begin collecting sales revenue. Typically, all units in a building eligible for presale are

[16]Source: https://www.census.gov/construction/nrs/pdf/newressales.pdf

Figure 1: Presale system in mainland China




offered simultaneously and often sell out quickly.[17] This stage also marks the onset of government supervision; in some cities, developers are required to deposit the remaining construction funds into a supervised account. However, as detailed in Section 4, there is considerable variation in the degree of supervision, both across cities and over time. Notably, some cities do not mandate developers to deposit any of the remaining construction funds into supervised accounts. Once presale begins, home buyers facing cash flow constraints borrow from the bank to finance their purchases.

Although we focus on the two key presale policies mentioned, there are several important institutional details that leave Chinese presale buyers particularly vulnerable. First, homebuyers in Mainland China are often required to pay the entire purchase price at the presale phase, thereby shifting the uncertainties of the construction process from

[17]Most developers face significant cash flow constraints and have incentives to sell the units as soon as possible.

developers to buyers. This places presale buyers at heightened vulnerability to a spectrum of risks, especially the threat of incomplete constructions, where developers might abscond with presale funds, leaving projects abandoned.

Second, the legal system in Mainland China is still under development, leading to inadequate protection for homebuyers in the event of unfinished projects. Homebuyers are still obligated to pay for the entire mortgage amount, even if a project turns out to be unfinished. Homebuyers of unfinished properties primarily rely on local governments to address these issues. This reliance incentivizes citizens to report unfinished projects through platforms like the Local Leaders' Message Board, as bringing the problem to the attention of local leaders such as mayors or city secretaries is often the only viable means of resolving these matters.

Other developing economies, such as India and Russia, face problems similar to those in China. Buyers are required to pay a large portion of the housing value at the time of presale, and the lack of protection for homebuyers in the event of unfinished homes has made the issue of incomplete buildings widespread (Agarwal, Fan, Ghosh, Sarkar, and Zhang, 2024). Homebuyers suffer significantly when they purchase an unfinished apartment.[18]

This is in stark contrast with other more developed markets, such as Hong Kong and the U.S. These markets commonly adopt the installment-based presale payment structures, facilitating a fairer risk distribution between developers and presale buyers. Upon reaching predefined construction milestones, buyers then make installment payments based on project progress, ensuring the project proceeds smoothly according to the initial schedule. Homebuyers generally are required to put down a deposit ranging from 5-10% of the purchase price to secure their presale contracts. This deposit and subsequent payment are then placed in a third-party escrow account, ensuring independent monitoring of presale proceeds. The funds in this account are earmarked exclusively for property construction and related expenses, restricting arbitrary withdrawal or utilization. This installment-based approach not only guarantees the project's progress but also motivates developers to complete the project while reducing financial pressure and risk for buyers.

[18]Source: https://www.nytimes.com/2015/02/10/nyregion/kabul-chawla-bptp-india-real-estate-manhattan.html

Above all, Table 1 summarizes the comparison of presale policies between mainland China, India, and other developed markets, in terms of the installment pay based on project progress, postsale supervision of developer, and buyer protection in case the project is delayed or unfinished.

Table 1: Buyer payment and protection policies in different markets

| **Market** | **Buyer payment in advance** | **Postsale supervision and buyer protection if delayed or unfinished** |
|---|---|---|
| Mainland China | 100% (downpayment + mortgage) | Buyers must continue mortgage payment if unfinished. Resolution depends on local government intervention. |
| US | Typically 5-10% | Require separate sales proceed account. Warning letter if delayed due to non-force majeure. If unresolved, government seizes and resells the project. Mortgage payment starts after completion. Buyer cancellation is permitted. |
| Hong Kong | 5% upon contract signing. Additional 10% in 90 days | Require separate sales proceed account. HK Consumer Protection Ordinance & HK Residential Property Ordinance allow buyers to seek compensation if unfinished. Buyer cancellation is permitted. |
| Australia | Typically 10% | Require separate sales proceed account. Domestic Building Warranty Insurance protects buyers against financial loss if unfinished. Buyer cancellation is permitted. |
| India | Vary between 20% and 90%, depending on developers' policies. | Lack of buyers' protection. A high proportion of presold homes become unfinished or delayed (Agarwal et al., 2024). |

## 2.2 Presale as a financial leverage and a risk-sharing tool

The most prominent feature of presale is that it serves as financial leverage, shortening the borrowing cycle for developers and enabling them to work on multiple projects concurrently. It also functions as a risk-sharing tool that transfers risks from the developer to buyers.

Given the high financial costs and profitability of the real estate market in mainland China, developers have heavily relied on their ability to swiftly move cash across different projects to maximize fund efficiency. As illustrated in Figure 1, developers often resort to bank loans or utilize their cash holdings to purchase land and finance the initial stage of construction to reach the presale milestone. Upon collecting presale revenue,

they can then reallocate their funds to initiate another project. Consequently, a lower presale criterion can enhance financial leverage and expedite this process.

However, a surge in unfinished apartments has drawn unprecedented attention to the presale model in the housing market of mainland China. For example, a news report on Quartz (2022/08/08) was titled "Pre-selling homes in China was a developer's dream, now it's 'only a matter of time before it explodes'."[19] Another article on New York Times (2023/01/24) was titled "They Poured Their Savings Into Homes That Were Never Built."[20] The Ministry of Housing and Urban-Rural Development was startled to find that funds from presales had been misappropriated, leaving many pre-sold residential projects unfinished.[21]

Under the Chinese presale model, presale serves as a risk-sharing tool that shifts risk from developers to homebuyers. Due to the relatively lenient regulations concerning presale criterion and postsale supervision, along with insufficient protection for homebuyers in the event of unfinished projects, households bear all the risks associated with housing construction progress after presale, including making monthly mortgage payments to their lender even if developers fail to deliver their homes as scheduled.

## 2.3 Lack of market-based mechanisms to mitigate unfinished projects

If homebuyers are perfectly informed about the risks of unfinished projects, particularly in relation to developers' track records, and are free to choose between completed homes and presold homes that are still under construction, a market-driven developer reputation system could potentially alleviate the problem of unfinished projects. Under these conditions, we would anticipate that projects with a higher likelihood of becoming unfinished would experience lower sale prices. Such mechanisms would encourage developers to improve their practices and enhance transparency, ultimately fostering a more stable and efficient housing market.

However, this may not have been the case during our sample period (2010-2017) within the context of Chinese real estate market. As depicted in Figure A9, the national

[19] Available at https://qz.com/china-pre-selling-homes-1849383480.

[20] Available at https://www.nytimes.com/interactive/2023/01/24/world/asia/china-unfinished-apartments.html, retrieved on October 4, 2023.

[21] Source: https://www.gov.cn/zhengce/zhengceku/2021-03/26/content_5596070.htm, retrieved on December 3, 2023

average housing price rose by approximately 60% during this period. In such a booming market, consumers may have been overly enthusiastic about purchasing homes, leading to a lack of awareness regarding the potential risks associated with unfinished projects.[22] Moreover, limited media coverage about unfinished projects during that time exacerbated this lack of risk awareness. Additionally, with over 90% of homes being presold during our sample period, consumers faced limited choices, further compounding their vulnerability to the risks inherent in presale practices.

# 3 Presale Model

## 3.1 Setup

Consider a model in which the developers maximize their payoff based on a given presale criterion and supervision extent. We aim to capture two key features of the presale system. First, without proper supervision, presale can lead to unfinished projects. Second, the presale system can encourage developers to work on multiple projects simultaneously and increase the pace of residential housing development. For ease of exposition, we only consider the scenario where there is *one* representative developer with *two* potential projects to develop in this model (Chan, Wang, and Yang, 2012; Edelstein, Liu, and Wu, 2012). The results remain robust when we extend the model to multiple developers and more projects.

Project 1's total expected construction costs are represented by $c$. On average, $c$ accounts for 40 to 50% of the housing price in mainland China (National Bureau of Statistics, 2014).[23] The duration required to complete Project 1 is normalized to 1. The presale criterion posits that presale can begin at time $t = \alpha$, where $\alpha$ represents the percentage of the construction process that must be completed before presale can commence. This construction milestone requries the developer to pay construction costs $c_1 = \alpha c$ upfront.

Once the construction milestone is achieved, presale starts and the developer can obtain presale revenue up to $R$.[24] In the model, we assume that all units in a building

[22]Source: Sina Finance. https://finance.sina.cn/cj/2022-06-28/detail-imizirav1017042.d.html, retrieved on October 7, 2024.

[23]https://data.stats.gov.cn/files/html/quickSearch/pc/pctz74.html

[24]To highlight the effect of presale policies on developer incentives, we abstract away from the endoge-

eligible for presale are offered simultaneously and sell out quickly.[25] Therefore, we ignore the possibility that the risk of unfinished buildings may change over time and that buyers may have strategic incentives to wait for others to buy first. Meanwhile, the developer is required to deposit the remaining construction costs $(c - \alpha c)$ in a third-party escrow account for supervision purposes. If Project 1 remains unfinished at the end of its planned duration, the developer can only receive a fraction of the supervised amount back from the government (i.e., $(1 - s) \cdot (c - \alpha c)$) at time 1. The parameter $s$ measures the intensity of *postsale supervision*, with $s = 0$ akin to no supervision whereby no fund in the escrow account would be held back from the developer if the project is not completed as scheduled, and $s = 1$ akin to full supervision where the entire amount required to finish the remaining construction needs to be held in the escrow account until project completion.

While Project 1 is ongoing, Project 2 can arrive at any time $t \in (0, 1)$ with equal likelihood. The expected profit from Project 2 is denoted by $\pi_2 > 0$. To initiate Project 2, the developer's cash flow must exceed a threshold denoted as $M$.

In short, the model highlights two key aspects of presale policies: presale criterion $\alpha$ and postsale suprevision $s$. Presale criterion $\alpha$ determines the point at which presales can commence. Lower $\alpha$ allows for earlier presale, which in turn increases the developer's cash flow by $R - (c - \alpha c)$, and the likelihood of the developer being able to initiate Project 2. Postsale supervision $s$ acts as a bond to counter the developer's strategic incentive to abandon Project 1 after presale. Under tighter supervision (higher $s$), the developer faces a high penalty for misbehavior, and thereby has less incentive to abandon the project. Put another way, the two policy levers play distinct roles in regulating developer behaviors: presale criterion impacts the developer's cash flow and liquidity constraints, while postsale supervision deters moral hazard.

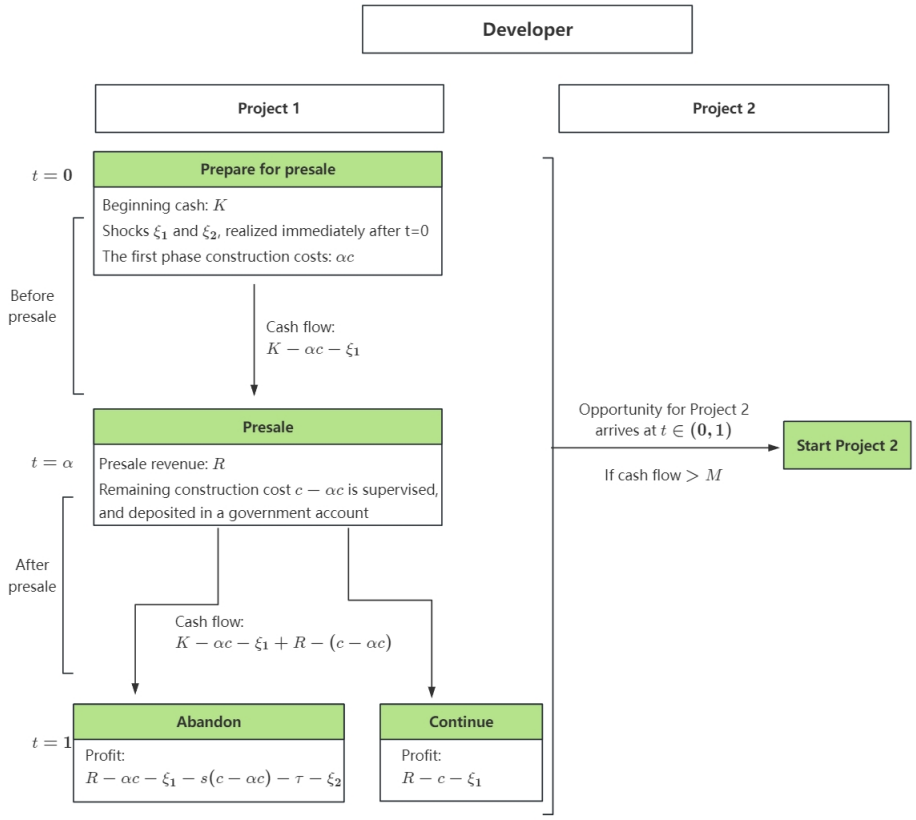
Like all principal-agent problems, the principal is unable to write a complete contract

nous formation of R as a function of presale policies. Note that the developers' decision of whether to abandon the project is made after the realization of $R$. Presale revenue cancels out, and will not affect the developers' choice of whether to abandon or not. This assumption is also reasonable from the individual developer's perspective because on average we observe 169 active developers in each city-year. In the empirical analysis, we use the new house price of each city as of 2010 (the beginning of our data period) to test the theoretical predictions about R, and always include city fixed effects. This circumvents the endogeneity of R in each data period after 2010.

[25] This assumption aligns with the situation during our sample period, when houses were typically sold out within one or two months of the presale.

as the agent holds private information or faces uncertainties unknown to the principal. In our model, we assume that after $t = 0$, the developer observes two shocks privately. The first shock, $\xi_1$, affects the actual construction costs needed for Project 1 before fulfilling the presale criterion. This shock might represent land conditions that determine whether the land is construction-ready or if the developer needs to stabilize it before development begins. The second shock, $\xi_2$, signifies a developer-specific cost tied to abandoning Project 1. It can be interpreted as a variation to the typical ethical, legal, or reputation costs of deserting an ongoing project ($\tau$). For ease of exposition, we assume $\xi_1 \sim \text{Uniform}(-\sigma_1, +\sigma_1)$, and $\xi_2 \sim \text{Uniform}(-\sigma_2, +\sigma_2)$.

Figure 2: Presale timeline




As shown in Figure 2, the timing of the model is as follows:

Stage 1: ($t = 0$) A representative developer initiates project 1 with cash $K$ in hand.

Stage 2: ($t = \epsilon$) Two shocks, $\xi_1$ and $\xi_2$, are realized immediately after $t = 0$. These shocks are private information to the developer.

Stage 3: ($0 < t < 1$) The new project 2 can arrive at any time with equal probability during $0 < t < 1$. The developer must decide whether to take Project 2 at the time of its arrival, however, initiating project 2 requires having at least cash $M$ in hand.

Stage 4: ($0 < t < \alpha$) Before satisfying the presale criterion, the developer is required to cover the realized presale construction costs $\alpha c + \xi_1$. With initial cash $K$, the developer's cash flow by time $\alpha$ can be expressed as $K - \alpha c - \xi_1$.

Stage 5: ($t = \alpha$) The presale takes place, the developer receives presale revenue $R$.

Stage 6: ($t = \alpha + \epsilon$) The developer decides whether or not to abandon project 1, trading off the benefits from abandoning the project ($(1 - s)(c - \alpha c)$) and the reputation, ethical, and legal costs of abandoning ($\tau + \xi_2$).

Stage 7: ($t = 1$) All outcomes related to project 1 are realized and revealed.

The developer faces two decisions: (1) whether to initiate Project 2 when the opportunity arises, and (2) whether to abandon Project 1 after the cost shock $\xi_2$ is realized to maximize profit.

For ease of exposition, we do not discount cash values over time, following prior studies (Chan, Wang, and Yang, 2012; Edelstein, Liu, and Wu, 2012). Adding a reasonable discount rate to the model is unlikely to alter the trade-offs highlighted in the model but doing so makes our model less tractable.

Before solving the model, we impose two assumptions to avoid edge cases:

*Assumption 1 (Sufficient presale revenue):* We assume presale revenue is strictly greater than the total expected construction costs, i.e., $R > c$. This assumption guarantees that the developer's cash flow after presale is always greater than before presale.

*Assumption 2 (Moderate initial cash):* We assume that the developers' initial cash in hand $K$ is not always enough for them to initial Project 2 when it arrives before the presale of Project 1, i.e., $K - M - \alpha c < \sigma_1$.

## 3.2 Analysis

To solve the model, we begin with the developer's decision on whether to initiate Project 2. When Project 2 arrives before presale ($t \in (0, \alpha)$), the developer will always choose

to invest in Project 2 as long as her cash flow surpasses $M$. This is because investing in Project 2 before presale can generate positive profits, and it does not impact her decision of whether to abandon Project 1 after presale, nor does it influence her profit from Project 1. When Project 2 arrives after presale ($t \in (\alpha, 1)$)[26], there are four potential outcomes, depending on the values of $\xi_1$ and $\xi_2$: *Outcome 1:* Abandon project 1 and ignore project 2 ($Pr_1$); *Outcome 2:* Abandon project 1 and start project 2 ($Pr_2$); *Outcome 3:* Continue project 1 and ignore project 2 ($Pr_3$); and *Outcome 4:* Continue project 1 and start project 2 ($Pr_4$). Detailed derivations for four conditional probabilities can be found in Appendix A. After calculating the conditional probability of each outcome, we can determine the two key outcomes:

The probability that the developer starts project 2 is:

$$Pr_{new} = \underbrace{\left(\frac{K - \alpha c - M}{2\sigma_1} + \frac{1}{2}\right) \cdot \alpha}_{\text{Project 2 arrives before the presale}} + \underbrace{(Pr_2 + Pr_4)\,(1 - \alpha)\cdot}_{\text{Project 2 arrives after the presale}} \tag{1}$$

The probability that project 1 becomes unfinished is:

$$Pr_{uf} = \frac{1}{2} - \frac{\tau - (1 - s)(c - \alpha c)}{2\sigma_2} \tag{2}$$

## 3.3 Comparative statics

After defining the two key outcomes, we conduct comparative static analyses to determine the impact of presale criterion $\alpha$ and postsale supervision $s$ on them.

**Prediction 1:** Strengthening postsale supervision $s$ and presale criterion $\alpha$ can reduce the probability of Project 1 becoming unfinished. Formally, $\frac{\partial Pr_{uf}}{\partial s} < 0$, $\frac{\partial Pr_{uf}}{\partial \alpha} < 0$.

This prediction is derived directly from equation (2). Intuitively, a higher level of supervision $s$ increases the loss of the developer if Project 1 remains unfinished, while a higher presale criterion $\alpha$ implies less gain from abandoning project 1.

**Prediction 2:** Strengthening presale criterion $\alpha$ reduces the developers' multitasking behavior, while the postsale supervision $s$ has no impact on multitasking. Formally, $\frac{\partial Pr_{new}}{\partial \alpha} < 0$, $\frac{\partial Pr_{new}}{\partial s} = 0$.

[26]Note that based on our assumption about the arrival of Project 2, Project 2 will definitely arrive during $t \in (\alpha, 1)$ if it doesn't occur before the presale.

This prediction is derived from equation (7). Intuitively, setting a higher presale criterion $\alpha$ prevents the developer from securing presale revenue $R$ early on. Consequently, if the opportunity to initiate Project 2 arises early, the developer is less likely to start Project 2 due to cash flow constraints. The zero impact of postsale supervision $s$ stems from the assumption that the total amount under supervision $c - \alpha c$ will not be returned to the developer (even if the project is abandoned) until the end of the game. In real-world contexts where government supervision is lax, however, the developer might receive a portion of the supervised amount before the construction is completed. This adjustment would grant developers greater flexibility in utilizing presale revenue. Consequently, it will amplify the impact of both $\alpha$ and $s$ in reducing unfinished projects, as well as enhancing $\alpha$'s positive impact on developers' multitasking behavior. Nonetheless, it is important to note that $s$ may have an indirect negative impact on developer multitasking, as it could affect developers' cash flow indirectly. However, we anticipate this impact to be less significant than that of $\alpha$, since the presale revenue R substantially exceeds the supervised amount $s$ the developer might receive during construction.

Based on Predictions 1 and 2, we can show that both presale criterion $\alpha$ and postsale supervision $s$ have a negative effect on the developer's expected profits. The negative effect of $\alpha$ is more pronounced than that of $s$, because in addition to influencing the option of abandoning Project 1, an indirect effect shared by $\alpha$ and $s$, $\alpha$ also directly reduces the probability of initiating Project 2, as suggested by Prediction 2.[27]

## 3.4 Model discussions

The model presented above offers a simplified representation of presale dynamics, highlighting two key features: (1) it serves as a form of financial leverage that can increase the likelihood of the developer taking up a new project; and (2) it may lead to a surge in

[27]Formally, the developer's expected profit from Project 1 and Project 2 can be written as:

$$\begin{aligned}\Pi = (1-\alpha)\{&Pr_1 \cdot (R - \alpha c - s(c - \alpha c) - \tau + a_2) + Pr_2 \cdot ((R - \alpha c - s(c - \alpha c) - \tau + a_2) + \pi_2) \\ &+ Pr_3 \cdot (R - c) + Pr_4 \cdot (R - c + \pi_2)\} + \\ \alpha \left\{ (\frac{K - \alpha c - M}{2\sigma_1} + \frac{1}{2})\pi_2 + (Pr_1 + Pr_2)&(R - \alpha c - s(c - \alpha c) - \tau + a_2) + (Pr_3 + Pr_4)(R - c) \right\}\end{aligned}$$

where $\pi_2$ denotes the expected profit from Project 2, $a_2 = \frac{\sigma_2 - ((1-s)(c-\alpha c) - \tau)}{2}$ denotes the strategic gain that the developer could obtain by choosing to abandon Project 1 based on his private observation of $\xi_2$.

The proof of all theoretical predictions is presented in Appendix A.

unfinished projects due to the developer's moral hazard. The model can be extended in several ways:

First, recursive features can be incorporated into the model, allowing future projects to share similar features and timelines as Project 1. Under this scenario, we expect most of the model predictions to remain the same. The presale criterion ($\alpha$) continues to positively influence developers' multitasking behaviors, as a lower $\alpha$ enables developers to underake more projects within a given timeframe. Both $\alpha$ and $s$ can still reduce the likelihood of unfinished projects, as $\alpha$ lowers the potential payoff and $s$ increases the penalty associated with abandoning construction. Postsale supervision $s$ may exert a negative impact on developers' multitasking behavior, as it influences their profit and thus their cash flow at the end of period 1. However, this effect is expected to be less significant than that of the presale criterion $\alpha$.

Second, we can endogenize the presale revenue $R$, allowing homebuyers to take into account the presale policies when making their purchasing decisions. Our predictions would still hold, as endogenizing $R$ does not alter the roles of $\alpha$ and $s$ in developers'multitasking and abandonment decisions. Recall that housing prices in China experienced rapid appreciation during our sample period, with demand significantly exceeding supply. Substantial price appreciation, combined with limited media coverage regarding unfinished projects, hindered most homebuyers from fully understanding the risks of unfinished projects. Additionally, presale policies are implemented at the city level. With over 90% of homes sold through presale, home buyers have limited choices between properties subject to presale and properties for sale after completion.

# 4 Data and Measures

We compile multiple data sources for our empirical analysis, including presale policy documents, incidents of unfinished residential projects, as well as records of land transaction and housing development. This section describes each dataset and the key measures. Summary statistics of the relevant variables are presented in Table 2.

## 4.1 Presale policy documents

In China, city governments have the authority to modify local presale policies by amending local laws and administrative regulations. Regarding presale criterion, the central government stipulates that all housing projects must reach a minimum completion level of 25% before presale. However, local governments have the flexibility to set higher presale criterion beyond this minimum threshold. In comparison, there are no specific nationwide regulations govern the extent of postsale supervision.

We collect presale criterion and postsale supervision from the China Law Database (www.pkulaw.net) maintained by the Legal Information Center of Peking University. This dataset collects all the local laws and regulations. We identified 792 policy documents from 270 cities, in effect between 2010 and 2017. These 270 cities, including four direct-administered municipalities (*Zhi Xia Shi*) and almost all prefecture-level cities in China, account for 96.3% of the population and 99.1% of the GDP in mainland China.[28] To the best of our knowledge, this represents the first comprehensive compilation of presale policy documents in mainland China.

Presale criterion in mainland China typically takes two forms: as a percentage of the total construction costs invested before the presale and/or based on visual construction progress. Figure A1 displays an example of a policy document regarding the presale criterion. After consulting with construction experts, we translate key milestones of construction progress into a percentage scale ranging from 0 to 100%: finishing the foundation is equivalent to 30% completion; finishing the main structure represents 65% completion; and finishing the exterior walls represents 80% completion.[29] Table 2 Panel (a) shows the summary statistics for the presale criterion ($\alpha$). We find that more than half the city-year combinations adhere to the national minimum requirement of 25% for presale criterion.

Postsale supervision is measured based on four variables, as illustrated in an example in Figure A2. First, we construct a dummy that equals 1 if the supervised amount ex-

[28] Due to data limitations, we are unable to include cities in Tibet and ethnic minority autonomous prefectures.

[29] If the policy document requires completion of a specified percentage of the building's main structure, then the presale criterion becomes $a\% \cdot (65-30)\% + 30\%$. For instance, if the document states that developers can start presale after completing 50% of the building's main structure, then the presale criterion is $50\% \cdot (65-30)\% + 30\% = 0.48$.

ceeds 110% of the remaining construction costs ($s_{cost}$). Second, we create another dummy that equals 1 if the release of the supervised amount is based on real-time construction progress ($s_{progress}$), and 0 otherwise. If $s_{progress} = 1$ , we then create a third variable, the percentage of the supervised amount ($S_{mainstructure}$) that the developer could retrieve from the escrow account upon completion of the building's main structure. Lastly, we create a dummy that equals 1 if the supervised construction costs are deposited in a third-party independent bank account ($s_{third}$). As reported in Table A1, all four of these measures are highly correlated with each other. After consulting with construction experts, we define postsale supervision ($s$) as a weighted average of the above four variables, namely $s = 0.25 \cdot S_{cost} + 0.2 \cdot S_{progress} + 0.35 \cdot (1 - \frac{S_{mainstructure} - 0.5}{0.5}) + 0.2 \cdot S_{third}$. Results are robust if we use alternative weighting as described in Appendix H.2. Table 2 Panel (a) reports the summary statistics for the postsale supervision ($s$). More than half the city-year combinations do not have any postsale supervision. The average level of $s$ is also very low.

Figure A4 plots how the average presale criterion and postsale supervision change year by year from 2010 to 2017. Both were tightened over time, especially postsale supervision. Of the 270 cities in our sample, 56 experienced one adjustment in their presale criterion between 2010 and 2017, while two other cities saw multiple changes. Regarding postsale supervision, 112 cities experienced one adjustment during our study period, and seven other cities saw multiple adjustments. As depicted in Table 2, the standard deviation of postsale supervision is 1.4 times higher than that of presale criterion.

In Table A3, we report the factors that drive the cross-sectional and over-time variations in presale criterion and postsale supervision. The results suggest that large cities and provincial capitals are more likely to have more stringent presale policies. However, they do not make statistically significant difference in the *changes* in these presale policies from 2010 to 2017. We further explore how mayors' characteristics affect the changes in the presale policies in Table A2. We find that older mayors are less likely to strengthen both presale criterion and postsale supervision, as they may have lower promotion incentives (Wang, Zhang, and Zhou, 2020; Zeng and Zhou, 2024).[30]

[30]The city fixed effects included in all regressions can address potential biases caused by city size and political hierarchy. We also control for mayors' characteristics in the main regressions.

Table 2: Summary statistics

| Variable | Mean | Std.Dev. | Minimum | Q1 | Median | Q3 | Maximum |
|---|---|---|---|---|---|---|---|
| **Panel (a). Presale policies (2,144 obs. by city-year, 270 cities)** | | | | | | | |
| Presale criterion ($\alpha$) | .33 | .12 | .25 | .25 | .25 | .38 | .80 |
| Postsale supervision ($s$) | .22 | .29 | 0 | 0 | 0 | .45 | 1 |
| **Panel (b). Unfinished residential development projects (2,144 obs. by city-year, 270 cities)** | | | | | | | |
| Probability of unfinished projects (%) | .80 | 1.72 | 0 | 0 | 0 | .88 | 23.88 |
| **Panel (c). Multitasking developers (364,248 obs. by developer-city-year, 270 cities)** | | | | | | | |
| # of projects | 1.75 | 1.42 | 0 | 1 | 1 | 2 | 9 |
| **Panel (d). New house constrcution (1,342 obs. by city-year, 198 cities)** | | | | | | | |
| New house construction area (0000' $m^2$) | 771.25 | 889.36 | 25.08 | 276 | 467.9 | 926.2 | 7641.6 |
| **Panel (e). Land auction records (144,948 obs. by land parcel up for auction, 270 cities)** | | | | | | | |
| Auction success | .68 | .47 | 0 | 0 | 1 | 1 | 1 |
| Aution deal price (RMB/$m^2$) | 4802.7 | 6950.16 | 43.93 | 286.23 | 1701 | 6021 | 25996 |

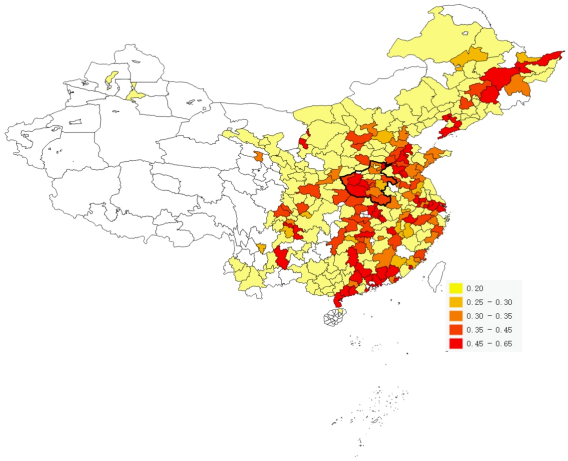
Notes: (1) The data in Panel (c) is constructed at the developer-by-year level. (2) Prices in current RMB.

## 4.2 Unfinished Residential Projects

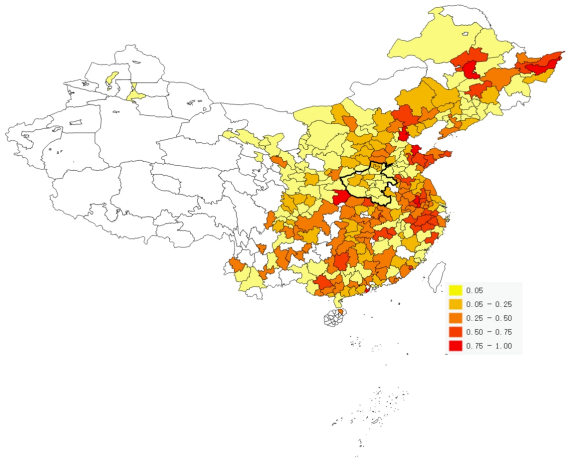
We collect data on unfinished residential projects from the Local Leaders' Message Board (LLMB), maintained by the main state media, People's Daily (www.liuyan.people.com.cn). Since 2006, the LLMB has functioned as a communication platform, enabling citizens to directly report their difficulties and complaints to local government officials. Local leaders are required to respond to these messages in a timely manner, maintaining a high response rate of approximately 90%. Both citizens' messages and leaders' responses are publicly accessible. Citizens have the option to send messages through their personal computers or a dedicated mobile app, and the service is provided free of charge. In China, it is important to make leaders aware of the problems like unfinished buildings in order to solve them. Given its accessibility and cost-effectiveness, the LLMB is frequently used by citizens to send messages to local leaders, especially when they encounter issues like unfinished residential projects that directly impact their interests. The dataset, compiled from the LLMB, comprises over 3 million messages spanning from 2010 to 2021. These messages encompass a broad spectrum of issues including housing, education, healthcare, corruption, and employment.

Figure A3 displays an example message posted on the LLMB. Note that response is not equivalent to solving the problem. One of the most common responses we observe on the LLMB is the government's promise to look into the problem. In this sense, LLMB

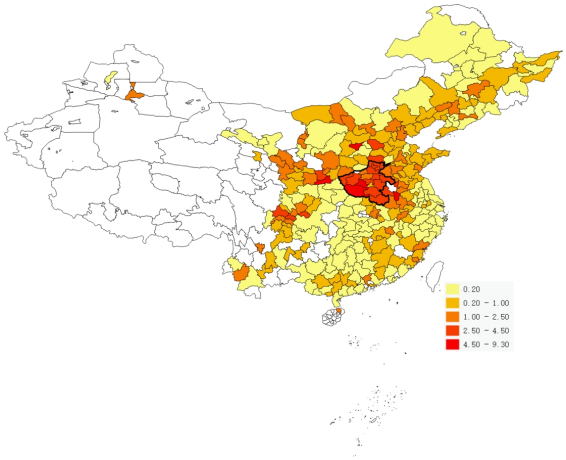
Figure 3: Presale policies and geographical distribution of unfinished projects




(a) Presale criterion




(b) Postsale supervision




(c) Probability of unfinished projects

Notes: This figure displays the spatial variations in presale criterion, postsale supervision, and the probability of unfinished projects (0-100%) from 2010 to 2017. We calculate the average of these variables for each city. Cities for which data is not available are displayed in shadow. These missing cities only account for around 4% of the population and 1% GDP in mainland China. The region encircled by a dark boundary at the center of each map represents Henan Province.

messages indicate problems at the time of message posting, but do not reveal whether, how and when the problems might be solved afterwards.

To identify unfinished residential projects from the LLMB, we search for messages that contain keywords such as *unfinished* and *buildings* (or synonyms such as *housing* and *property*). This process yielded 7,478 complaint messages. To extract more specific details about these unfinished projects, we manually collect property names and project

starting years from the LLMB messages sent by citizens, the corresponding responses from leaders, and related news online.[31] After removing duplicate complaints related to the same unfinished projects and excluding irrelevant messages, we successfully identify 2,330 unfinished projects across 270 cities. These projects started construction between 2010 and 2017. We link these projects to the presale policies (denoted by $\alpha$ and $s$) based on the timing of their presale. According to the presale policy documents, these projects are subject to the regulations in effect at the time of their presale.[32] We exclude unfinished projects that commenced in or after 2018 because a residential project typically takes three years to complete. Consequently, by 2021, we lack sufficient information to ascertain whether a project starting in 2018 was indeed unfinished or not. By focusing on projects initiated before 2018, we ensure a more accurate assessment of the unfinished residential developments.

It is worthwhile to note that most unfinished projects identified from the LLMB are those whose construction progress has been stalled for more than one year. It is possible that the government will find another developer to complete these projects in the future. Unfortunately, we are unable to track the lifecycle of these projects.

We acknowledge potential under-reporting of unfinished buildings on the LLMB, despite the relatively low cost of communication and high response rate. In all econometric specifications, we include city and year fixed effects to control for geographic and temporal differences in under-reporting. Additionally, we assess the extent of underreporting by comparing the aggregate number of unfinished buildings from our dataset to the numbers reported in the media and government reports. In cities where we have counts of unfinished projects from other sources, the unfinished projects we identify account for more than 60% of the total.[33]

To measure the probability of unfinished projects by city-year, we divide the total number of unfinished projects that *started* in a given city-year by the annual number of

[31] In most cases, the starting year of the residential projects can be found within the messages and responses on the LLMB. However, for projects whose starting year is not explicitly stated, we utilized search engines to ascertain this information.

[32] Some presale documents describe this rule as "new building, new law; old building, old law".

[33] For instance, according to China News Weekly, Zhengzhou had 106 unfinished projects by 2022, but we successfully identified 72 of those projects that began between 2010 and 2017. Data source: Henan Government, retrieved on October 21, 2023. Similarly, in Kunming, local officials in 2021 stated that there were 93 unfinished projects, yet we identify 56 of these in our dataset. Data source: Yunnan Net, retrieved on October 21, 2023.

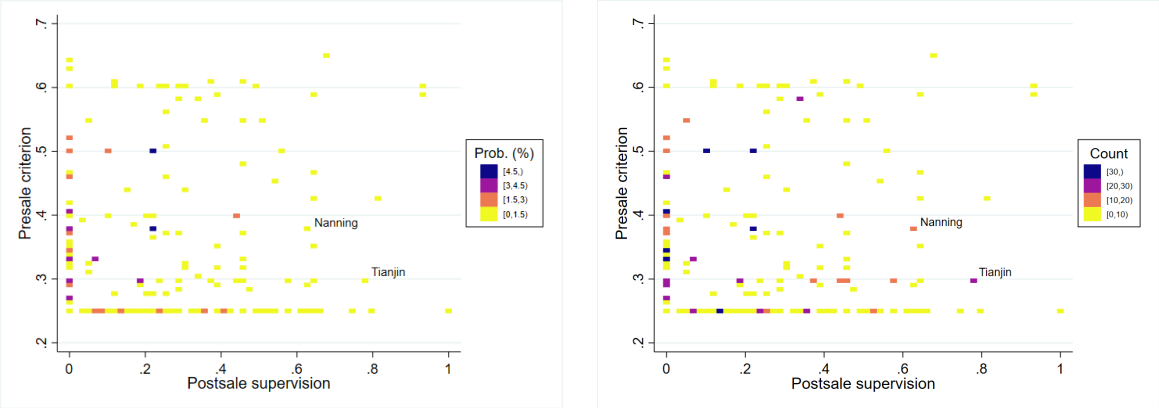
residential land transactions in the city for the same year. Due to data limitations, we cannot determine the exact starting time of each residential project. Instead, we use the land transaction time as a proxy. This approach is justified because, as stipulated in most land development agreements between the local government and developers, residential projects are usually required to start within several weeks after the land transaction. Additionally, presale should incentivize developers to initiate each project as soon as they acquire the land. As detailed in Appendix H.3, our results are robust when we use the absolute number of unfinished projects as the dependent variable.

Figure 3 Panel (c) visualizes the spatial distribution of the probability of unfinished projects. For ease of exposition, we aggregate our city-by-year panel data into average per city. Consistent with media coverage anecdotes, the share of unfinished projects is extraordinarily high in Henan Province (marked by a black circle on the map). By visually comparing the probability of unfinished projects with the stringency of presale policies across cities (Panels a and b), we observe that cities with less stringent presale policies, particularly in terms of postsale supervision, tend to have a higher likelihood of unfinished projects.

Figure 4 uses heatmaps to illustrate the relationship between presale criterion $\alpha$ (on the x-axis) and postsale supervision $s$ (on the y-axis) with respect to unfinished projects (in color). In Panel (a), darker colors denote a higher probability of unfinished projects. For comparison, Panel (b) uses the absolute number of unfinished projects as the outcome variable. We observe that both the probability of unfinished projects and the total number of unfinished projects are the highest in the lower-left region, where both presale criterion and postsale supervision are at their lowest. This aligns with our theoretical predictions. Our main regression analyses will use the probability of unfinished projects (rather than their absolute count) as the outcome variable, because the number of unfinished projects may appear high merely due to a greater number of land transactions in that city, as exemplified by Tianjin and Nanning marked in Panel (b).

Figure A4 Panel (c) plots the average probability of unfinished projects over time. We find that it first increased from 2010 to 2014 and then zigzagged afterward. According to our theory, this pattern may be related to the tightening of the presale criterion and postsale supervision over time (as displayed in Figure A4 Panels (a) and (b)).

Figure 4: Presale policies and unfinished projects




(a) Probability of unfinished projects

(b) # of unfinished projects

Notes: The heatmaps visualize the initial relationship among the average of presale criterion, postsale supervision, and the total count/probability of unfinished projects from 2010 to 2017.

## 4.3 Land data and new house construction

To measure the likelihood of developers working on multiple projects simultaneously and to evaluate the associated outcomes in the land market, we compile a dataset of land sales in China, which is from China Stock Market and Accounting Research (CSMAR).[34] In this paper, we focus on residential land transactions. Apart from land use type, this dataset also includes details such as auction date, reserve price, deal price, area, developer of the land, and the project start and completion dates as stipulated in the land contract.

Based on developer information as well as project start and completion dates, we reshape the land data to a developer-city-year panel where each observation denotes the number of projects a developer $d$ is working on simultaneously in city $j$ and year $t$.[35] Note that we define a developer by its company name and city. As detailed below, our results remain robust if we exclude the top 50 developers, who often work on projects in multiple cities.

[34]The dataset used in this study includes information on land transactions in mainland China's primary land market after the implementation of the 2007 Land Management Law. The law mandates local governments to report all land sales within their jurisdictions on www.landchina.com, ensuring the availability of comprehensive land transaction records.

[35]For instance, if developer $d$ works on only one project from 2011 to 2014 and starts working on another project in 2017, then the number of projects developer $d$ works on is labeled as 1 for the years 2011 to 2014 and 2017, and labeled as 0 for 2015 and 2016.

We also collect data on city-level annual new construction area from the China Urban Statistical Yearbooks, which are maintained by the National Bureau of Statistics. This variable measures the construction area of housing projects *newly* started within the calendar year.[36] This variable allows us to measure developers' multitasking behavior from an aggregate perspective.

Two outcomes from land auctions can further enhance our analysis of developers' multitasking behavior: the land auction success rate and the land auction deal price.[37] These variables reflect bidders' willingness to pay at the extensive and intensive margins, which likely correlate with their expectations for early presales and the potential profits from constructing and abandoning a project.

The summary statistics for multitasking developers, annual new construction area, and land auction outcomes are reported in Panels (c), (d), and (e) of Table 2. On average, each developer has 1.75 ongoing projects in a city-year. For the 68% of auctions that succeed in land sale, the average deal price is 4,802 RMB per square meter.

# 5 Empirical Strategies

## 5.1 Empirical specification

To explore the impact of presale policies on key outcomes, we use a generalized DiD (two-way fixed effects) approach. In particular, we compare changes in outcomes of interest between cities that experienced a presale policy modification and those that did not. The baseline regression is estimated using the following specification:

$$Y_{(i,)j,t} = \beta_1 \alpha_{j,t} + \beta_2 s_{j,t} + \gamma X_{(i,)j,t} + \theta_j + v_t + \epsilon_{(i,)j,t} \tag{3}$$

where $j$ denotes city, $t$ denotes year, and $i$ denotes the observation level more detailed than city $j$ and time $t$ if applicable. $Y_{i,j,t}$ represents the outcome variables, which includes the probability of a project being unfinished (at the city-year level), annual new construction area (at the city-year level), land auction success rate (at the land parcel level), land

[36] It does not include the construction area of buildings that were started in the previous year and continued into the current year.

[37] Our land data includes both successed and failed auctions, which enables us to measure auction success rate at the land parcel level and link it to presale policies. The average auction success rate is approximately 68%.

auction price (at the land parcel level), and the number of projects a developer works on simultaneously (at the developer-city-year level). $\alpha_{j,t}$ denotes the presale criterion in city $j$ and year $t$. $s_{j,t}$ is the extent of postsale supervision in city $j$ and year $t$. $\theta_j$ denotes city fixed effects that absorb all time-invariant city-level characteristics. $v_t$ denotes year fixed effects, which captures common shocks in year $t$. These fixed effects are crucial for our identification strategy, as they absorb the local institutional and economic conditions that may simultaneously influence both presale policies and our outcome variables of interest. $X_{j,t}$ is time-variant socioeconomic characteristics in city $j$ and year $t$, including the city's GDP growth rate, share of population with internet access, the mayor's attributes (age, gender, and education attainment), and the city's other observable regulations on unfinished projects (more details below). When the observation level is at the land level, $X_{i,j,t}$ also includes land parcel attributes such as the auction reserve price. $\epsilon_{(i,)j,t}$ is the error term. Standard errors are clustered by city. The key parameters of interest are $\beta_1$ and $\beta_2$.

## 5.2 Identification and interpretation

One potential concern in our Difference-in-Differences (DiD) analysis is that mayors who have incentives to modify presale policies $\alpha_{j,t}$ and $s_{j,t}$ may also modify other relevant policies to achieve similar policy goals. They may also undertake other unobservable actions to reduce the occurrence of unfinished projects during their tenures. These unobservable actions — for example negotiating with relevant stakeholders behind the scenes or allocating ad hoc resources to address specific unfinished projects — can potentially confound the estimated impact of presale policies on the prevalence of unfinished projects.

We take several steps to address this concern. First, we conduct a placebo test by examining whether changes in presale policies correlate with other policies aimed at reducing unfinished projects or regulating the real estate market. For policies aimed at reducing unfinished projects, we searched for all laws and local government regulations containing the word "unfinished" in the China Law Database and defined a new dummy variable equal to 1 if such regulations exist in certain city-year. To identify austerity real estate policies, we searched the China Law Database for laws and regulations containing the term "real estate" alongside terms like "regulation," "restriction," or "supervision."

Expansionary real estate policies were defined as those containing "real estate" but not these specific terms. As reported in Appendix E, we find that neither the presale criterion nor postsale supervision is correlated with these policies. Still, we include them as additional controls in the main regressions.

Second, we employ a "donut DiD" specification:

$$Y_{i,j,t\neq m} = \beta_1 \alpha_{j,t\neq m} + \beta_2 s_{j,t\neq m} + \gamma' X_{j,t\neq m} + \theta_j + v_{t\neq m} + \epsilon_{j,t\neq m} \tag{4}$$

where the subscript $t \neq m$ indicates that we exclude those city-year observations if the mayor changed any presale policies during his term. Since mayors play an important role in deciding a city's economic policy, these city-year observations are more likely to be affected by the same mayor's unobservable actions, which may also aim to reduce unfinished projects or regulate the real estate industry. The idea is that it is unlikely for successors to continue the unobserved actions of the current mayor, such as negotiating with relevant stakeholders behind the scenes or allocating ad hoc resources to address specific unfinished projects.

Note that changes in the presale policies occurred only once or twice in almost all cities in our sample period. By excluding the city-year observations that are most susceptible to endogeneity concerns, we still retain a sufficient number of observations for statistical inference. The same approach was employed in Baltrunaite et al. (2021).

Third, we employ an event study approach to examine the parallel-trend assumption and assess dynamic treatment effects over time. In particular, we define a treatment dummy on presale criterion equal to 1 if the presale criterion in the focal city-year is strictly above the national minimum (25%) and another treatment dummy on postsale supervision equal to 1 if the postsale supervision is strictly above 0.5, which implies at least two of the four supervision indicators are met. As detailed in Appendix H.1, the event study results confirm parallel pretreatment trends between the cities that have either treatment dummy turned on over time and other cities that remain lenient in the presale policies. This alleviates the reverse causality concern that cities changing presale policies might face more severe issues with unfinished buildings or offer different support of multitasking developers in other unobserved ways.

One may argue that presale policies, even if exogenous to the current mayor, may interact with other government regulations or industry policies prevailing at that time. For

example, banks may provide debt financing for developers if they can demonstrate that they have money to cover a minimum percentage of the total costs of the project. More lenient presale policies, in the form of either allowing presale at an earlier time (lower $\alpha$) or relaxing postsale supervision (lower $s$), would enhance the developer's financial condition and therefore boost their ability to initiate additional development projects. Although city fixed effects can account for heterogeneous bank-related policies across cities, and year fixed effects can absorb national bank-related policy changes, the aforementioned interaction effects are not captured by these fixed effects. In fact, these effects contribute to the estimated coefficients of presale policies because they are enabled by the change of presale policies in the city. This is consistent with the typical interpretation of the coefficients as the average treatment effect on the treated.

# 6 Empirical Results

To test our theoretical predictions, we associate presale criterion and postsale supervision to two sets of key outcomes: (a) the probability of unfinished projects, and (b) the extent of developer multitasking, new house construction area, and land auction outcomes.

## 6.1 Unfinished projects

To link presale policies with the probability of unfinished projects, we estimate:

$$\text{Unfinished}_{j,t} = \beta_1^u \alpha_{j,t} + \beta_2^u s_{j,t} + \gamma^u X_{j,t} + \theta_j^u + v_t^u + \epsilon_{j,t}^u \tag{5}$$

where the dependent variable $Unfinished_{j,t}$ denotes the probability of a residential project being unfinished in city $j$ and year $t$. As aforementioned, we define $\text{Unfinished}_{j,t} = \frac{\text{\# of unfinished projects started in city j year t}}{\text{total \# of residential land parcels sold in city j year t}}$. The superscript $u$ denotes the coefficients generated from the unfinished project regressions. Other notations are the same as in Equation (3).

Table 3 reports our regression results progressively in five columns. Column (1) regresses the probability of unfinished projects solely on presale criterion. Column (2) changes the explanatory variable to postsale supervision. Column (3) includes both presale criterion and postsale supervision to capture their combined effects. Column (4) introduces additional control variables. Column (5) employs the donut Difference-

Table 3: Presale and unfinished projects

| Dep. Variable | Probability of a project being unfinished (%) | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Presale Criterion ($\alpha$) | -0.139 | | -0.136 | -0.142* | -0.166* |
| | (0.0851) | | (0.0846) | (0.0813) | (0.0950) |
| Postsale Supervision ($s$) | | -0.161*** | -0.160*** | -0.157*** | -0.229*** |
| | | (0.0505) | (0.0505) | (0.0503) | (0.0689) |
| Sample mean | 0.8% | 0.8% | 0.8% | 0.8% | 0.8% |
| Observations | 2,144 | 2,144 | 2,144 | 2,144 | 1,878 |
| Adjusted $R^2$ | 0.438 | 0.439 | 0.440 | 0.445 | 0.444 |
| Extra controls | No | No | No | Yes | Yes |
| Donut analysis | No | No | No | No | Yes |
| City FE | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes |

Notes: (1) This table reports the estimates of $\beta_1^u$ and $\beta_2^u$ from Equation (5). (2) To make $\beta_1^u$ and $\beta_2^u$ comparable, we normalize presale criterion $\alpha$ and postsale supervision $s$ to a distribution with mean zero and standard deviation 1. (3) Control variables include the cities' GDP growth rate, mayors' characteristics (age, gender, and education attainment), a dummy variable indicating the presence of other policies related to unfinished projects, and a dummy variable reflecting whether the real estate policies were austerity-oriented or expansionary.. To further address potential under-reporting due to limited internet access, we control for the share of population with internet access. (4) All regressions include city and year fixed effects. (5) Robust standard errors clustered at the city level are reported in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

in-Differences (DiD) approach, according to Equation (4). All columns include city and year fixed effects, and standard errors are clustered at the city level.

In line with Prediction 1, our estimation results consistently demonstrate a strong, robust, negative link between postsale supervision ($s$) and the probability of unfinished projects. Regarding presale criterion ($\alpha$), results indicate a negative link to the extent of unfinished projects, albeit with less precision. Note that, to make the two coefficients comparable, we normalize presale criterion $\alpha$ and postsale supervision $s$ to a distribution with mean zero and standard deviation 1. The coefficients suggest that, increasing postsale supervision by one standard deviation (around 0.29 increase in $s$ on top of its sample mean of 0.22) would reduce the probability of a project being unfinished by 0.16% to 0.23%, which corresponds to 20% to 29% of the sample mean. In comparison, increasing presale criterion by one standard deviation (around 0.12 increase in $\alpha$ on top of its sample mean of 0.33) would have a slightly smaller effect in reducing unfinished projects; the effect is less precise and at most marginally significant with 90% of confidence. The findings in Table 3 also echo the raw pattern we observe in Figure 3: cities

with less stringent postsale supervision and presale criterion have a higher probability of unfinished projects. Taken together, our empirical findings provide strong evidence supporting the importance of both presale criterion and postsale supervision in reducing unfinished projects.

As a robustness check, we utilize the absolute number of unfinished projects as the dependent variable. The findings, as reported in Table A8, indicate similar patterns.

In Appendix F, we further explore the impact of presale policies on unfinished projects at both extensive and intensive margins. The results suggest that presale criterion primarily reduces unfinished projects from the extensive margin (i.e. whether having any unfinished projects), while postsale supervision has a more significant impact on the intensive margin (i.e. the probability of unfinished projects conditional on having any unfinished projects).

## 6.2 Multitasking developers, new house construction, and land auction outcomes

### 6.2.1 Multitasking developers

As suggested by Prediction 2, a lower presale criterion $\alpha$ could potentially incentivize developer multitasking but postsale supervision may not exert a significant influence on this outcome. To test this prediction, we estimate:

$$\#\text{ of Projects}_{i,j,t} = \beta_1^p \alpha_{j,t} + \beta_2^p s_{j,t} + \gamma^p X_{j,t}^C + \eta^p X_{i,j,t}^P + \theta_j^p + v_t^p + \mu_{i,j,t}^p. \tag{6}$$

The dependent variable $\#\text{ of Projects}_{i,j,t}$ measures the extent of multitasking for developer $i$, calculated as the number of projects developer $i$ is concurrently working on in city $j$ during year $t$. The superscripts $C$ and $P$ in $X$ denote city- or developer-city-specific variables. The superscripts $p$ denote the parameters to be estimated in the regression regarding # of projects. The key parameters are $\beta_1$ and $\beta_2$. As suggested by Cohn, Liu, and Wardlaw (2022), we use Poisson pseudo-likelihood regression with fixed effects to estimate Equation (6).

Consistent with Prediction 2, Table 4 shows that a stricter presale criterion discourages developers from multitasking, while postsale supervision has a negligible correlation with developer multitasking. Specifically, a one standard deviation increase in the

presale criterion ($\alpha$) is associated with a 1.7% reduction in the number of projects that developers concurrently work on.

In Table A9, we check the robustness of our results when we exclude the top 50 developers, who typically work on projects in multiple cities. Specifically, a Leju report identifies these top 50 developers based on their 2018 sales revenue, serves as our reference.[38][39]

Table 4: Presale and multitasking developers

| Dep. Variable | # of projects (Poisson) | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Presale Criterion ($\alpha$) | -0.0139** | | -0.0141** | -0.0140** | -0.0182* |
| | (0.00670) | | (0.00679) | (0.00700) | (0.00937) |
| Postsale Supervision ($s$) | | -0.00659 | -0.00670 | -0.00608 | -0.00495 |
| | | (0.00421) | (0.00418) | (0.00408) | (0.00598) |
| Sample mean | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 |
| Observations | 364,248 | 364,248 | 364,248 | 364,248 | 302,404 |
| Pseudo $R^2$ | 0.024 | 0.024 | 0.024 | 0.024 | 0.025 |
| Extra controls | No | No | No | Yes | Yes |
| Donut analysis | No | No | No | No | Yes |
| City FE | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes |

Notes: (1) This table reports the estimates of $\beta_1^p$ and $\beta_2^p$ from Equation (6), using Poisson pseudo-likelihood regression (Correia, Guimarães, and Zylkin, 2020). (2) We normalize presale criterion $\alpha$ and postsale supervision $s$ to a distribution with mean zero and standard deviation 1. (3) Control variables are the same as in Table 3. (4) All regressions include city and year fixed effects. (5) Robust standard errors clustered at the city level are reported in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

### 6.2.2 New house construction

An important benefit of the presale is that it serves the role of the financial leverage. A lower presale criterion can accelerate the new house development speed. To link presale policies and new house development speed, we estimate the following equation:

$$\text{Log (Annual new house construction area)}_{j,t} = \beta_1^n \alpha_{j,t} + \beta_2^n s_{j,t} + \gamma^n X_{j,t} + \theta_j^n + v_t^n + \epsilon_{j,t}^n \tag{7}$$

[38]Source: China Real Estate Information Center: http://m.fangchan.com/data/17/2018-12-31/6485515862089732345.html, retrieved on December 25, 2023.

[39]It is worthwhile to note that even though these top 50 developers have received significant media attention, most of the residential housing projects are developed by local developers.

The dependent variable is the logarithm of the annual new house construction area in city j year t. The superscripts $n$ denote the parameters to be estimated in the regression, which pertain to this year's new construction area. Other variables have the same definiton as in Equation (5).

Consistent with our model implications, the impact of presale criterion ($\alpha$) on the city-level annual new house construction area is negative and significant. In contrast, postsale sale supervision ($s$) does not have a significant impact. The results in Table 5 corroborates those in Table 4, implying an important financial leverage role the presale criterion plays.

Table 5: Presale and new house development speed

| Dep. Variable | log (Annual new construction area) | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Presale Criterion ($\alpha$) | -0.104*** | | -0.104*** | -0.102*** | -0.137*** |
| | (0.0328) | | (0.0328) | (0.0334) | (0.0441) |
| Postsale Supervision ($s$) | | 0.00624 | 0.00492 | 0.00575 | 0.0247 |
| | | (0.0215) | (0.0214) | (0.0211) | (0.0249) |
| Sample mean | 771.25 | 771.25 | 771.25 | 771.25 | 723.11 |
| Observations | 1,342 | 1,342 | 1,342 | 1,342 | 1,136 |
| Adjusted $R^2$ | 0.890 | 0.888 | 0.890 | 0.889 | 0.884 |
| Extra controls | No | No | No | Yes | Yes |
| Donut analysis | No | No | No | No | Yes |
| City FE | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes |

Notes: (1) Some cities do not report their annual new construction area in their yearbook, so we miss some data in this table. (2) We normalize presale criterion $\alpha$ and postsale supervision $s$ to a distribution with mean zero and standard deviation 1. (3) Control variables are the same as in Table 3. (4) All regressions include city and year fixed effects. (5) Robust standard errors clustered at the city level are reported in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

### 6.2.3 Land market outcomes

One potential consequence of developers multitasking is an increase in land purchases. Following our theory, we anticipate a higher $\alpha$ to decrease both the land auction success rate and the land transaction price. To test these hypotheses, we use the land transaction data in the primary land market and estimate:

$$\text{LandOutcome}_{i,j,t} = \beta_1^L \alpha_{j,t} + \beta_2^L s_{j,t} + \gamma^L X_{j,t}^C + \eta^L X_{i,j,t}^P + \theta_j^L + v_t^L + \mu_{i,j,t}. \tag{8}$$

$\text{LandOutcome}_{i,j,t}$ can take two possible variables: (a) a dummy that indicates whether the land auction for land parcel $i$ in city $j$ year $t$ is successful or not; and (b) conditional on a successful auction, the logarithm of the deal price of land parcel $i$ in city $j$ year $t$. The superscript $L$ denotes the estimated coefficients pertain to the land market outcomes. Table 6 reports the estimation results.

Consistent with our model predictions and the results in Table 4, Panel A of Table 6 suggests that a more stringent presale criterion ($\alpha$) relates to a lower auction success rate. On the other hand, postsale supervision appears to have no significant correlation with the auction success rate.

Table 6: Presale and land auction

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| **Panel A: Auction success=1** | | | | | |
| Presale Criterion ($\alpha$) | -0.0277*** | | -0.0277*** | -0.0287*** | -0.0202** |
| | (0.00758) | | (0.00759) | (0.00766) | (0.0100) |
| Postsale Supervision ($s$) | | -0.00120 | -0.000994 | -0.000252 | -0.000375 |
| | | (0.0105) | (0.0105) | (0.0103) | (0.00755) |
| Sample mean | 0.68 | 0.68 | 0.68 | 0.68 | 0.68 |
| Observations | 144,948 | 144,948 | 144,948 | 144,948 | 122,366 |
| Adjusted $R^2$ | 0.093 | 0.093 | 0.093 | 0.093 | 0.091 |
| **Panel B: Log land auction deal price** | | | | | |
| Presale Criterion ($\alpha$) | 0.0414 | | 0.0414 | 0.0146 | 0.00437 |
| | (0.104) | | (0.104) | (0.0180) | (0.0217) |
| Postsale Supervision ($s$) | | -0.000605 | -0.000684 | 0.0238 | 0.0201 |
| | | (0.0446) | (0.0445) | (0.0160) | (0.0153) |
| Sample mean | 4802.70 | 4802.70 | 4802.70 | 4802.70 | 4649.05 |
| Observations | 95,240 | 95,240 | 95,240 | 95,240 | 80,365 |
| Adjusted $R^2$ | 0.266 | 0.266 | 0.266 | 0.967 | 0.969 |
| Extra controls | No | No | No | Yes | Yes |
| Donut analysis | No | No | No | No | Yes |
| City FE | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes |

Notes: (1) This table reports the estimates of $\beta_1^L$ and $\beta_2^L$ from Equation (8). (2) We normalize the presale criterion $\alpha$ and postsale supervision $s$ to a distribution with mean zero and standard deviation 1. (3) Control variables include the cities' GDP growth rate, the mayors' characteristics (age, gender, and education attainment), the other policies that relate to unfinished buildings, and the land auction reserve price. (4) Robust standard errors clustered at the city level are reported in parentheses. (5) * significant at 10%; ** significant at 5%; *** significant at 1%.

Turning to the land price regressions in Panel B, we find that the estimates corresponding to both presale criterion and postsale supervision are insignificant. This may be driven by the unique context of China's land market, where a substantial portion (approximately half) of land is sold at the reserve price. This suggests that only one bidder

participates in these auctions. As a result, the limited price variation hampers our ability to detect a significant relationship between presale policies and land transaction prices. Hence, it is important to acknowledge that the insignificant results in Panel B do not necessarily imply the absence of a true effect.

# 7 Back-of-the-envelope Analysis

Based on the empirical results presented in Tables 3 and 4, we conduct a back-of-the-envelope analysis to assess the potential impact of alternative presale policies. As admitted before, our estimates reflect the average treatment effect on the treated, and thus include the ripple effects that presale policies may generate through their interaction with other national or city-specific policies even if these policies do not change during our sample period.

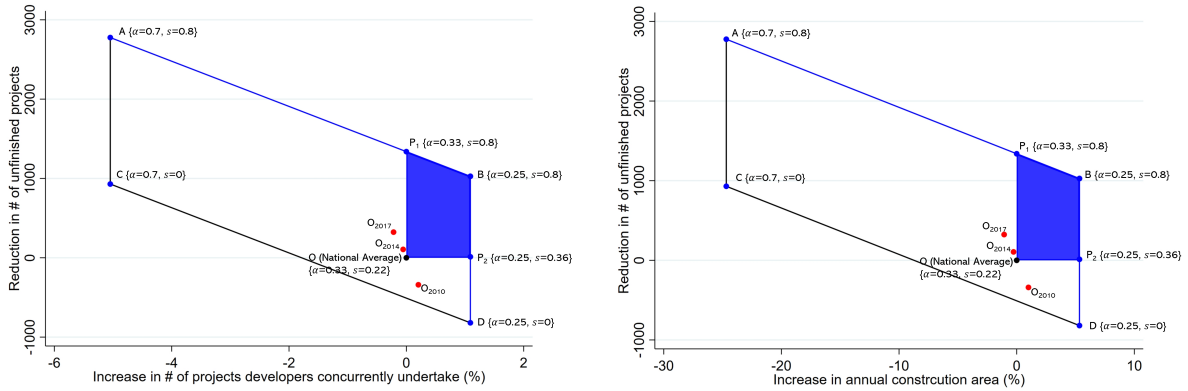
In this exercise, we use the national average of presale criterion (0.33) and postsale supervision (0.22) as the status quo. We then vary the values of presale criterion and postsale supervision based on our regression results,[40] to evaluate the potential effects of different policy settings on the severity of unfinished projects as well as new house development speed.

Figure 5 illustrates the back-of-the-envelope results. The y-axis in both panels represents the *reduction* in the number of unfinished projects. The x-axis in panels (a) and (b) represents the *percent increase* in the number of projects that developers concurrently undertake and the *percent increase* in annual new construction area, respectively. The region enclosed by the parallelogram *ABCD* depicts the potential outcome region for all possible combinations of presale criterion $\alpha \in [0.25, 0.7]$, and postsale supervision $s \in [0, 0.8]$. These ranges encompass 95% of our empirical observations. The blue line represents the Pareto frontier, which signifies the highest possible reduction in the number of unfinished projects given different levels of multitasking behavior.

We observe that the current presale policy, at the national average ($\alpha$=0.33, $s$=0.22), is inferior to the Pareto frontier. The region shaded in blue designates the Pareto Improvement area. If the national average presale policy shifts to point $P_1$ ($\alpha$=0.33, $s$=0.8),

[40]The estimates we use come from the donut DiD results (Column 5) in Tables 3 and 4. For clarity, we set statistically insignificant coefficients (with p-value above 0.1) to zero. The results remain similar when we use the empirically estimated parameters that are insignificant.

Figure 5: Back-of-the-envelope analysis




(a) Unfinished projects and developer multitasking

(b) Unfinished projects and new house development

Notes: (1) The y-axis represents the *reduction* in the number of unfinished projects compared with the status quo. (2) In Panel (a), the x-axis represents the *percent increase* in the number of projects developers concurrently undertake (%). In Panel (b), the x-axis represents the *percent increase* in the annual house construction area (%). (3) The region shaded in blue is the Pareto Improvement region. (4) The black point represents the current presale policy, at the national average ($\alpha$=0.33, $s$=0.22). The red points indicate the outcomes of changes in presale policies from 2010 to 2014 and 2017.

the number of unfinished projects could decrease by approximately 1,360 (58%), without impacting the pace of new housing development. Point $A$ ($\alpha$=0.7, $s$=0.8) represents the strictest presale policy combination within our explored policy range. At this point, the unfinished project issue in mainland China can be completely eliminated, but it would lead to a 25% decrease in annual new house construction area, and reduce developer multitasking by 5%. Point $B$ ($\alpha$=0.25, $s$=0.8) represents a different Pareto improvement, with the number of unfinished projects decreasing by 1,040 (45%), while the pace of new house development accelerating by 5%.

The presale practices of several developed economies, such as Hong Kong, US, and Australia, have presale policies akin to the point A, if $\alpha$ reflects the time when a developer can access the full sales revenue of the new house rather than the time that the developer can start to collect any money from the buyer.

It is important to note that this back-of-the-envelope analysis provides a preliminary assessment; the actual policy impact may be more complicated and influenced by additional factors beyond presale criterion and postsale supervision. Nonetheless, it highlights the potential for improving the current presale policies in mainland China and the range of outcomes associated with different policy configurations. It also high-

lights the main economic tradeoffs underlying presale policies, namely the occurrence of unfinished projects and the pace of new housing development.

# 8 Conclusion

In this paper, we investigate the costs and benefits of presale policies. We begin with a theoretical framework with two key presale policies: presale criterion in terms of construction progress required prior presale and postsale supervision of presale revenue to cover construction costs. The model predicts that a higher presale criterion would undermine the effectiveness of presale as a financial leverage tool, thus lowering the likelihood of the developer undertaking multiple projects simultaneously. In the meantime, the model also predicts that both presale criterion and postsale supervision help to ensure project completion and mitigate the probability of unfinished projects. These predictions highlight the tradeoff between developer moral hazard and potential acceleration of new housing development through presale.

To empirically test our model predictions, we construct a novel dataset that tracks presale policies, unfinished projects, and land auction outcomes in 270 major cities of China from 2010 to 2017. Not only are our empirical results consistent with the theoretical predictions, they but also suggest that China's current presale policy is in the interior of the Pareto frontier. The back-of-envelope results suggest that increasing postsale supervision by 2 standard deviations (from 0.22 to 0.8) can relate to a 58% reduction in unfinished projects, while keeping the pace of new housing development unchanged. Strenghening presale criterion to 0.7 and postsale supervision to 0.8 would eliminate all unfinished projects, but with 4% lower annual new construction area and less developer multitasking.

Overall, our study provides valuable insights into the optimal design of presale policies in the real estate market, which holds significant importance in major economies worldwide. Our results underscore the crucial role of postsale supervision in effectively addressing the issue of unfinished projects in mainland China. The widespread occurrence of unfinished developments can be attributed to the lack of adequate oversight in the postsale development phase. Moreover, our findings suggest that the relatively lax presale criterion contributes to the rapid urbanization of China, highlighting the role

of presale policies as a mechanism for stimulating development speed. However, it is crucial to strike a balance between development speed and ensuring project quality to achieve optimal outcomes and sustainable growth. Our model and empirical implications can also be applied to other developing economies, such as India, Russia, and many African countries, where the problem of unfinished buildings is prevalent due to a lack of government supervision.

Last, we acknowledge that our study is subject to a few data limitations. First of all, since we infer unfinished projects from citizen complaints on a website run by the central government, it could underestimate the problem of unfinished projects because of underreporting. It also does not tell us whether the unfinished projects have been eventually finished with a delay or remain unfinished as of today. Nor do we know whether any finished projects are subject to serious quality problems, which is another form of moral hazard that could be related to presale policies. Second, lack of exact geocoding prevents us from linking a particular unfinished project to a specific parcel of land sale, this is why we conduct the analysis at the city-year level rather than the project level. Third, there is no doubt that financial tools and related liability regulations – including home mortgage, developer loans, bonds, and foreclosure polices – play an important role in mainland China's residential housing market and may interact with the presale policies in multiple ways. We do not have adequate data to explicitly address them in this paper, but we hope our data collection efforts on the presale policies and unfinished projects across Chinese cities can help other researchers to explore these additional dimensions in future work.

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# Appendix

## A Four potential outcomes in the presale model

Outcome 1: *Abandon project 1 and ignore project 2*. In this scenario, we need the net payoff from abandoning project 1 to be greater than the net payoff from continuing construction, and the cash flow postsale to be smaller than $M$. Thus, $\xi_1$ and $\xi_2$ satisfy $R - \alpha c - \xi_1 - s(c - \alpha c) - \tau - \xi_2 > R - c - \xi_1$ and $R + K - c - \xi_1 < M$. The conditional probability that outcome 1 occurs after presale is:

$$Pr_1 = \left(\frac{1}{2} - \frac{R + K - c - M}{2\sigma_1}\right)\left(\frac{1}{2} - \frac{\tau - (1 - s)(c - \alpha c)}{2\sigma_2}\right).$$

Outcome 2: *Abandon project 1 and start project 2*. In this scenario, $\xi_1$ and $\xi_2$ satisfy: $R - \alpha c - \xi_1 - s(c - \alpha c) - \tau - \xi_2 > R - c - \xi_1$ and $R + K - c - \xi_1 > M$. Therefore, the conditional probability that outcome 2 occurs after presale is:

$$Pr_2 = \left(\frac{R + K - c - M}{2\sigma_1} + \frac{1}{2}\right)\left(\frac{1}{2} - \frac{\tau - (1 - s)(c - \alpha c)}{2\sigma_2}\right).$$

Outcome 3: *Continue project 1 and ignore project 2*. In this scenario, $\xi_1$ and $\xi_2$ satisfy: $R - \alpha c - \xi_1 - s(c - \alpha c) - \tau - \xi_2 < R - c - \xi_1$ and $R + K - c - \xi_1 < M$. Therefore, the conditional probability that outcome 2 occurs after presale is:

$$Pr_3 = \left(\frac{R + K - \alpha c - M}{2\sigma_1} + \frac{1}{2}\right)\left(\frac{1}{2} - \frac{\tau - (1 - s)(c - \alpha c)}{2\sigma_2}\right).$$

Outcome 4: *Continue project 1 and start project 2*. In this scenario, $\xi_1$ and $\xi_2$ satisfy: $R - \alpha c - \xi_1 - s(c - \alpha c) - \tau < R - c - \xi_1 - \xi_2$ and $R + K - c - \xi_1 - \xi_2 > M$. The conditional probability that outcome 4 occurs after presale is:[41]

$$Pr_4 = 1 - Pr_1 - Pr_2 - Pr_3.$$

## B Proof of the theoretical results

**Proof of Prediction 1:**
$\frac{\partial Pr_{uf}}{\partial s} = \frac{-(c - \alpha c)}{2\sigma_2} < 0$, and $\frac{\partial Pr_{uf}}{\partial \alpha} = \frac{-(c - s \cdot c)}{2\sigma_2} < 0$

[41] Note that when $\frac{1}{2} \geq \frac{R + K - c - M}{2\sigma_1}$, $Pr_1 = 0$, and when $\frac{1}{2} \geq \frac{\tau - (1 - s)(c - \alpha c)}{2\sigma_2}$, $Pr_2 = 0$.

**Proof of Prediction 2:**

When $R + K - c - M < \sigma_1$, $\frac{\partial Pr_{new}}{\partial \alpha} = \frac{-(R+K-c-M)+(K-M-2\alpha c)}{2\sigma_1} - \frac{1}{2} = \frac{-R+c-2\alpha c}{2\sigma_1} - \frac{1}{2} < 0$, since the presale revenue $R$ is assumed to be greater than the construction cost $c$.

When $R + K - c - M \geq \sigma_1$, $\frac{\partial Pr_{new}}{\partial \alpha} = -1 + \frac{K-M-2\alpha c}{2\sigma_1} < 0$, since we assume that the initial cash in hand $K$ is moderately small, such that $K < M + \sigma_1 + \alpha c$

**Proof of Heterogenous Result 1 (i.e., $\frac{\partial Pr_{uf}}{\partial s\ \partial c} < 0$, $\frac{\partial Pr_{uf}}{\partial \alpha\ \partial c} < 0$):**

$\frac{\partial Pr_{uf}}{\partial s \partial c} = \frac{-(1-\alpha)}{2\sigma_2} < 0$, and $\frac{\partial Pr_{uf}}{\partial \alpha \partial c} = \frac{-(1-s)}{2\sigma_2} < 0$

**Proof of Heterogenous Result 2 ( (i.e., $\frac{\partial Pr_{new}}{\partial R\ \partial \alpha} \leq 0$, and, $\frac{\partial Pr_{new}}{\partial c\ \partial \alpha} \geq 0$):**

$\frac{\partial Pr_{new}}{\partial \alpha \partial R} = \frac{-1}{2\sigma_1} < 0$, when $R + K - c - M < \sigma_1$. When $R + K - c - M \geq \sigma_1$, $\frac{\partial Pr_{new}}{\partial \alpha \partial R} = 0$

$\frac{\partial Pr_{new}}{\partial \alpha \partial c} = \frac{-\alpha}{\sigma_1} < 0$, when $R + K - c - M < \sigma_1$. When $R + K - c - M \geq \sigma_1$, $\frac{\partial Pr_{new}}{\partial \alpha \partial c} = 0$

# C Additional data details

Figure A1: Example of a policy document on presale criterion

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厦门市商品房预售管理规定(2022)

第二章 预售项目管理

**第五条** 预售商品房应当符合下列条件：

（一）已交付全部土地使用权出让金，取得土地使用权证书；

（二）持有建设工程规划许可证和施工许可证；

（三）房屋建设工程承包合同已生效，房屋交付使用日期已经确定；

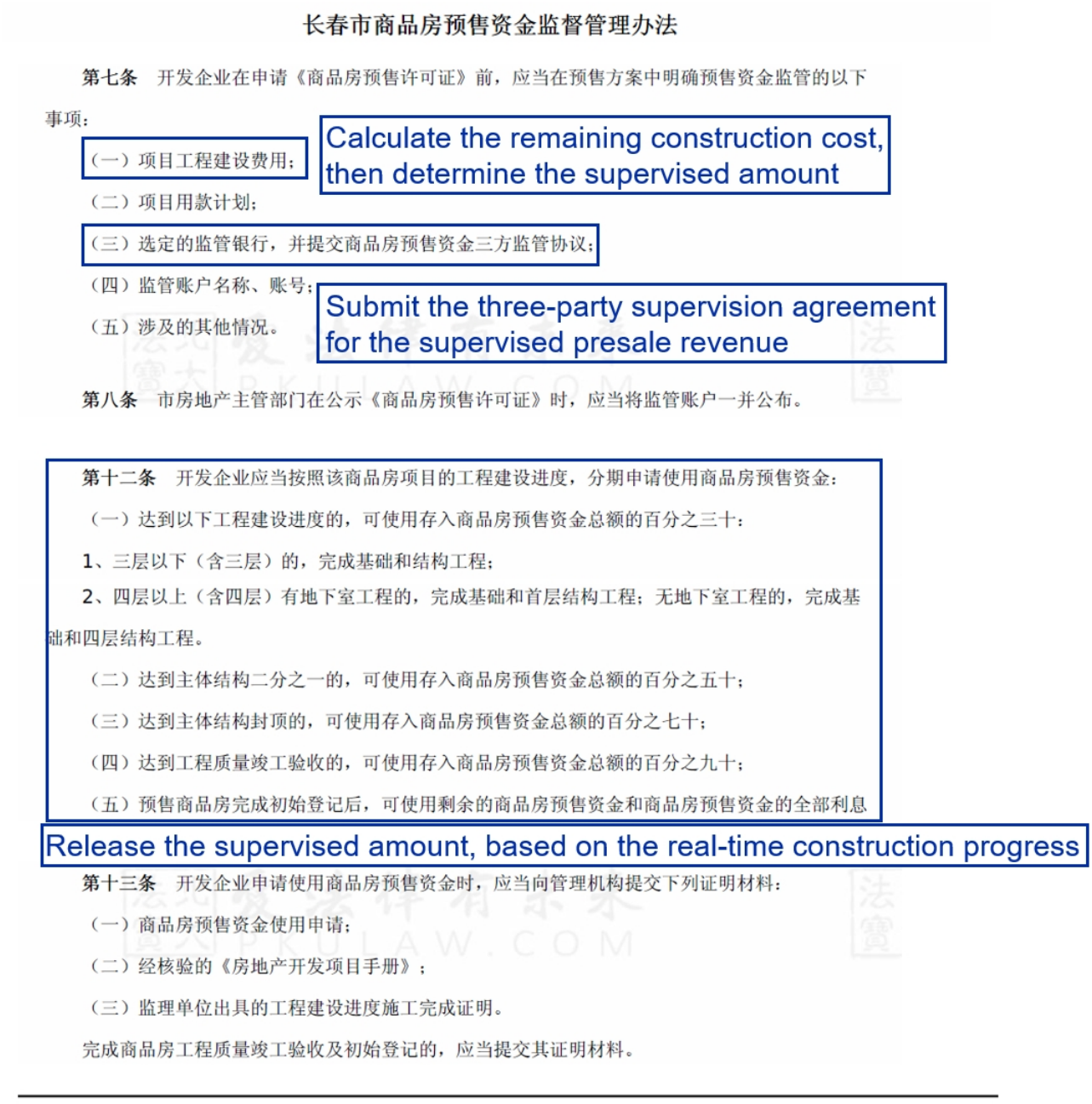
（四）投入开发建设的资金已达到该项目工程建设总投资的25%以上。其中，申请预售商品房项目工程形象进度应达到的标准为：7层以下（含7层）的，已完成主体建筑封顶工程；8层以上（含8层）的，已完成主体结构工程的二分之一以上，且不得少于7层；

（五）已取得预售主管部门核发的商品房预售许可证明。

预售主管部门可以根据市场情况，对前款第四项规定的预售商品房项目工程形象进度进行调整，报市人民政府批准后实施。

Presale criterion:
a. Share of the total construction cost (**25%**)
b. Visual construction progress (**50%** main structure finished)

Figure A2: Example of a policy document on postsale supervision



长春市商品房预售资金监督管理办法

**第七条** 开发企业在申请《商品房预售许可证》前，应当在预售方案中明确预售资金监管的以下事项：

（一）项目工程建设费用；

Calculate the remaining construction cost, then determine the supervised amount

（二）项目用款计划；

（三）选定的监管银行，并提交商品房预售资金三方监管协议；

（四）监管账户名称、账号；

（五）涉及的其他情况。

Submit the three-party supervision agreement for the supervised presale revenue

**第八条** 市房地产主管部门在公示《商品房预售许可证》时，应当将监管账户一并公布。

**第十二条** 开发企业应当按照该商品房项目的工程建设进度，分期申请使用商品房预售资金：

（一）达到以下工程建设进度的，可使用存入商品房预售资金总额的百分之三十：

1、三层以下（含三层）的，完成基础和结构工程；

2、四层以上（含四层）有地下室工程的，完成基础和首层结构工程；无地下室工程的，完成基础和四层结构工程。

（二）达到主体结构二分之一的，可使用存入商品房预售资金总额的百分之五十；

（三）达到主体结构封顶的，可使用存入商品房预售资金总额的百分之七十；

（四）达到工程质量竣工验收的，可使用存入商品房预售资金总额的百分之九十；

（五）预售商品房完成初始登记后，可使用剩余的商品房预售资金和商品房预售资金的全部利息

Release the supervised amount, based on the real-time construction progress

**第十三条** 开发企业申请使用商品房预售资金时，应当向管理机构提交下列证明材料：

（一）商品房预售资金使用申请；

（二）经核验的《房地产开发项目手册》；

（三）监理单位出具的工程建设进度施工完成证明。

完成商品房工程质量竣工验收及初始登记的，应当提交其证明材料。

Figure A3: Screenshot of the local leaders' message board

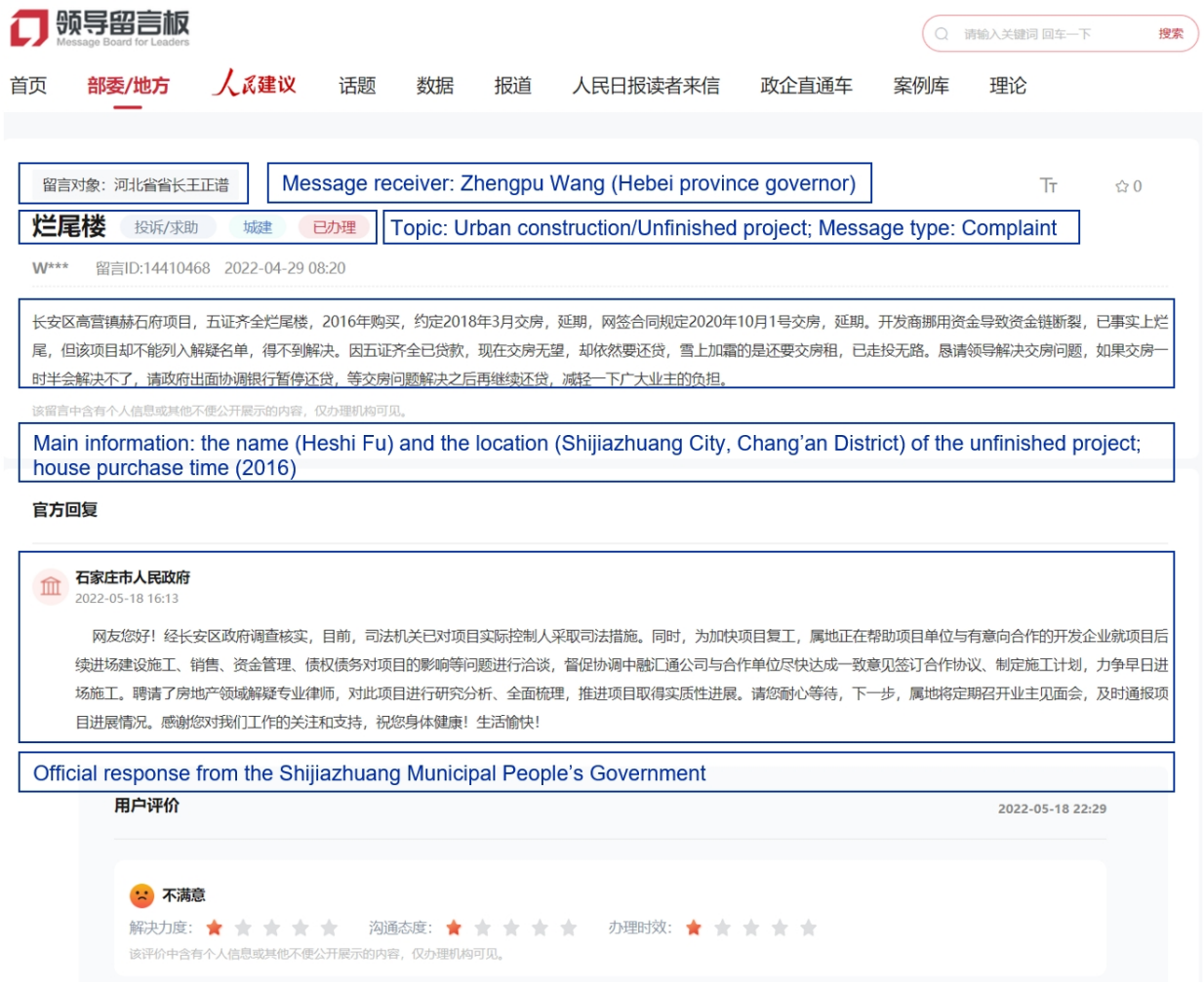
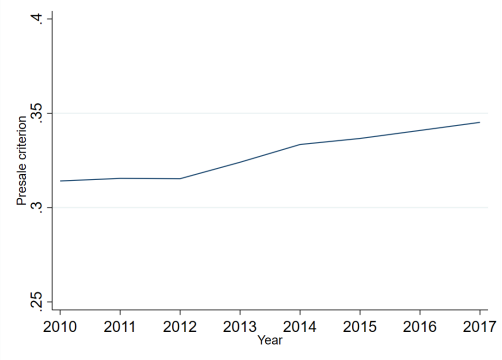
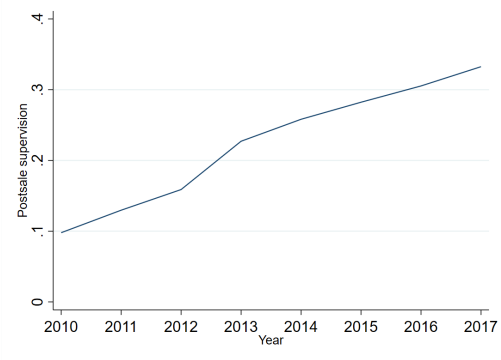


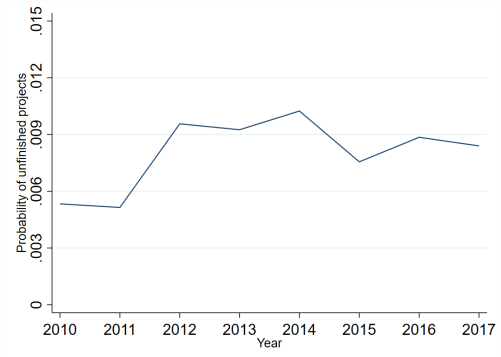
Figure A4: Presale and unfinished projects: Cross-time variation




(a) Presale criterion




(b) Postsale supervision




(c) Probability of unfinished projects

Notes: This figure displays the cross-time variation in the average of presale criterion, postsale supervision, and the probability of unfinished projects from 2010 to 2017.

Table A1: Correlation between four postsale supervision measures

| | $S_{cost}$ | $S_{progress}$ | $S_{third}$ | $S_{mainstructure}$ |
|---|---|---|---|---|
| $S_{cost}$ | 1.0000 | | | |
| $S_{progress}$ | 0.4694 | 1.0000 | | |
| $S_{third}$ | 0.4067 | 0.6757 | 1.0000 | |
| $S_{mainstructure}$ | 0.5709 | 0.5013 | 0.3775 | 1.0000 |

Notes: All coefficients are significant at 1%.

## D What causes presale policy change?

We conduct two analyses to investigate the factors driving changes in presale policies. First, we examine the relatiopnship between the characteristics of mayors and policy changes during their terms. As detailed in Table A2, the dependent variable in Column (1) represents the changes in presale criterion during the mayor's term, denoted by $\alpha_{last} - \alpha_{initial}$. Column (2) uses the dependent variable the changes in post-sale supervision $s_{last} - s_{initial}$. The dependent variable in Columns (3) and (4) is a dummy variable that equals 1 if the mayor strengenthens the presale criterion and post-sale supervision during her term, repspectively. The results show that older mayors are less likely to strengenthen both presale criterion ($\alpha$) and postsale supervision ($s$). This finding is consistent with the results in Zeng and Zhou (2024) and Wang, Zhang, and Zhou (2020), which suggest that older mayors typically have weaker promotion incentives and are reluctant to make substantive policy changes.[42] Mayors' gender and education background do not have a significant impact on the presale policy changes.

Table A2: Presale policy and mayors' characteristics

| Dep. Variable | $\alpha_{last}$-$\alpha_{initial}$ | $s_{last}$-$s_{initial}$ | $D_{\alpha\uparrow}$ | $D_{s\uparrow}$ |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Age | -0.000443 | -0.00639** | -0.00402* | -0.0128** |
| | (0.000463) | (0.00266) | (0.00193) | (0.00485) |
| Education | -0.00259 | -0.0109 | -0.0113 | -0.0248 |
| | (0.00220) | (0.00893) | (0.0117) | (0.0196) |
| Female=1 | 0.00240 | 0.0405 | 0.00593 | 0.0701 |
| | (0.00587) | (0.0416) | (0.0295) | (0.0591) |
| Observations | 886 | 886 | 886 | 886 |
| $R^2$ | 0.322 | 0.317 | 0.301 | 0.305 |
| City FE | Yes | Yes | Yes | Yes |
| First year FE | Yes | Yes | Yes | Yes |

Notes: (1) The dependent variable in the first two columns is the change in the presale policy variables, $\alpha$ and $s$, during the mayor's term. The dependent variable in Columns (3) and (4) is a dummy variable that equals 1 if the mayor strengthens the presale policy during their term. (2) Explantory variables include the mayor's average age during her term, education attainment, and gender. (3) Since the data is collapsed at the mayor level, year fixed effects are not included in these regressions. We control for fixed effects for the first year the mayor is in office (i.e., First year FE in the table). (4) Robust standard errors clustered at the city level are reported in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Second, we examine the relationship between city characteristics and changes in pre-

[42] Note that we control for mayors' characteritics in the main regression results.

sale policies. Table A3 suggests that large cities and provincial capitals are more likely to have more stringent presale policies in both the presale criterion ($\alpha$) and postsale supervision ($s$). However, the results in Columns (5) to (8) suggest that there is no statistically significant difference in the *changes* in these presale policies from 2010 to 2017.

Table A3: Presale policy and cities' characteristics

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| Dep variable | Average presale policy intensity | | | | Changes in presale policy from 2010 to 2017 | | | |
| | $\alpha$ | $\alpha$ | s | s | $\alpha_{2017-2010}$ | $\alpha_{2017-2010}$ | $s_{2017-2010}$ | $s_{2017-2010}$ |
| Big city=1 | 0.110*** | | 0.158** | | 0.00993 | | 0.0522 | |
| | (0.0376) | | (0.0644) | | (0.0196) | | (0.0869) | |
| Provincial capital=1 | | 0.0551** | | 0.0989** | | -0.00774 | | 0.0830 |
| | | (0.0262) | | (0.0500) | | (0.0138) | | (0.0606) |
| Observations | 270 | 270 | 270 | 270 | 264 | 264 | 264 | 264 |
| R-squared | 0.056 | 0.022 | 0.028 | 0.017 | 0.001 | 0.001 | 0.002 | 0.008 |

Notes: (1) The dependent variable in the first four columns is the average presale policy intensity at the city level between 2010 and 2017. The dependent variable in columns 5-8 is the changes in the presale policy from 2010 to 2017. (2) Big city is a dummy variable that equals 1 if the city is identified as new tier 1 city or above based on the Yicai Report (https://m.yicai.com/news/101769520.html). (3) Robust standard errors are reported in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

# E A placebo test: Do any other real estate policies relate to the presale policy change?

One potential concern with our empirical strategy is that other policies aimed at reducing unfinished projects and/or regulating the real estate market might correlate with changes in the presale policy. To address this concern, we conduct a placebo test to examine whether these policies are correlated with presale policy changes.

Table A4, panel (a), reports the relationship between presale policies and other policies aimed at reducing unfinished projects. We collected all laws and local government regulations containing the term "unfinished" (*lan wei*, in Chinese) from the China Law Database. We then created a dummy variable set to 1 if a city-year has other policies mentioning "unfinished" and regressed it on the presale criterion and postsale supervision in our data. The results suggest that neither the presale criterion nor postsale supervision has a statistically significant correlation with additional policies related to unfinished buildings.

Table A4: Presale policies and other real estate policies

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| **Panel (a). Dep. Variable: Dummy of any other policies that relate to unfinished projects** | | | | | |
| Presale Criterion ($\alpha$) | 0.00996 | | 0.00991 | 0.00986 | 0.0152 |
| | (0.0185) | | (0.0185) | (0.0183) | (0.0259) |
| Postsale Supervision ($s$) | | 0.00268 | 0.00258 | 0.00152 | 0.0155 |
| | | (0.0115) | (0.0116) | (0.0112) | (0.0162) |
| Observations | 2144 | 2144 | 2144 | 2144 | 1878 |
| Adjusted $R^2$ | 0.607 | 0.607 | 0.607 | 0.608 | 0.600 |
| **Panel (b). Dep. Variable: Dummy of austerity real eatate policies** | | | | | |
| Presale Criterion ($\alpha$) | -0.00373 | | -0.00367 | -0.00377 | -0.0112 |
| | (0.00720) | | (0.00719) | (0.00726) | (0.0104) |
| Postsale Supervision ($s$) | | -0.00271 | -0.00268 | -0.00280 | -0.00425 |
| | | (0.00499) | (0.00500) | (0.00501) | (0.00732) |
| Observations | 2144 | 2144 | 2144 | 2144 | 1878 |
| Adjusted $R^2$ | 0.199 | 0.199 | 0.199 | 0.197 | 0.217 |
| **Panel (c). Dep. Variable: Dummy of expansianry real eatate policies** | | | | | |
| Presale Criterion ($\alpha$) | 0.0100 | | 0.00982 | 0.0102 | -0.000369 |
| | (0.0120) | | (0.0120) | (0.0122) | (0.0171) |
| Postsale Supervision ($s$) | | 0.0104 | 0.0104 | 0.0104 | 0.00937 |
| | | (0.00835) | (0.00836) | (0.00839) | (0.0106) |
| Observations | 2144 | 2144 | 2144 | 2144 | 1878 |
| Adjusted $R^2$ | 0.308 | 0.308 | 0.308 | 0.308 | 0.286 |
| Extra controls | No | No | No | Yes | Yes |
| Donut analysis | No | No | No | No | Yes |
| City FE | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes |

Notes: (1) In panel (a), the dependent variable is the dummy variable representing the other policies that relate to unfinished buildings. In panel (b) and (c), the dependent variable is the dummy variable representing the other austerity and expansionary real estate policies, respectively. (2) Robust standard errors clustered at the city level are reported in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

To identify austerity real estate policies, we searched the China Law Database for laws and regulations containing "real estate" alongside terms like "regulation," "restriction," or "supervision." Expansionary real estate policies were defined as those containing "real estate" but not these specific terms. The results reported in panels (b) and (c) of Table A4 suggest that neither the presale criterion nor postsale supervision correlates with austerity or expansionary real estate policies.

Nonetheless, we control for the dummy variables of all three additional policies in the main regressions for completeness.

## F Presale and unfinished projects: Extensive and intensive margins

This section examines the impact of presale policies on unfinished projects in both extensive and intensive margins. The results are presented in Table A5. The dependent variable in Panel (a) is a dummy that switches on if a city-year has *any* unfinished projects. In Panel (b) we examine the impact of presale on the probability of unfinished projects from the extensive margin, only keeping the observations with a positive probability of unfinished projects.

Table A5: Presale and unfinished projects

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| **Panel (a). Extensive margin: Dummy of unfinished project occurrence** | | | | | |
| Presale Criterion ($\alpha$) | -0.0488** | | -0.0485** | -0.0485** | -0.0481* |
| | (0.0241) | | (0.0242) | (0.0236) | (0.0254) |
| Postsale Supervision ($s$) | | -0.0125 | -0.0121 | -0.0123 | -0.0308 |
| | | (0.0204) | (0.0204) | (0.0203) | (0.0228) |
| Observations | 2,144 | 2,144 | 2,144 | 2,144 | 1,878 |
| Adjusted $R^2$ | 0.354 | 0.353 | 0.354 | 0.354 | 0.364 |
| **Panel (b). Intensive margin: Probability of a project being unfinished (%)** | | | | | |
| Presale Criterion ($\alpha$) | 0.00940 | | -0.0242 | 0.0219 | -0.202 |
| | (0.246) | | (0.239) | (0.217) | (0.350) |
| Postsale Supervision ($s$) | | -0.334*** | -0.335*** | -0.305*** | -0.539*** |
| | | (0.101) | (0.102) | (0.109) | (0.180) |
| Observations | 797 | 797 | 797 | 797 | 670 |
| Adjusted $R^2$ | 0.429 | 0.436 | 0.435 | 0.448 | 0.442 |
| Extra controls | No | No | No | Yes | Yes |
| Donut analysis | No | No | No | No | Yes |
| City FE | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes |

Notes: (1) This table replicates Table 3, but in panel (a), the dependent variable is the dummy variable representing the occurrence of any unfinished projects. (2) Panel (b) uses the same dependent variable but excludes the city-years that do not have any unfinished projects. (3) Robust standard errors clustered at the city level are reported in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

The decomposition results suggest that presale criterion mainly reduces unfinished projects from the extensive margin. In contrast, post-sale supervision has a more significant impact on the intensive margin. Earlier presale exposes the project to more risks post-sale. Therefore, even in cities with stringent post-sale supervision, some unfinished projects may occur, resulting in the outcome variable being labeled as '1' in Panel (a), though the probability of a project remaining unfinished is low due to stringent post-sale

supervision.

## G Heterogeneity analysis

We focus on two sources of heterogeneity: expected construction costs $c$ and presale revenue $R$. Our model predicts that: (1) construction costs $c$ amplify the impact of presale criterion $\alpha$ and postsale supervision $s$ in reducing unfinished projects; (2) presale revenue has no heterogenous impact on unfinished projects; (3) both construction costs $c$ and presale revenue $R$ can amplify the negative impact of $\alpha$ on developers' multitasking behavior, though the magnitude of the effect of $c$ may be smaller; and (4) $c$ and $R$ would play a limited role in moderating the impact of postsale supervision on multitasking developers.

We use the urban building earthquake resistance requirements as a proxy for expected construction costs $c$. These requirements are established by the central government and serve as a guideline for construction standards. Cities are classified into three tiers based on their geographic conditions. Approximately 50% of cities are classified as Tier 1, where buildings are designed to withstand magnitude 6 earthquakes. Around 40% of cities fall into Tier 2, with buildings constructed to withstand magnitude 7 earthquakes. The remaining 10% of cities are designated as Tier 3, with buildings designed to withstand magnitude 8 earthquakes. As we move up one tier, the construction costs typically increase by 10% to 15%. To measure presale revenue, we use the average housing price per square meter minus the average land price per square meter in 2010 as a proxy. Using pre-determined $R$ helps us to circumvent the endogeneity of concurrent $R$.

The heterogeneity results reported in Table A6 are in line with our model predictions.[43] Specifically, we find that construction costs $c$ could amplify the negative link between postsale supervision $s$ and unfinished projects. The interaction term between construction costs $c$ and presale criterion $\alpha$ also exhibits a negative sign, indicating that higher construction costs can also strengthen the negative link between stricter presale criterion and unfinished projects. However, the estimation of this interaction term is imprecise, which could be attributed to the imprecise estimation of the standalone coefficient of presale criterion ($\alpha$) on unfinished projects.

In line with our expectations, presale revenue significantly amplifies the negative link

[43]Note that we focus on developers' multitasking behavior in this exercise, as it directly links to the theretical model and we have some missing data in the new construction area.

Table A6: Heterogeneity analysis: Construction costs and presale revenue

| Dep. Variable | Probability of unfinished project | | | # of projects (Poisson) | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Presale Criterion ($\alpha$) | -0.161* | -0.142* | -0.155* | -0.0169** | -0.0147** | -0.0164** |
| | (0.0894) | (0.0819) | (0.0883) | (0.00684) | (0.00619) | (0.00646) |
| Postsale Supervision ($s$) | -0.189*** | -0.160*** | -0.197*** | -0.00735* | -0.00641 | -0.00752* |
| | (0.0555) | (0.0506) | (0.0552) | (0.00424) | (0.00402) | (0.00423) |
| Presale Criterion × Construction Cost | -0.0553 | | -0.0525 | -0.00775 | | -0.00494 |
| | (0.108) | | (0.112) | (0.00725) | | (0.00784) |
| Postsale Supervision × Construction Cost | -0.112** | | -0.130** | -0.00721* | | -0.00717* |
| | (0.0540) | | (0.0546) | (0.00374) | | (0.00373) |
| Presale Criterion × Revenue | | -0.0235 | -0.0127 | | -0.00697*** | -0.00586** |
| | | (0.0564) | (0.0596) | | (0.00223) | (0.00286) |
| Postsale Supervision × Revenue | | 0.0573 | 0.105 | | -0.00323 | -0.00113 |
| | | (0.0705) | (0.0783) | | (0.00658) | (0.00634) |
| Observations | 2,144 | 2,144 | 2,144 | 364,248 | 364,248 | 364,248 |
| Adjusted $R^2$ | 0.446 | 0.445 | 0.446 | | | |
| Pseudo $R^2$ | | | | 0.024 | 0.024 | 0.024 |
| Extra controls | Yes | Yes | Yes | Yes | Yes | Yes |
| City FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |

Notes: (1) Control variables are the same as previously defined in Table 3. (2) We normalize presale criterion $\alpha$ and postsale supervision $s$ to a distribution with mean zero and standard deviation 1. (3) All regressions include city and year fixed effects. (4) Robust standard errors clustered at the city level are reported in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

between presale criterion ($\alpha$) and multitasking behavior among developers. This finding supports Prediction 4 that higher presale revenue strengthens the deterrent effect of a stricter presale criterion on multitasking developers. Note that we observe the interaction term between construction costs and postsale supervision to be negative in Columns (4) and (6), although it is only marginally significant with 90% confidence. This could be attributed to the fact that, in reality, developers can obtain a portion of the supervised construction costs $c$ before the final stage of the game when the postsale supervision $s$ is low. This can enhance the developers' cash flow before $t = 1$.

## H Robustness checks

We conduct several robustness checks. First, we use an event study approach to check the pretrend and dynamic treatment effects. We also check the robustness of our results when we use alternative weights to construct the postsale supervision $S$, and use the absolute number of unfinished projects as the outcome variable. Finally, we test the

robustness of using restricted samples.

### H.1 Event study results

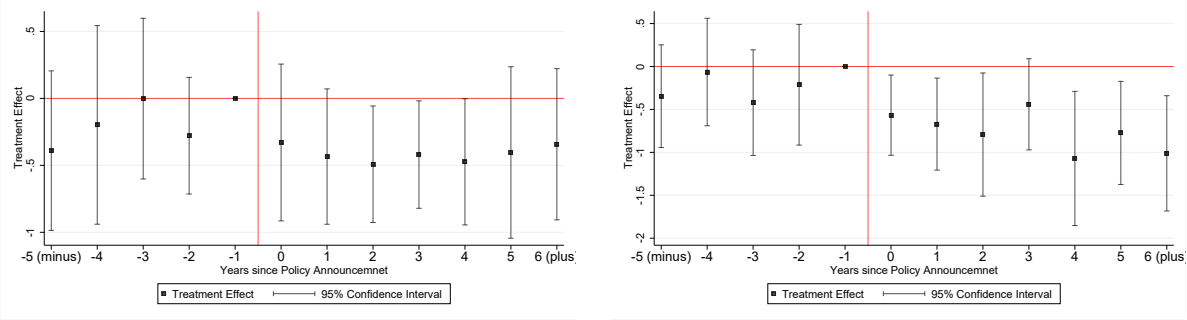
We transform the continuous presale policy variables $\alpha_{j,t}$ and $s_{j,t}$ into binary indicators, denoted by $Dsj,t$ and $D\alpha_{j,t}$. Specifically, we define $Ds_{j,t} = 1$ if $s_{j,t} > 0.5$, which implies that at least two out of the four supervision indicators are met. For presale criterion, we define $D\alpha_{j,t} = 1$ if $\alpha_{j,t} > 0.25$, implying that the city has increased the presale criterion strictly above the national minimum of 0.25.

In Figure A5, we present the event study results of the two presale policy dummies on the probability of unfinished projects. Consistent with our main regression results reported in Table 3 Panel (b), we find a significant drop in the unfinished projects almost immediately after the postsale supervision dummy $Ds$ increases from 0 to 1. This effect remains relatively stable afterwards. In Panel (a), we also find the presale criterion dummy $D\alpha$ reduces the unfinished projects probability, but the estimates are less precise. We do not find a significant difference of pretreatment trends in both graphs.

Figure A6 and Figure A7 present the event study results of the two presale policy dummies on multitasking developers and annual new house construction area, respectively. The results in Panel (a) suggest that during the pre-treatment periods, the presale criterion dummy $D\alpha$ has a small and insignificant impact on multitasking developers and annual new house construction area. The impact of $D\alpha$ becomes negative and increases over time after the treatment. This pattern can be attributed to the fact that constructing a residential apartment complex typically requires three years to complete. Consequently, in the initial one or two years after the treatment, developers are still working on the projects they acquired prior to the treatment. Similar to our regression results, we find an imprecise impact of the postsale supervision dummy $Ds$ on multitasking developers and annual new house construction area.

Figure A8 presents the event study results regarding auction success rate and land price, revealing an immediate drop in the auction success rate after an increase in the presale criterion dummy $D\alpha$. This effect remains relatively stable in the subsequent years. For the postsale supervision dummy $Ds$, we generally find it has no impact on the auction success rate. Although there is an imprecise jump happens after 5 years of policy implementation. However, this jump is likely driven by a few observations given that our sample spans for nine years (2010-2017), and many changes in the postsale

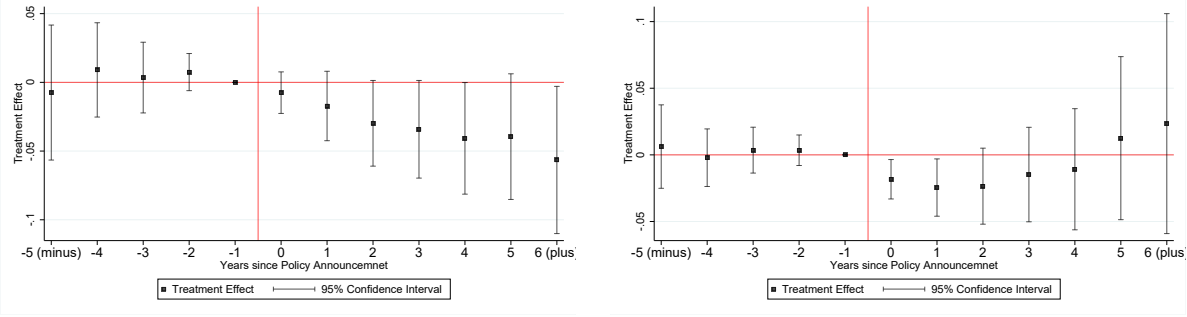
Figure A5: Presale and unfinished projects: Event study




(a) Presale criterion (b) Postsale supervision

Notes: (1) This figure displays the event study, using the variant of Equation 5. (2) In order to improve the statistical power, observations 6 or more years after the treatment are categorized in the event window '6 (plus),' and those 5 or more years prior to treatment are categorized in the event window '-5 (minus).' (3) The omitted category $t = -1$ is the calendar year prior to the policy treatment. (4) The capped spikes (I-beams) plot the 95% confidence interval for the estimates.

Figure A6: Presale and multitasking developers: Event study

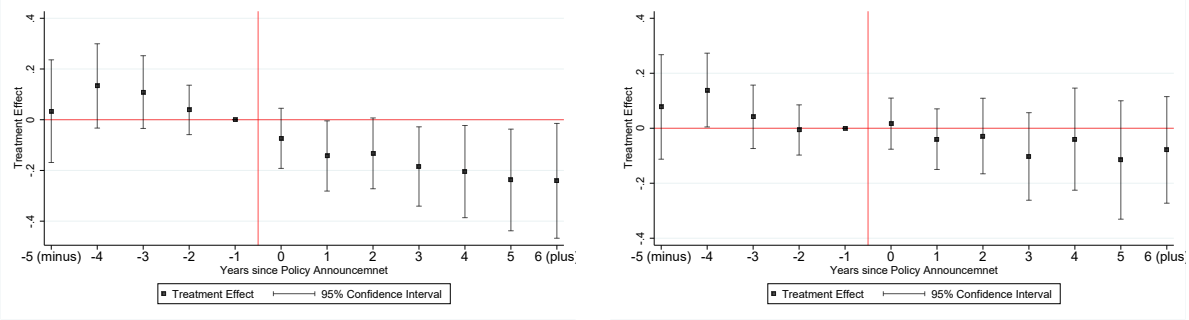



(a) Presale Criterion (b) Postsale supervision

Notes: (1) This figure displays the event study, using the variant of Equation 6. (2) In order to improve the statistical power, observations 6 or more years after the treatment are categorized in the event window '6 (plus),' and those 5 or more years prior to treatment are categorized in the event window '-5 (minus).' (3)The omitted category $t = -1$ is the calendar year prior to the policy treatment. (4) The capped spikes (I-beams) plot the 95% confidence interval for the estimates.

supervision dummy $Ds$ took place after 2013. Consistent with our regression results, we find no impact of both $D\alpha$ and $Ds$ on land transaction price. As aforementioned, this is due to most lands transacted only have one bidder and are transacted at the reserve price.

Figure A7: Presale and new house development: Event study




(a) Presale criterion

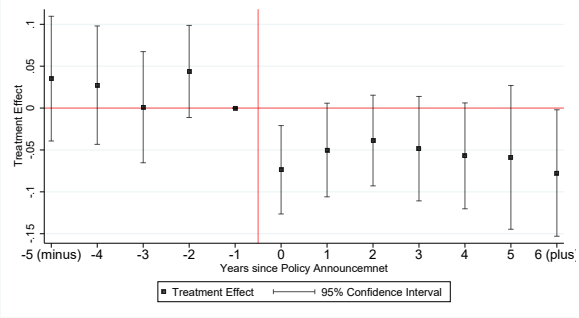
(b) Postsale supervision

Notes: (1) This figure displays the event study, using the variant of Equation 7. (2) In order to improve the statistical power, observations 6 or more years after the treatment are categorized in the event window '6 (plus),' and those 5 or more years prior to treatment are categorized in the event window '-5 (minus).' (3) The omitted category $t = -1$ is the calendar year prior to the policy treatment. (4) The capped spikes (I-beams) plot the 95% confidence interval for the estimates.

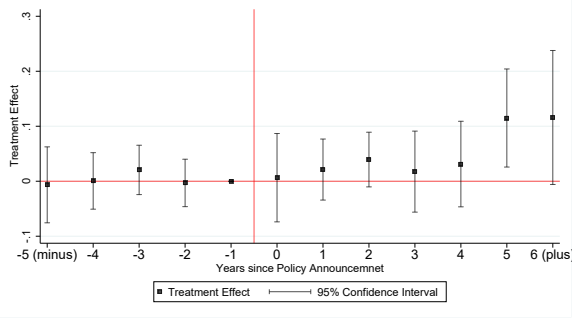
### H.2 Alternative measures of $s$

It is plausible to raise concerns about the potential arbitrariness in defining the measure of postsale supervision. To address this, we have constructed two alternative measures, adjusting the weight assigned to the four key components: $S_{cost}$, $S_{progress}$, $S_{superstructure}$, and $S_{third}$. First, we apply uniform weights (0.25 each) to all four components in the construction of the $s$ measurement. The outcomes of this approach are displayed in Table A7 Panel (a). Second, we assign greater weight to $S_{cost}$ and $S_{superstructure}$ (0.3 and 0.4, respectively), in alignment with the emphasis placed on the two components by construction experts. The results of this adjustment can be found in Panel (b). Reassuringly, regardless of alternative measures of $s$ used, the effect of presale policies remains robust.

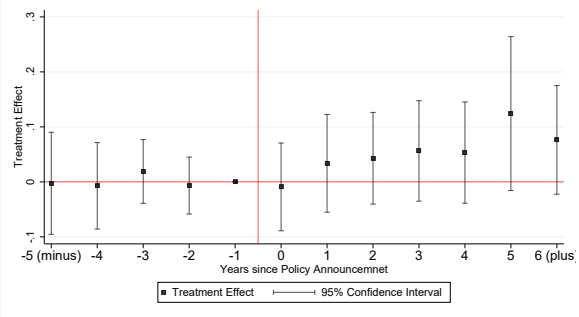
Figure A8: Presale and land market outcomes: Event study



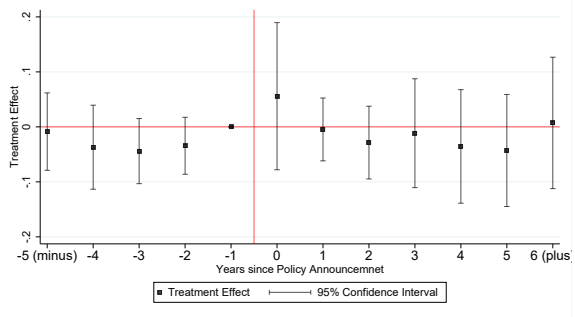

(a) Success rate (Presale criterion)




(b) Success rate (Postsale supervision)




(c) Auction price (Presale criterion)




(d) Auction price (Postsale supervision)

Notes: (1) This figure displays the event study, using the variant of Equation 8. (2) In order to improve the statistical power, observations 6 or more years after the treatment are categorized in the event window '6 (plus),' and those 5 or more years prior to treatment are categorized in the event window '-5 (minus).' (3) The omitted category $t = -1$ is the calendar year prior to the policy treatment. (4) The capped spikes (I-beams) plot the 95% confidence interval for the estimates.

## H.3 Alternative measures of unfinished projects

Table A7: Robustness checks: Alternative measure of postsale supervision ($s$)

| Dep. Variable | Unfinished project | Multitasking | Auction success | Price |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| **Panel (a): Alternative** $S = 0.25 \cdot S_{cost} + 0.25 \cdot S_{progress} + 0.25 \cdot (1 - \frac{S_{superstructure} - 0.5}{0.5}) + 0.25 \cdot S_{third}$ | | | | |
| Presale Criterion ($\alpha$) | -0.142* | -0.0140** | -0.0287*** | 0.0146 |
| | (0.0813) | (0.00700) | (0.00766) | (0.0180) |
| postsale supervision (alter measure 1) | -0.166*** | -0.00649 | -0.000268 | 0.0253 |
| | (0.0533) | (0.00435) | (0.0110) | (0.0170) |
| Observations | 2,144 | 364,248 | 144,948 | 95,240 |
| Adjusted $R^2$ | 0.445 | | 0.093 | 0.967 |
| Pseudo $R^2$ | | 0.024 | | |
| **Panel (b): Alternative** $S = 0.3 \cdot S_{cost} + 0.15 \cdot S_{progress} + 0.4 \cdot (1 - \frac{S_{superstructure} - 0.5}{0.5}) + 0.15 \cdot S_{third}$ | | | | |
| Presale Criterion ($\alpha$) | -0.142* | -0.0140** | -0.0287*** | 0.0146 |
| | (0.0813) | (0.00700) | (0.00766) | (0.0180) |
| postsale supervision (alter measure 2) | -0.155*** | -0.00597 | -0.000249 | 0.0235 |
| | (0.0498) | (0.00400) | (0.0102) | (0.0158) |
| Observations | 2,144 | 364,248 | 144,948 | 95,240 |
| Adjusted $R^2$ | 0.445 | | 0.093 | 0.967 |
| Pseudo $R^2$ | | 0.024 | | |
| Extra controls | Yes | Yes | Yes | Yes |
| Donut analysis | No | No | No | No |
| City FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |

Notes: (1) This table replicates the results for Column (4) in Table 3, 4, and 6 but uses alternative measures of postsale supervision ($s$). The results for other columns remain robust. (2) Robust standard errors clustered at the city level are reported in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

## H.4 Sample restriction

Table A8: Presale and unfinished projects

| Dep. Variable | # of unfinished projects (Poisson) | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Presale Criterion ($\alpha$) | 0.0530 | | 0.0358 | 0.0529 | -0.0589 |
| | (0.106) | | (0.101) | (0.0951) | (0.139) |
| Postsale Supervision ($s$) | | -0.153*** | -0.151*** | -0.129*** | -0.213*** |
| | | (0.0491) | (0.0486) | (0.0475) | (0.0572) |
| Observations | 2,144 | 2,144 | 2,144 | 2,144 | 1,878 |
| Peseudo $R^2$ | 0.446 | 0.448 | 0.448 | 0.452 | 0.459 |
| Extra controls | No | No | No | Yes | Yes |
| Donut analysis | No | No | No | No | Yes |
| City FE | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes |

Notes: (1) This table replicates Table 3 but uses the dependent variable the absolute number of unfinished projects, using Poisson pseudo-likelihood regression (Correia, Guimarães, and Zylkin, 2020). (2) Control variables are the same as in Table 3. (3) All regressions include city and year fixed effects. (4) Robust standard errors clustered at the city level are reported in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

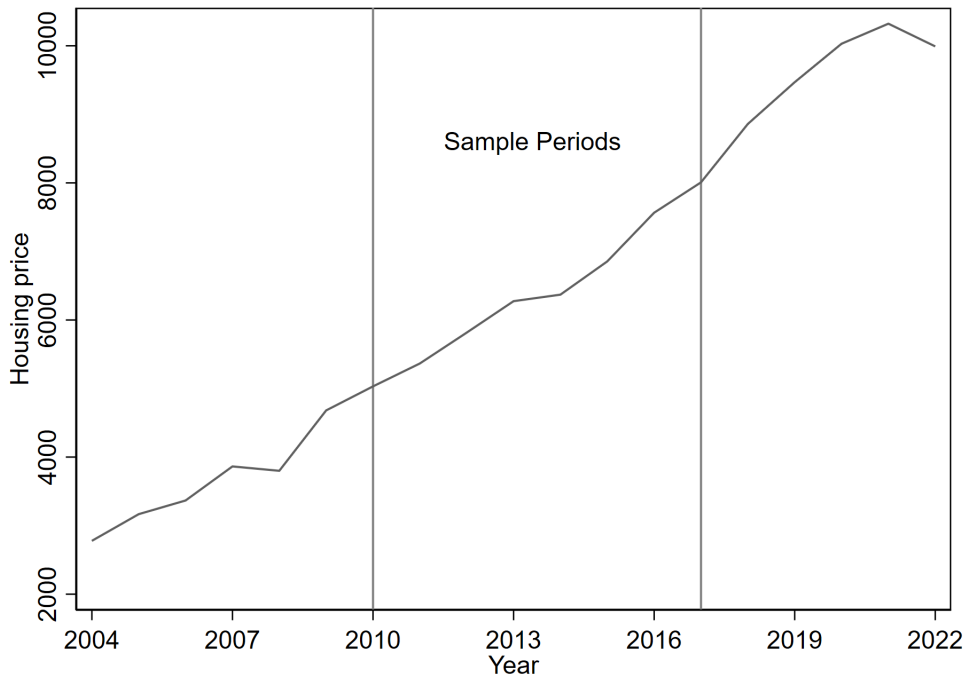
Table A9: Presale and multitasking developers: Remove top-50 developers

| Dep. Variable | # of projects (Poisson) | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Presale Criterion ($\alpha$) | -0.0152** | | -0.0153** | -0.0153** | -0.0195** |
| | (0.00658) | | (0.00668) | (0.00690) | (0.00933) |
| Postsale Supervision ($s$) | | -0.00722* | -0.00733* | -0.00658 | -0.00580 |
| | | (0.00424) | (0.00421) | (0.00409) | (0.00602) |
| Sample mean | 1.73 | 1.73 | 1.73 | 1.73 | 1.73 |
| Observations | 351,036 | 351,036 | 351,036 | 351,036 | 291,612 |
| Pseudo $R^2$ | 0.024 | 0.024 | 0.024 | 0.024 | 0.025 |
| Extra controls | No | No | No | Yes | Yes |
| Donut analysis | No | No | No | No | Yes |
| City FE | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes |

Notes: (1) This table uses the specification as in Table 4 but removes top-50 developers from the working sample. (2) Control variables are the same as in Table 4. (3) * significant at 10%; ** significant at 5%; *** significant at 1%.

# I Housing price over time

Figure A9: Housing price over time




Notes: The national average housing price used in this figure is sourced from the National Bureau of Statistics.