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Anatomy of a Bubble: Causes, Consequences, and Market Trajectories in China's Real Estate Crisis

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Introduction

Following the COVID-19 pandemic, the Chinese real estate market exhibited one of the worst downturns in history. The crisis reached a peak in 2021 with the collapse of major property developers, most notably China Evergrande Group once China's largest real estate company, which defaulted on more than \$300 billion in debt. The crisis was fueled by several simultaneous factors like unsustainable levels of debt, speculative investment, and demographic changes. Even after the introduction of policy measures by the Chinese government, the tide of defaults didn't halt, signaling structural vulnerabilities in the sector. This triggered a liquidity squeeze, which resulted in unfinished projects, falling property prices, and a sharp slowdown of economic growth. The size of the collapse was so huge that it became not only a Chinese issue, but rather a considerable menace for the whole global financial stability.

The purpose of this study is to analyze the crisis of the real estate market that emerged during the post-pandemic era, from 2020 until today. This research will adopt both qualitative and quantitative approaches: first a qualitative review of available literature, comprising articles, papers, and books, will lay the foundation for understanding the crisis; and second quantitative analysis using econometric techniques will be conducted as a way to pursue an empirical investigation.

The study is structured around two main goals. The first is to identify and analyze the cause of the collapse of the residential market, focusing on the determinants that led to the actual inflation of the real estate bubble. Chapter 1 "China's Real Estate Landscape," will give a broad overview of the Chinese real estate sector, putting into context the analysis that will follow in the subsequent chapter. Chapter 2 "China's Housing Market Crisis," provides more information on the fundamental drivers of the crisis such as demographic changes, speculative investment in housing, excessive leveraging by developers and policy interventions that have so far been carried out to stabilize the market.

The second objective of this study is to evaluate the current state of the residential market and hypothesize which phase of the real estate market cycle we are currently in. Drawing on the insights from Chapter 2, Chapter 3 "Empirical Analysis of the Chinese Housing Market", will use empirical methodologies to derive statistical results, which will be compared against the theoretical frameworks and qualitative findings explored earlier.

By investigating both the causes and the current state of the Chinese real estate crisis, this study aims to first: contribute to a broader understanding of the behaviors and causes leading to the inflation of housing market's bubbles, and second: generate solid foundation on which taking investment decisions, assessing both the immediate impact of the crisis and the long-term trajectory of the real estate sector in China.

Chapter I

China's Real Estate Landscape

1. China's Real Estate Landscape

The real estate market is not only a crucial driver of economic growth in China but also a reflection of the complex economic evolution, regional disparities, and intricate legal framework of the nation. Understanding the multifaceted dynamics of this market requires an analysis of its historical context, provincial variations, and legal intricacies.

This chapter explores the diversified landscape of China's real estate industry examining the nation's economic transformation from centrally planned socialism to a market-driven dynamism. Since the initiation of its economic reform in 1978, the country went through high increases in GDP growth and urbanization that reshaped the country's financial landscape, while at the same time, it opened an era for a new dynamic real estate industry.

This chapter provides a window into how provincial dynamics impact the configuration of the property market, as well as the various challenges and opportunities present within the different regions of China: from industrial hubs in the northeast to technology-driven coastal cities, each province presents unique economic structures and policy landscapes that set trends for real estate and investment strategies.

Consequently, there will be an analysis of the legal system of property rights in China, including insights into laws and rules relevant to real estate investment for domestic and foreign investors, from constitutional protections through property laws to regulatory changes, it is essential to understand the legal landscape to identify and navigate the complexities of the Chinese real estate market.

Through the overview of these aspects, this chapter will give a complete comprehension of the Chinese real estate environment, hence arming the stakeholders with the knowledge they need to make informed decisions concerning this dynamic market.

1.1 China's Journey: From Ancient Civilization to Global Economic Powerhouse

The Chinese civilization's history goes back several millennia, through many great transitions and phases. China underwent centuries of evolution, starting from the time when early centralized states were settled to unify in one vast country. The ancient state of China is renowned for its high cultural achievements, philosophy, art, science and rich development of the deep political and social organization.

During its imperial age, China had cycles of growth, consolidation, and periods of instability: dynasties rose and were brought down. Thanks to territorial expansions, flourishing trade, and innovation, China became the main regional power of East Asia. At the same time internal fighting, invasions, and external strains slowly shaved away its power, until it gradually morphed into something else.

Great changes occurred in China in the 20th century; imperialism was abolished and new political theories were established in order to determine the direction of the country. China emerged out of the chaos of those years under the form of a communist state, requiring centralized planning and strict political control. The leadership encouraged industrialization and emphasized both collective ownership and a state-driven economy, at the same time though, had to deal with massive socio-economic problems (Britannica, 2024).

Since the initiation of the economic reform in 1978, China has experienced a profound transition from a centrally planned, communist economy to a dynamic, market-oriented system. The transformation is characterized by unprecedented GDP growth averaging over 9 percent per year and the lift-up of more than 800 million people out of poverty. From a socialist era marked by rigid controls and collective ownership, China rapidly moved towards an open market-oriented economy that embraced some aspects of capitalism while maintaining the political skeleton of the Communist Party.

The late-1970s reforms initiated by Deng Xiaoping, led in the direction of reforms that began a process of rapid economic liberalization and modernization. Under the new mindset of "reform and opening up," the Chinese government worked out ways to decentralize economic decisions, spur entrepreneurship and attract foreign investment. Such freedom from the constraints of central planning, unleashed entrepreneurial spirits and sparked waves of innovation and economic dynamism among the Chinese citizens.

The economic landscape of China changed drastically over the past few decades. It went from being agrarian-oriented one to becoming the "the world's factory", thanks to an abundance of cheap labor and natural resources. Foreign direct investment poured into China, fueling the growth of export-oriented industries, driving urbanization on an unprecedented scale. The Chinese government, on its part, took several pragmatic policy decisions in an attempt to pursue economic stabilization, such as the creation of special economic zones and the gradual liberalization of trade and investment regulation.

However, alongside China's remarkable economic progress, the transition also faced significant challenges, like the persistent influence of the socialist era, particularly the dominance of state-owned enterprises and bureaucratic inefficiencies, which has hindered deeper reforms and slowed the shift toward a fully market-oriented economy. Additionally, rapid growth has brought environmental degradation, widened income inequality, and increased social disparities, raising concerns about the long-term sustainability and inclusiveness of China's development model.

As a countermeasure, the Chinese government has taken up many reform agendas to rebalance its economy in support of sustainable development and further social welfare. This involves a more rule-of-law-driven society, promotion of innovation and entrepreneurship, and addressing the phenomenon of deteriorating environment conditions through stringent environmental regulations for promoting renewable sources of energy.

Going forward, China will need to negotiate the complex interaction of economic liberalization with political control and manage impulses for economic growth with the prerequisites for social stability and political legitimacy.

The transformation from a centrally planned to a market-oriented economy has been one of the most significant changes in modern history. With the continuous reforms in China, enormous opportunities as well as challenges are created, requiring courageous leadership, innovative policy-making, and commitment to inclusive and sustainable development (The World Bank, 2023).

1.2 Understanding China's Provincial Dynamics: Implications for Real Estate Analysis

China's vast and diversified economic landscape, caught between opportunities and challenges, given the unique geographical, demographic, and historical factors, holds one of the largest global economies. Marked by swift industrialization and urbanization, it transited from an agrarian society to a global manufacturing powerhouse in a short span of time.

China's economic rise over the past several decades has been accompanied by stunning regional disparities, some provinces rose faster due to the benefits of privileged policies, infrastructural investment, and opening to global markets. An example is the early market reforms and foreign investment that took place in the coastal regions, much to their advantage, while some inland provinces lagged behind.

Over the past five years, China went through the process of economic rebalancing: from heavy reliance on debt-fueled investment booms to an alternate way of sustainable growth. This move is important not just for the country but also for every single province in China. Problems that each province will face are dramatically different and depend on factors like its economic structure and geographical location (Wang & Just, 2021).

Figura 1 China's Provinces



The 23 Provinces of China, source: https://www.thoughtco.com/china-provinces-4158617

Economic specialization is, therefore, leaving provinces such as Hebei, focused on steel production, and Hainan, reliant on real estate, extremely diversified with respect to the challenges they face. The north-eastern provinces, traditionally part of what is known as the 'rust belt,' are the ones that suffered the most from China's economic shifts and remain reliant on state investment. Inland provinces, instead, are now struggling against Asia's other low-cost manufacturing centers.

The worry regarding provincial finances still lies in fiscal risks from the dependence on revenue from land sales and the discrepancy between revenues and expenses. Efforts to diversify local government bond financing are focused on reducing the risks associated with this system, rather than reducing local debt accumulation (Wang & Just, 2021).

Even though the "New Silk Road" (China's new global trade network connecting Asia, Europe and Africa) is enhancing connectivity, especially for the provinces and other inland areas on the west and southwest borders, discrepancies in living standards still exist as indicated by big inequalities in GDP and population.

The historical reforms and open-door policies started in the late 1970s to allow marketoriented measures, have increased economic activities, especially in the coastal areas and special economic zones. However, they created regional disparities that triggered "Development of the West" initiatives implemented in the early 2000s as a mean to reduce imbalance and inequality by providing infrastructure and investment incentives to raise economic activities.

Existing regional imbalances are proving to be a continuous challenge for economic development between different provinces of China. To that end, China consistentlyh pursues initiatives such as the "go West" one and others concerning further investment in infrastructure in order to close these gaps and reach a more inclusive growth (Wang & Just, 2021).

In summary, to effectively analyze the real estate market in this country, it is very important to keep in mind the myriads of challenges and opportunities that exist at the provincial level. There are great differences between the provinces in terms of economic structure, regional development policies and demographic trends that have significant impacts on the real estate dynamics. Ignoring such differences across the provinces will give overly simplistic assessments and strategies that will not work properly.

Special consideration should be given to the specificity of each province in more elaborated aspects of the factors that determine real estate demand, supply, and pricing dynamics. From economic rebalancing efforts to infrastructural development initiatives, it seems that the provincial-level policies and trends have a very big role to play in shaping the overall real estate landscape in China (Wang & Just, 2021).

Furthermore, such disparities in the provinces' economic development level and living standards underline the need for interventions targeted at respective provinces and customized approaches in overcoming local challenges. Policies that go with inclusive

growth and help to reduce regional disparities are hence very essential in the performance and stability of the real estate market.

It is, thus, imperative that these provincial differences and their influence are considered in an analysis of the real estate market in China. This will allow stakeholders to make better decisions, hedge risks, and grab opportunities in such a dynamic and complex market environment.

1.3 Evolution of China's Real Estate Sector: From Emergence to Formalization

China's real estate sector stands out, not only for its direct impact on the nation's economic growth and social stability, but also for its pivotal role in facilitating the remarkable urbanization journey China had in recent times. In the span of four decades, China's real estate industry has transitioned from non-existence prior to economic reforms to its present state. Investment in real estate development substantially encreased, from 779.09 billion yuan (USD equivalent (2023): \$106.77 billion USD) in 2002 to 14.14 trillion yuan (USD equivalent (2023): \$1.94 billion USD) in 2020, which is approximately 18 times increase. The ratio of real estate development investment to total investment increased from 17.91% in 2002 to 26.83% in 2020 (National Bureau of Statistics of China, 2024).





Source: National Bureau of Statistics. https://data.stats.gov.cn. Last accessed July 13, 2024.

The formalization of China's real estate market was not an overnight transformation, but a gradual and intricate process deeply intertwined with broader economic reforms that swept across the nation from the late 1970s. At the heart of these reforms were measures such as the introduction of the household responsibility system in the rural areas and Special Economic Zones (SEZs) in selected coastal regions. Such pioneering steps laid the groundwork for a modern real estate industry in China: the ground on which commoditization of land use rights and profit sharing, alien to the socialist economic model reigning in the country, would gain footing (Xu & Xue, 2016).

In this period, intense theoretical debates and policy discussions among intellectuals and policymakers on the journey toward a formalized real estate market, were taking place. The debates, which began in the late 1970s, eventually initiated a gradual implementation of state policies aimed at reforming the outmoded welfare housing system. Shenzhen, one of the earliest SEZs, played a pivotal role in implementing these policies, becoming the first city to utilize compensable industrial land offerings to attract international investment. This decentralized approach to land commercialization empowered local governments and paved the way for the gradual privatization and commercialization of housing in urban areas.

In the 1980s, different players from various backgrounds would come together in this newly established real estate market as China moved from a centrally planned economy to a market-oriented one. State-owned enterprises had dominated the market till then, but privately-owned real estate companies quickly joined them after the formal recognition of private enterprises in 1988. This unlocked entrepreneurial spirit, further fueled by Deng Xiaoping's visit to southern China in 1992, and led to the growth of the real estate sector, especially in places like Shenzhen and Hai'nan, which turned into hotbeds of entrepreneurial activities (Ting & Stough , 2013).

However, this transition period had its challenges, as evidenced for example by the real estate bubble experienced in Hai'nan in 1993. The bursting of this bubble served as a sound reminder of the cyclic nature of the real estate market and provided valuable lessons for the whole public. Despite setbacks, the real estate sector continued to expand, driven by rising demand for housing and increasing disposable income (Jiang, Chen, & Isaac, 1998).

The land leasehold system instated in 1988, further pushed the formalization of the real estate market, by allowing private businesses to capitalize on land use rights through transfers. By 1998, housing supply and consumption had become market-driven activities. This was a major step toward the formalization of the real estate market.

As the real estate sector developed, so did its contribution to China's economy, with investment in real estate development forming the largest share of investments in fixed urban assets. The creation of a middle class by the government and the relatively increasing disposable incomes provided an even greater demand for housing and, consequently, unprecedented growth in the real estate sector.

There were two specific players that marked the landscape of the Chinese real estate market: state-owned real estate companies (SOEs) and publicly listed real estate companies. While SOE real estate companies enjoyed some benefits like access to finance and government support, public listed companies operated in a more transparent and market-driven environment.

In more recent years with the slowdown in economic growth and intensifying competition, real estate companies have begun to think about diversified strategies and income-producing operations. Those companies do not completely rely solely on the development of real estates available for sale anymore, but rather diversified their income sources, this marks a fresh era of development in the Chinese real estate industry.

To sum it up, the birth and formalization of the real estate sector in China has been a complex fusion of policy reformation, economic trends, and entrepreneurial dynamics. As China progresses through its process of economic transformation, the sector of real estate will surely play a significant part in driving future growth and development of the nation (Wang & Just, 2021).

1.3.1 Focus into China's Residential Market

Before the 1988 housing reforms in China, urban housing distribution was controlled by an outdated system, allocating homes based on family size and seniority within workplaces. In the early 1980s, the Chinese government took cautious steps toward privatizing property rights. This culminated in 1988 when the government allowed the buying and selling of land-use rights, creating a secondary market where apartments, could now be traded.

The transition away from China's welfare housing policy wasn't swift though, opposition delayed its full dismantling until 1998. Despite only incremental reforms, housing demand surged, driven by China's booming economy, which grew at an impressive average GDP rate of over 10% from 2004 to 2010. During this period, household disposable income increased significantly and citizens aspired to improve their living standards. Foreign direct investment (FDI) also grew dramatically, rising from USD 60.6 billion in 2004 to USD 114.7 billion in 2010, reflecting a robust annual growth rate of 9.5%.

As disposable income and FDI surged, China's property market experienced exponential growth in both volume and prices. However, the 2008 global financial crisis briefly slowed demand and property prices. A swift government response in 2009, including a massive RMB 4 trillion (USD 581.4 billion) stimulus package, revitalized the market and realigned it towards its previous growth path (Edwards & Yao, 2012).

By the end of 2010, China was grappling with skyrocketing property prices, driven partly by speculative investments. In 2011, the government introduced policies to curb these trends, including higher down payments and elevated mortgage rates for second-home buyers, discouraging speculative purchases. The government also tightened controls on cross-border financial activities to limit overseas speculative investments. Local governments were urged to increase land supply and accelerate public housing projects, which eventually stabilized the overheated market by 2014.

However, as credit conditions tightened, the economy showed signs of slowing, leading to decreased transaction volumes and property prices due to rising inventory levels. In response, in March 2015, the government introduced policies to stimulate property demand. These included lowering down payments for second-home buyers from 60-70% to 40%, and for first-time buyers from 30% to 20% (Fung, 2015).

Between November 2014 and October 2015, the People's Bank of China cut the benchmark interest rate six times, along with lowering the reserve requirement ratio (RRR) for banks to inject liquidity into the market. These measures boosted transactions and property prices till early 2018, when the market stabilized as the government sought to balance economic stability with long-term sustainable growth (Schrader, 2018).

From 2020 onward, the Chinese real estate market faced significant challenges, most notably marked by the Evergrande crisis. Evergrande, one of China's largest property developers, struggled under a debt load of over \$300 billion, failing to meet debt obligations and sparking fears of a financial crisis in the sector. This crisis underscored the risks of high leverage and speculative investments, leading to increased government oversight and efforts to stabilize the market (IMF, 2024).

Throughout 2021 and 2022, the government implemented stricter regulations to control financial risks, including the "three red lines" policy, which limited borrowing property developers based on their financial health. The government also introduced measures to cool speculative investments in the housing market, including higher down payments, property purchase limits, and stricter lending requirements (Reuters, 2024).

Despite these efforts, the real estate market continued to struggle, impacted by the economic slowdown and lingering effects of the pandemic. Sales and investment fell, leading to rising inventories and declining prices. The government remains focused on steering the sector toward more stable, sustainable growth to ensure it contributes to the broader economy without posing systemic risks (Reuters, 2024).

In summary, recent years have been transformative for China's real estate market, marked by regulatory interventions aimed at curbing financial excesses and promoting sustainable growth. The government's proactive approach to managing risks emphasizes the importance of maintaining financial stability while supporting economic development.

1.4 Legal Foundations: Navigating China's Real Estate Market

Real estate investment stands as a cornerstone of the Chinese economy, wielding significant influence over its economic landscape. However, before venturing into the dynamic realm of the Chinese real estate market, it's essential to understand the legal framework that governs property rights in China.

A pivotal moment in China's legal evolution occurred in 1988 when the country altered its constitution, introducing transferable land-use rights for real property. This constitutional change acted as a catalyst, unlocking immense opportunities for real estate development nationwide. Following this, the current constitution of the People's Republic of China, amended in 2004, further solidifies the protection of private property, reflecting the government's commitment to safeguarding property rights.

Enshrined within Article 13 of the Constitution is the explicit protection of citizens' lawful private property, deeming it "inviolable." This constitutional provision marked a critical milestone, offering equal protection to private investors' interests alongside those of the state (Constitution of the People's Republic of China).

Among the preeminent legal protections is the Property Law, promulgated on 1 October 2007. This comprehensive legislation established a solid framework for the protection of property rights, covering their establishment, modification, transfer, and termination. The Property Law also defined clear procedures for the registration and passage of real property rights, ensuring transparency and efficiency in property transactions (Library of Congress).

In 2006, major regulatory changes in China were introduced to curb the volume of foreign investment in the real estate sector, aimed at balancing an inflow of speculative capital and cooling down the overheated market. These measures, coupled with a broader economic slowdown, led to a significant decline in foreign investment within the real estate market (Zhang, 2015). To reverse this downward trend and continue the general relaxation of foreign investment restrictions in real estate, China released the Notice on Adjusting the Policies on the Entry into and Administration of Foreign Investment in the Real Estate Market on August 19, 2015. Additionally, to stimulate greater interest among

foreign investors, the Ministry of Commerce of China (MOFCOM) released a draft of the Foreign Investment Law for public consultation on January 19, 2015 (Foo, China proposes new Foreign Investment Law, 2015). Then the First Draft of the Foreign Investment Law (FIL) was revised by the National People's Congress on December 26, 2018. And on March 15, 2019, the new draft of the Foreign Investment Law was passed by the National People's Congress. (Foo, China's New Foreign Investment Law – What Does This Mean for Foreign Investors in China?, 2019). The new Foreign Investment Law (FIL) was implemented on January 1, 2020, becoming the foundational law for all foreign investment activities in China, significantly transforming the previous regulatory system. The legal framework governing real estate asset classes in China is now divided into two main parts. The first part covers the legal rules applicable to domestic investors in China, while the second part addresses the regulations concerning foreign investors.

The first part explains the real property rights regime, introducing the rights and procedures that apply when domestic investors engage in property investments. This includes a broad overview of property ownership rights, transfer procedures, and the regulatory requirements for domestic real estate investment.

The second part focuses on the legal environment for foreign investors in China's real estate market. It examines recent changes, such as the relaxation of restrictions on foreign investment and assesses their impact on foreign investors. This section helps to understand the evolving foreign investment regulations in China's real estate sector and provides guidance on navigating legal complexities to seize investment opportunities.

1.4.1 Legal Framework for Domestic Investors

According to the Constitution, China does not allow private ownership of land and natural resources. In urban areas, land must be owned by the state, while in rural and suburban areas, it must be owned by the state or local collectives. Although this limits land ownership, individuals can still acquire transferable land-use rights for a specified period in exchange for a fee.

These land-use rights can be obtained through various methods, including agreement, tender, or auction by engaging with the land administration department. Once an agreement is reached, a land grant contract is signed between the land user and the relevant municipal or county land administration department.

Under current State Council regulations, land-use rights are granted for different durations based on the intended use. Residential land-use rights typically last up to 70 years, industrial land-use rights are granted for 50 years, and land allocated for education, science, culture, public health, and physical education is also set for 50 years. Meanwhile, land designated for commercial, tourist, and recreational purposes is usually granted for 40 years (Library of Congress).

1.4.2 Legal Framework for International Investors

All land in China is owned by the state or collectives, meaning no private individual or entity can own land completely. However, like domestic investors, foreign investors can obtain land-use rights for a specified period. The process for purchasing real estate in China typically begins with the submission of an official offer letter, outlining the proposed purchase price, payment terms, and other relevant conditions. A nominal deposit, usually around 1% of the agreed purchase price, is paid upfront to the seller (Sinojobs, 2024).

In the next step, the buyer or their representative conducts due diligence on the property and its ownership status. Depending on the property's location, an approval from government authorities, such as the public security bureau, may be required before the sale can proceed. Once all necessary checks and approvals are completed, the buyer and seller finalize an official sales contract, which must be notarized if the buyer is a foreign investor. Unlike domestic investors, foreign buyers typically need approval from their local Foreign Office before completing the purchase (Wang & Just, 2021).

If financing is needed, foreign investors may have access to mortgage facilities provided by certain foreign banks operating in China. A down payment, usually around 29% of the purchase price in Chinese currency (RMB), is required in addition to the initial deposit.

Upon payment of all relevant fees and taxes, an application is submitted to the Government Deed and Title Office for the transfer of the property deed from the seller to the buyer. After a few weeks, an ownership certificate is issued, and the remaining 70% of the purchase price is paid to the seller.

It's important to note that, the real estate investment process in China is subject to governmental laws, regulations, and controls at the local, provincial, and national levels. The interpretation and application of these laws can vary by jurisdiction. While China's legal framework is gradually aligning with international markets, the government maintains macro-control over the real estate market through regulatory oversight and approvals (ROTHSTEIN, 2013).

Conclusion

China's move from a centrally planned economy to a more market-oriented approach has had sweeping effects on the real estate market. The rapid urbanization and economic growth have led to an extraordinary investment rush into real estate, boosting property prices significantly. However, the rapid growth has raised concerns about the market's sustainability with signs of a real estate bubble emerging in recent years.

The speculative investment practices and high leverage in the sector, exemplified by the Evergrande crisis, have revealed vulnerabilities that could threaten broader financial stability. In response, Chinese regulatory moves, such as the "three red lines" policy and efforts to cool speculative investment, highlight the fine line between fostering economic growth and maintaining financial stability.

As China's economic evolution continues, addressing structural issues in the real estate market will be crucial. The government's focus on promoting sustainable development and rebalancing the economy aims to minimize the risks associated with potential real estate bubbles. Understanding these dynamics is essential for stakeholders to make informed decisions and develop strategies that capitalize on opportunities while mitigating risks in this complex market environment. The future of China's real estate market will depend on the successful implementation of these reforms and the ability to achieve stable and sustainable growth.

Chapter II

China's Housing Market Crisis

2. China's Housing Market Crisis

China's housing market crisis is a multifaced issue, influenced by demographic shifts, economic policy, and regulatory intervention. This chapter will go into the complex dynamics of China's real estate market and specially focus on market cyclicality, demographic trends, and the financial distress of major developers. The research will investigate the phases of the real estate cycle: Recovery, Expansion, Oversupply, and Recession; outlining the impacts on property values, vacancy rates, and construction activities. The chapter also explains the influence of the aging population and declining birth rates in China on the demand for housing, coupled with some government initiatives on the issue.

This research also looks back at the financial strains that large property developers like Evergrande have operated under due to various strategies of aggressive expansion and high leverage. Many regulatory measures, such as the policy known as "Three Red Lines," have impacted the market in a meaningful way. It will follow a review on the implications brought about by ghost cities through speculative investment and overambitious urban planning policies, making urban areas not fully populated with considerable economic and social impacts.

Finally, the chapter provides an assessment of regulatory policies instituted to address the crisis in the housing market by tightening land supply control and property taxes. While aiding in the stabilization of the market, those measures have generally resulted in a lot of pressure on developers, hence halted market growth. Continuous adjustment of such policies will determine the future of the real estate market in China, hence attainment of sustainable development and financial stability within a constantly changing economic environment.

2.1 Literature

These next chapters build on the key academic literature, which helps us understand the real estate market, not just its cyclical nature but also how demographics, interest rates, economic health, and government policies influence real estate values and trends. The chapter examines the stages of the property cycle: Recovery, Expansion, Oversupply, and Recession, explaining how each stage impacts elements like property values, vacancy rates, construction activity, and rental growth. This existing literature provides a foundation for a deeper exploration of the dynamic and often complex landscape of real estate investment.

2.1.1 Market Bubbles: Origins, Stages, and Historical Impact

A market bubble occurs when asset prices rise well above their intrinsic value, driven by speculative behavior. These bubbles are marked by a rapid increase in market value, followed by a crash or sharp price drop once investors lose confidence. The term "bubble" originated from the South Sea Bubble of the early 18th century, where speculation caused the South Sea Company's stock to soar before collapsing in 1720. The term metaphorically implies that asset prices are inflated and fragile, poised to burst suddenly.

Market bubbles typically progress through five stages:

Displacement: Investors become excited about a new development, such as a new technology or market.

Boom: Prices increase as more investors participate, building momentum.

Euphoria: Optimism peaks, caution is ignored, and investors expect continuous growth, pushing prices to irrational levels.

Profit-taking: Savvy investors begin to sell, anticipating a price decline.

Panic: The bubble bursts, prices crash, and many investors rush to sell, deepening the collapse.

One of the earliest examples is the Tulip Mania of the 1630s in the Netherlands, where tulip bulbs were traded at the value of houses, only to crash abruptly in 1637. More recently, the dot-com bubble in the late 1990s saw investors driving up stock prices of internet companies, many of which lacked profitable business models. The bubble burst in 2000, resulting in significant market losses.

Bubbles are often fueled by speculation, excess liquidity, and psychological factors like herd mentality, where investors follow the crowd without considering the fundamental value of assets. Central bank policies, such as low interest rates, can also contribute to bubbles by making borrowing cheaper, encouraging risk-taking. When bubbles burst, they can cause economic crises, bankruptcies, and recessions, as seen with the 2008 U.S. housing bubble that led to the global financial crisis.

The collapse of a bubble can expose underlying vulnerabilities in financial systems, making them critical case studies for understanding market psychology and speculative behavior (Investopedia, 2022).

2.1.2 Real Estate Market Fundamentals

Real estate fundamentals are both critical measures and factors that form the basis for determining the value and demand of real estate properties. These include demographics, interest rates, the health of the economy and government policies and funding. Understanding these factors is essential for making informed investment decisions and forecasting market trends.

Demographics:

Demographics refer to the statistical characteristics of a population, such as age, race, gender, income, migration patterns, and population growth. These factors play a significant role in shaping real estate demand and pricing. For example, an aging population can increase the demand for retirement communities, while urban migration can drive up the need for city apartments. Major demographic shifts can influence real estate trends for decades, affecting which types of properties are in demand and how they are priced (Casertano, 2023).

Demographic changes have been a powerful factor affecting the real estate market in China. The rapid pace of urbanization and the mass migration of millions from rural to urban areas have driven a huge demand for urban housing, leading to extensive city development. Additionally, the legacy of the one-child policy has resulted in an aging population, increasing the need for elderly care facilities and influencing the types of housing in demand (Wang & Just, 2021).

Interest Rates:

Real estate markets are greatly influenced by interest rates, as they affect borrowing costs. Low interest rates make mortgages more affordable, boosting property demand and driving prices higher. Conversely, higher interest rates increase borrowing costs, reduce demand and can lead to lower property prices. Thus, interest rates play a key role in shaping real estate investment and development, influencing overall market dynamics (Casertano, 2023).

In China, interest rate policies set by the People's Bank of China have a direct impact on the real estate market. For example, between 2014 and 2015, monetary easing measures, including reductions in the benchmark interest rate and the reserve requirement ratio (RRR), were implemented to stimulate economic activity and boost the real estate market. These lower interest rates made mortgages more affordable, increasing demand and driving property prices higher (Fung, 2015).

The Economy:

Broader indicators such as GDP, employment rates, manufacturing activity, and consumer spending are key drivers of real estate value and are highly sensitive to the overall health of the economy. Economic growth typically increases real estate demand as higher employment and incomes make property ownership more affordable. Conversely, economic slowdowns can reduce demand, depress property values, and slow market activity. Additionally, different real estate segments may be affected differently based on their sensitivity to economic cycles. (Casertano, 2023).

China's real estate market has been directly influenced by the rapid growth and periodic slowdowns in its economy. The economic boom following the 1978 reforms sparked a surge in real estate development. Recent efforts to reduce over-reliance on debt-fueled investments and moderate growth have led to economic rebalancing. The government's focus on sustainable development and minimizing financial risks in the property sector reflects its goal of stabilizing the market amid broader economic transitions (IMF, 2024).

Government Policies and Subsidies:

Government policies, particularly tax incentives, subsidies, and regulations, have a significant impact on real estate markets. Policies that reduce the cost of homeownership or promote development can boost demand and supply, affecting overall market conditions. For instance, tax deductions on mortgage interest or subsidies for affordable housing can increase demand and support market stability (Casertano, 2023).

In China, government policies play a key role in shaping the real estate market. Initiatives such as the establishment of Special Economic Zones (SEZs) in the 1980s spurred urban development and attracted foreign investment. More recently, policies like the "three red lines" introduced in 2020 aim to limit excessive borrowing by property developers and promote financial stability. These regulations, along with subsidies for affordable housing, demonstrate the government's influence on market dynamics and efforts to address housing affordability. (Reuters, 2024).

In conclusion, understanding real estate fundamentals such as demographics, interest rates, economic health, and government policies is crucial for analyzing the Chinese real estate market. In China's socio-economic and policy context, these factors influence market trends and investment opportunities. This knowledge is essential for making informed decisions and strategically navigating China's complex real estate landscape.

2.1.3 Real Estate Market's Life Cycle

Understanding the principles of the real estate cycle is fundamental for anyone involved in real estate investing. The real estate market is inherently cyclical, driven by various economic factors. Its phases include Recovery, Expansion, Over Supply, and Recession. Each phase comes with distinct market conditions that influence property values, vacancy rates, construction activity, and rental growth.



Figura 3 The Four Phases of the Real Estate Cycle

Source: Real Vantage. https://www.realvantage.co/insights/the-real-estate-cycle/. Last accessed July 18, 2024.

Recovery Phase

The Recovery Phase marks the beginning of the real estate cycle. During this phase, vacancy rates start to decrease, but new construction remains limited. There is moderate space absorption, which means that previously vacant spaces are gradually being occupied. Employment growth tends to be low to moderate, and rental growth rates are either negligible or remain low. This phase signals the end of a recession and the slow return to market stability. Real estate investors and developers begin to notice opportunities for investment as the market begins its recovery and shows signs of stability (Casertano, 2023)

In China, the recovery phase was evident after the 2008 global financial crisis when the government introduced a significant stimulus package to revitalize the economy. This phase was marked by a gradual decrease in vacancy rates, cautious resumption of construction, moderate employment growth, and stabilization of rental rates.

Expansion Phase

The Expansion Phase is marked by declining vacancy rates and an increase in new construction, both in residential and commercial sectors. Space absorption rates are high, indicating strong demand for real estate. Employment growth ranges from moderate to high, which supports rising rental rates. During this phase, the real estate market experiences substantial growth, with rental and property values steadily increasing. This phase is characterized by booming real estate development, driven by rising rents that make new construction projects highly attractive (Casertano, 2023).

In China, the expansion phase was clearly visible during periods of rapid urbanization and economic growth, particularly in the early 2010s. Cities like Shanghai, Beijing, and Shenzhen saw substantial new construction projects and soaring property values, fueled by strong demand and increasing urban migration.

Hyper Supply Phase

The Hyper Supply Phase occurs when the market becomes saturated with new construction, leading to rising vacancy rates. Space absorption rates decline, and employment growth slows down. Rental growth rates are moderate or even turn negative. This phase typically follows a period of overenthusiastic building and investment, which results in an oversupply of properties. During this phase, developers may continue building, but demand for new space fails to keep up, leading to a glut in the market (Casertano, 2023).

In recent years, China has experienced periods of oversupply, particularly in lower-tier cities. The rapid pace of construction outstripped demand, causing high vacancy rates and stagnant rental growth. This oversupply has been especially problematic in "ghost cities," where large-scale developments have remained largely unoccupied.

Recession Phase

The Over Supply Phase occurs when the market becomes oversaturated with new construction, leading to rising vacancy rates. Space absorption rates begin to slow, and employment growth decelerates. Rental growth rates moderate or may even become negative. This phase often follows a period of overenthusiastic building and investment, creating an oversupply of properties. During this time, developers may continue to build, but demand for new space fails to keep up, leading to a market surplus (Casertano, 2023).

China's real estate market has shown signs of entering recessionary phases at various points, particularly during economic slowdowns or policy-induced market corrections. For example, the government's strict regulations on property developers aimed at controlling financial risks have reduced construction activity and increased vacancy rates in recent years.

Conclusion

The real estate cycle, which includes phases of recovery, expansion, oversupply, and recession, serves as a key framework for understanding market dynamics. In China, these cycles have been driven by rapid urbanization, economic policies, and government interventions. Recognizing these phases is essential for investors to make informed decisions, capitalize on growth opportunities, and navigate potential market downturns. As the market continues to mature, staying attuned to these cycles will remain crucial for successful real estate investment.

2.2 Demographic Shifts and Their Impact on China's Real Estate Market

As already seen from the previous chapter, demographic analysis plays a critical role in understanding the dynamics of the real estate market. Demographic trends drive the demand for various types of properties, influence economic development, and guide investment strategies. In the context of China, where significant shifts in population structure are occurring, recognizing these demographic patterns is crucial to fully analyze the real estate landscape.

China's population trends carry significant implications for the real estate market. As of 2023, population growth in China has slowed drastically, with the country facing a declining birth rate and an aging population, this demographic shift affects many economic sectors, especially real estate. China is undergoing a profound demographic change, characterized by a declining population and a rapidly aging society. After peaking at over 1.42 billion in 2021, China's population is projected to drop by more than 100 million by 2050, potentially falling to under 800 million by the end of the century.

The driving force behind this decline is a significant reduction in the fertility rate, which has dropped from 2.6 in the late 1980s to around 1.15 in recent years, this is despite policy changes such as relaxing the one-child policy and introducing the three-child policy. Economic pressures, the high costs associated with raising children and shifting social norms that delay marriage and childbearing are key factors contributing to this trend (Pew Research Center, 2022) (IMF, 2022).

Figura 4 China's Population and Projections



Low scenario. Total population, millions

Source: Shanghai Academy of Social Sciences

The rapid aging of the population is another key issue, the proportion of people over 60 is expected to rise to 28% by 2040, significantly increasing the dependency ratio. This shift will place immense pressure on China's social security and healthcare systems while also reducing the working-age population, which will impact economic growth and drive up labor costs (ChinaPower, 2024) (SCPM, 2023). The dependency ratio, which compares the number of dependents (children and the elderly) to the working-age population, is projected to exceed 50% by 2050, putting additional strain on economic resources (SCPM, 2023).


Figura 5 China Working-Age Population, 65+ Population

Source: Shanghai Academy of Social Science

These demographic changes are significantly affecting China's real estate market. Historically, the real estate sector has been a key driver of economic growth, contributing around 20% to the country's GDP. However, with a declining younger population and an oversupply of housing in certain areas, the market is facing a downturn. The reduced demand for housing, combined with financial stress among property developers due to over-leveraging, has resulted in a slowdown in the sector (Pew Research Center, 2022) (IMF, 2022).

In response to these challenges, the Chinese government is implementing a range of measures aimed at stabilizing the population and bolstering the economy. Among these initiatives are financial incentives designed to encourage families to have more children, including childcare subsidies and extended parental leave. Additionally, various local governments have introduced cash incentives and additional benefits to support larger families. For instance, in Shenzhen, families who have a third child are entitled to a cash allowance of 19,000 yuan per year until the child reaches the age of three. Similarly, in Jinan, Shandong Province, families benefit from childcare subsidies and extended parental leave to ease the financial burden of raising children (SCPM, 2023).

The government is also prioritizing improvements to social welfare and healthcare systems to address the challenges posed by an aging population. Efforts include expanding elderly care services and strengthening support mechanisms for senior citizens to ensure they receive adequate care. The 14th Five-Year Plan highlights the need for a comprehensive, long-term population development strategy. Key aspects of this strategy involve enhancing parental leave policies, improving access to childcare facilities, and providing more resources during pregnancy and childbirth. These initiatives aim to promote family well-being and support population stabilization over the long term (ChinaPower, 2024).

Conclusion

From the information provided in this analysis, it is evident that China's shifting population trends will have a negative impact on the housing market in the coming years, as declining birth rates and an aging population reduce the demand for housing. However, other real estate sectors, such as healthcare, are likely to see growth due to the increasing needs of an aging society. While these demographic changes pose significant challenges, the measures implemented by the government, including incentives for larger families and improvements to social welfare systems, may help slow or potentially reverse the negative trends, offering a more balanced outlook for the future.

2.3 Financial Distress of Developers (Evergrande Case Study)

The Chinese real estate sector has been going through considerable turmoil over the last few years, with major developers in deep financial distress. Foremost among them is China Evergrande Group, which has come to become the personification of the deep problems rooted in the sector. The crisis does not involve uniquely Evergrande; other major companies in trouble include Kaisa Group, Fantasia Holdings, Sunac China Holdings, Shimao Group and Modern Land. This chapter explores the causes and consequences of such financial distress, focusing on Evergrande as a case study. Regulatory changes to address these risks will also be briefly examined, to be then analyzed in detail in a dedicated chapter.

China Evergrande Group, founded by Xu Jiayin in 1996, quickly rose to become one of the largest and most influential real estate developers in China. Headquartered in Shenzhen, Evergrande expanded aggressively across the country, developing millions of square meters of real estate. In addition to real estate, the company diversified its investments into various industries such as electric vehicles, healthcare, and even professional soccer, becoming the owner of the Guangzhou Evergrande football team.

Business Model

Evergrande's business model was characterized by rapid expansion, high leverage, and aggressive diversification. This approach resulted in significant debt accumulation, which ultimately contributed to the company's financial troubles. Below are the key elements of Evergrande's business model that played a central role in its downfall:

Evergrande's model revolved around booming growth through large-scale property developments across China. The company rapidly expanded into multiple cities, developing residential compounds, commercial buildings, and various other real estate projects. This aggressive expansion required vast amounts of capital, primarily raised by issuing significant amounts of debt. Evergrande's strategy was to dominate the market by quickly acquiring land and launching new projects, even before existing ones were completed. This approach created a relentless cycle of debt accumulation, as new loans were often used to finance ongoing construction and further land acquisitions (Ren, 2022).

Debt was at the core of Evergrande's business model. To sustain its rapid growth, the company issued bonds, took out loans from banks, and relied on other forms of debt financing. By 2021, Evergrande's total liabilities had exceeded \$300 billion, making it one of the most indebted companies globally. This high level of debt left the company vulnerable to market fluctuations and regulatory changes. When the Chinese government introduced the "Three Red Lines" policy to reduce financial risks in the real estate sector, Evergrande's inability to meet the new borrowing limits led to a liquidity crisis and a loss of investor confidence (Hou, Wang, & Zhu, 2022).

A significant portion of Evergrande's revenue came from pre-selling properties during their construction phase. Homebuyers would make deposits and partial payments for homes still under development, providing Evergrande with upfront cash flow. However, this model also made the company heavily reliant on continuous sales to finance ongoing projects. When market conditions shifted and sales slowed, Evergrande's cash flow diminished, worsening its financial troubles. The company's reliance on pre-sales meant that any disruption in sales could lead to delays in project completion, as there would be insufficient funds to keep construction going (Zhu, 2023).

Reasons for the Collapse

Broader economic factors also contributed to Evergrande's collapse. The COVID-19 pandemic and the resulting economic slowdown significantly reduced demand for new properties, leading to lower sales and revenue. Additionally, the Chinese government's measures to limit property speculation and stabilize housing prices further suppressed market activity. Combined with Evergrande's massive debt obligations, these factors created a perfect storm that led to the company's financial collapse. The situation was worsened by declining property values, which reduced the collateral available for securing new loans. (Hou, Wang, & Zhu, 2022).

A turning point came for Evergrande in 2020 with the enforcement of the "Three Red Lines" policy. The policy, designed to reduce financial risks in the real estate sector, imposed strict limits on debt-to-asset, debt-to-equity, and cash-to-short-term debt ratios. Given Evergrande's high leverage, the company struggled to meet these regulatory requirements, resulting in liquidity issues and a loss of investor confidence. The company was forced to sell assets at distressed prices to meet its debt obligations, further weakening its financial position. Additionally, the regulatory pressure limited Evergrande's ability to raise new debt, which had been a key part of its business model (Ren, 2022).

Consequences and Collapse

All of these factors culminated in Evergrande's inability to meet its debt obligations. In 2021, the company missed interest payments on its offshore bonds, sparking panic in the financial markets. The crisis led to the suspension of numerous construction projects, leaving thousands of homebuyers with unfinished properties. Unpaid suppliers and contractors caused a ripple effect throughout the construction industry. The Evergrande crisis raised serious concerns about the stability of China's real estate market and the potential for broader financial contagion.

In response, the Chinese government intervened to stabilize the situation and prevent a wider economic fallout. Evergrande Group was officially declared bankrupt and ordered to undergo liquidation by a Hong Kong court on October 30, 2023. Measures included selling off Evergrande's assets in an orderly fashion and ensuring that construction

projects were completed to protect homebuyers and creditors. Despite these efforts, the crisis highlighted the fragility of China's real estate sector, revealing the systemic risks associated with high leverage and speculative investments. The crisis also prompted developers to reassess their business practices, with both investors and regulators becoming more cautious about excessive debt and aggressive expansion strategies (Ren, 2022).

To better illustrate how aggressive borrowing can lead to a financial crisis when market or regulatory conditions change, consider the following simplified example:

Step 1: The Growth Phase (Leveraged Expansion)

Imagine a property developer, Company X, starting with \$1 billion in assets but borrowing \$4 billion in loans to fund aggressive expansion. With this borrowed capital, Company X begins numerous housing projects, expecting to sell them and generate revenue. As a result, its total liabilities rise to \$4 billion, while its total assets grow to \$5 billion, including ongoing projects. Confident in rising property prices and high market demand, Company X continues borrowing, pushing its debt to \$6 billion while reporting \$7 billion in assets as development continues.

Step 2: Regulatory Changes and Market Slowdown

Suddenly, the government introduces the "three red lines" policy, which restricts how much companies can borrow based on specific financial ratios like debt-to-asset and debt-to-equity. Now, Company X can no longer borrow additional funds, as its debt-to-asset ratio stands at 86% (\$6 billion in debt against \$7 billion in assets), well above the 70% threshold. At the same time, the real estate market slows down, reducing housing demand. This leaves Company X struggling to sell its properties, cutting its cash flow and leaving projects unfinished with unsold homes.

Step 3: The Crisis

This situation leads to a financial crisis for Company X due to several factors:

The company is still required to make interest payments on its \$6 billion debt, but its property sales cash flow has fallen dramatically.

The regulatory restrictions prevent Company X from refinancing its debt (i.e., borrowing more to pay off existing loans).

As demand weakens, the market value of Company X's assets falls. What was once reported as \$7 billion in assets is now valued at only \$5 billion due to lower property prices. Consequently, Company X becomes insolvent, with \$6 billion in liabilities and only \$5 billion in assets. Without additional financing or sufficient revenue, the company defaults on its loans, moving toward bankruptcy.

This example demonstrates how over-reliance on debt, combined with changing market conditions or regulatory constraints, can lead to severe financial instability and insolvency.

Regulatory Impact and Government Intervention

Evergrande's financial crisis, along with that of other smaller developers, is a direct consequence of the Chinese government's efforts to limit financial risks in the real estate market. A key regulatory measure was the introduction of the "Three Red Lines" policy in late 2020, aimed at controlling developer debt levels. This policy forced many developers to deleverage and make sharp adjustments to their business models to comply with the new criteria.

Additionally, the government curbed speculative activities by tightening mortgage lending, controlling land supply, and increasing oversight of property transactions. These measures were designed to stabilize property prices and promote more sustainable development, but they also put immense pressure on heavily indebted developers, leading to a wave of defaults and financial distress across the sector.

The Chinese government's intervention in the Evergrande crisis was intended to prevent broader economic fallout. They ensured that Evergrande's assets were sold in an orderly manner and that construction projects were completed to protect homebuyers and creditors. However, the crisis highlighted the need for more sustainable business practices and stronger financial oversight in the real estate sector. The government's enforcement of the "Three Red Lines" policy and related regulations reflects its commitment to reducing systemic risks and promoting long-term market stability (Ren, 2022).

Conclusion

The financial strains faced by major real estate developers such as Evergrande, Kaisa, and Fantasia reflect broader challenges within China's property sector. While the Chinese government's regulatory measures aim to ensure long-term stability, they have worsened the financial difficulties of highly leveraged developers. As the government continues to enforce stricter regulations and push for more sustainable growth, the real estate sector is likely to undergo significant restructuring. Understanding these dynamics is essential for stakeholders navigating the complexities of China's real estate market.

2.4 Ghost Cities: The Consequence of Speculative Development

China's rapid urbanization has given rise to numerous urban centers, many of which are now referred to as "ghost cities." Despite being fully constructed with modern infrastructure and services, these cities have struggled to attract enough residents, leaving vast areas empty and facilities underutilized. This chapter explores the phenomenon of ghost cities in China, examining their causes, characteristics, and the broader social and economic implications.

The creation of ghost cities in China is primarily driven by aggressive urban planning and real estate policies aimed at fostering economic growth, Both central and local governments have encouraged large-scale urban development as a way to boost GDP and support the construction industry. Local governments, in particular, have had strong incentives to pursue ambitious real estate projects, often financed through land sales and debt. Many of these developments though, were built in anticipation of future demand that has not yet materialized, resulting in underpopulated cities (Shepard, 2015).

Another contributing factor is the speculative nature of real estate investment in China. Unlike in Western economies where diverse financial instruments (stocks, bonds, mutual funds, etc.) are widely available and trusted, China offers fewer accessible and reliable options. Many Chinese investors are hesitant to engage with the stock market, viewing it as volatile and risky, while real estate is perceived as a safer, more tangible investment. Furthermore, historically low-interest rates on bank deposits further limit appealing investment avenues, encouraging citizens to invest in property instead of leaving their wealth in savings accounts. A third factor involves the fact that property ownership is deeply rooted in Chinese culture. It is considered both a symbol of financial security and social status. Culturally, owning property is essential for various life milestones, such as marriage, where owning a home is often a prerequisite for men to secure a partner. This emphasis on property is linked to concepts of familial stability and passing down wealth through generations. These three factors drove property prices up and encouraged developers to build more, even in areas that were less economically viable. The result has been an oversupply of housing and commercial space, with demand lagging behind, especially in less developed regions (Shengnan & Zhen, 2016).

These ghost cities are characterized by modern infrastructure, including expansive road networks, public transport, and high-rise buildings. The construction quality and urban planning in these cities are generally high, with amenities such as shopping malls, parks, and cultural institutions. Despite their advanced infrastructure, the lack of a resident population leaves these cities eerily quiet and underutilized. (Chen, Li, & Xu, 2017).

These cities are often characterized by structures that still stand incomplete, abandoned buildings, and a noticeable lack of activity. The contrast between the quality of infrastructure and the lack of residents indicates a huge gap between ambitions in urban planning and the realities of demographic and economic trends. Whole neighborhoods have been left uninhabited, with people taking no interest in moving into these places due to the lack of employment opportunities and community life (Jiang & Zheng, 2019).

These ghost towns have significant economic implications. While construction in the cities in the short term has driven economic activity, the long-term returns on these investments are uncertain. The oversupply of real estate has caused property prices to stagnate and led to high levels of debt among developers and local governments. This financial overextension poses a risk to the broader economy, especially if property values decline significantly, potentially leading to defaults and financial instability (Wu & Shen, 2017).

Socially, ghost cities are failures in managing urbanization under a controlled economy. While these cities were meant to attract rural migrants and ease pressure on overcrowded urban centers, many have not met these expectations due to a lack of jobs and services. This has led to a misallocation of resources and highlights the weaknesses of top-down planning without proper market demand assessment (Li & Li, 2016).

Ordos in Inner Mongolia is one of the most infamous examples of a ghost city. Originally intended to house over a million people, the city has seen only a fraction of that population move in. Similarly, Kangbashi, also in Inner Mongolia, was built with high expectations but remains sparsely populated, with much of its real estate sitting empty. These cases illustrate the broader issue of building infrastructure without ensuring that there is a corresponding demand from potential residents (Li & Li, 2016).

The Chinese government took several steps once it had recognized the problem posed by ghost cities. Among them were stricter control over real estate development, efforts to stimulate demand in underpopulated areas, but also initiatives to create jobs and develop local economies. The government also made attempts to sell these properties to private investors, both local and international, to recover part of the investment and stabilize the market (Jiang & Zheng, 2019).

Despite all this, the problem of ghost cities persists and has become emblematic of the complexities and challenges within China's urbanization strategy. As the country continues to develop, the key will be finding a balance between building new infrastructure and ensuring sustainable population growth and economic development.

Conclusion

China's ghost cities embody the ambitious urban planning and economic policies that have driven the country's rapid development. On one hand, they showcase the capacity for modernization and large-scale construction, while on the other hand, they reflect significant miscalculations in anticipating market demand and managing urban growth. The lessons learned from these ghost cities will be critical as China continues to navigate its path toward urbanization and economic stability.

2.5 Government Policies Addressing the Crisis: Impacts and Future Directions

Recently, China's real estate market has been under pressure due to high property prices, overly leveraged developers, and financial instability. To address these challenges, the government introduced a series of regulatory measures aimed at controlling the market, reducing financial risks, and promoting sustainable development. This chapter will review the key policy measures taken by the government, including the "Three Red Lines" policy, land supply regulations, property taxes, and increased regulatory oversight in the real estate market.

The "Three Red Lines" Policy

The "Three Red Lines" policy, introduced in 2020, is one of the most critical regulations aimed at limiting the excessive borrowing of developers in China's property market. The policy outlines three financial thresholds that developers must meet:

A liability-to-asset ratio of less than 70% (excluding advance receipts)

A net gearing ratio below 100%

A cash-to-short-term debt ratio exceeding 100%

The more thresholds a company surpasses, the stricter the limitations on its ability to borrow and finance new projects. For example, surpassing one line the developer's debt growth is limited to 10% annually, two lines debt growth is restricted to 5% annually, and surpassing all three lines the developer is prohibited from increasing its debt.

This policy aims to reduce financial risks by pressuring highly leveraged developers to deleverage and stabilize their balance sheets. As a result, many developers have faced significant financial pressure, leading to a slowdown in new project launches and a stronger focus on reducing debt. The policy has also created a more cautious investment environment, with both domestic and international investors rethinking their exposure to China's real estate market (Ren, 2022).

Land Supply and Property Taxes

The Chinese government exercises significant control over land supply, which directly influences the real estate market. In recent years, policies have been introduced to manage land supply more effectively to prevent speculative land hoarding and ensure a stable housing supply. One key approach has been the use of controlled land auctions.

By regulating the release of land for development, the government aims to maintain a balance between supply and demand, preventing developers from overbidding on land, which could drive up housing prices.

In addition to this, the introduction of property taxes in select pilot cities represents another major step toward curbing speculative activity. Property taxes are designed to discourage investors from holding multiple properties for the sake of profit, making more housing available for actual homebuyers. These taxes are intended to shift focus away from real estate as an investment tool and towards its use as living space for end-users (The Guardian, 2021).

Research shows that these measures have helped to stabilize land prices and reduce speculation in the market. However, the effectiveness of property taxes has been somewhat mixed, with some analysts suggesting that further reforms are necessary to secure their long-term success. While initial results are promising, more work may be required to fully address speculative activity in the real estate sector (Hou, Wang, & Zhu, 2022).

Impact of Policies on the Real Estate Market

The combined effect of the "Three Red Lines" policy, tightened mortgage lending, land supply regulations, property taxes, and enhanced regulatory oversight has had a profound impact on China's real estate market. One of the key outcomes is a market slowdown, with lower transaction volumes and falling property prices in certain regions. While these measures have successfully prevented the formation of a property bubble, they have also placed significant financial strain on developers, particularly those with highly leveraged balance sheets (Zhu, 2023).

Increased Market Stability: The government's policies have helped bring greater stability to the real estate market by curbing speculative activities and promoting more sustainable development practices.

Challenges for Developers: Many developers have struggled with significant financial challenges due to the "Three Red Lines" policy and tightened credit conditions. This has resulted in delays in project completions, defaults, and, in some cases, bankruptcies. (Ren, 2022).

Long-Term Outlook: In the long term, the government's regulatory measures are anticipated to create a more stable and sustainable real estate market. However, ongoing adjustments and reforms will be required to address the sector's evolving challenges (Hou, Wang, & Zhu, 2022).

Recent Mortgage Rate Cuts: A Policy Reversal?

In sharp contrast with the previously restrictive policies, September 2024 saw a major shift as the government moved towards mortgage rates cut of 50 basis points for first-home buyers. This was done with the express purpose of stimulating the now stagnant property Real Estate market and easing financial burdens on homeowners. Perhaps the mortgage cuts alone could inject more than 200 billion yuan-\$27.3 billion-into the economy. This was interpreted as a move designed to revitalize the market and boost consumption in response to the crisis. In addition there was a relaxation on the down-payment ratio, which is now reduced to 20% for first-home purchases and 30% for second homes from current 30% and 40%, respectively (Global Times, 2024).

Conclusion

The Chinese government's approach to regulating the real estate market is comprehensive, including the tightening of land supply management, property taxes, and increased regulatory oversight through policies such as the "Three Red Lines." While the radical regulatory steps, particularly the "Three Red Lines", have been able to avoid risk at the same time they caused a dramatic deceleration in the real estate market. The sharp reduction in developer activity coupled with rising defaults, indicated that policymakers may have overcorrected. A recent easing in mortgage rates and down-payment requirements in many cities may be a sign of further recalibration of government policy to avoid further economic drag.

Conclusion

The chapter provides a critical review of the cyclic nature evidenced within the real estate market, focusing on such controlling factors like demographics, interest rates, economic health, and government policies.

From the research conducted it is plausible to suggest how the crisis that recently hit China's real estate market neither happened overnight nor out of the control of the government. Rather, it was the result of a predetermined intervention on the state's part to deflate an overheated property market. The so-called "Three Red Lines" policy, among other regulatory measures, was utilized against excessive leveraging and speculative development. The tight financial regulation, painful as it might have been for many developers, was a deliberate step carried out to avoid the uncontrollable burst of a greater future market bubble.

Using a metaphor, this crisis can therefore be seen as a controlled demolition, rather than some inevitable unexpected collapse. Indeed, the state's role in intervening through monetary policies, raising credit conditions, and the use of macroprudential measures, has been successful altering in advance the direction taken up by the market. Even if the intervention has placed great financial burden on developers and contributed to a slower market growth, it has been successful in moving towards stability in the long term and preventing a more severe collapse of the market.

At the same time recent decisions to lower mortgage rates and relax down-payment requirements indicate a shift toward stimulating the market after a period of excessive tightening. This might indicate that the Chinese residential market is now in the passage between a recession phase to a recovery phase.

China's government measures have once again revealed the delicate balance existing between fostering economic growth while at the same time keeping financial risk at bay. As the real estate market evolves, understanding its cycles and underlying fundamental, along with the government's influence, remains essential for investors and policymakers.

Chapter III

Empirical Analysis of the Chinese Housing Market

3. Empirical Analysis of the Chinese Housing Market

This chapter presents an empirical study of the Chinese residential market, providing a quantitative counterpart to the more qualitative discussions of the previous chapter. The aim is to develop a solid hypothesis regarding the current state of the market as of today.

The study involves testing for cointegration between the dependent variable, housing prices, and several independent variables: GDP, population, land prices, investment in real estate, and interest rates. This analysis will assess whether the average housing price in China aligns with its fundamental determinants. A lack of cointegration would suggest that housing prices are inflated due to factors such as speculation, indicating the presence of a bubble.

This methodology has been employed in several studies, including Drake (1993), Engsted, Hviid, & Pedersen (2016), and Costello, Fraser, & Groenewold (2011). By following these established approaches, we aim to ensure the robustness and validity of our findings.

To conduct the analysis, time series econometric techniques will be utilized in order to detect potential speculative bubbles in the housing market like advanced bubble detection methods like the Generalized Supremum Augmented Dickey-Fuller (GSADF) test developed by Phillips, Shi, and Yu (2015). This test allows for the identification of multiple bubble episodes over time, providing a comprehensive understanding of market dynamics and the timing of speculative periods.

The results from this empirical study, based on quantitative evidence, will offer valuable insights into whether China's housing market is still currently experiencing a bubble or, as intuited in the previous chapter, the bubble already burst and the market is at the start of a new cycle.

3.1 Literature

Regression analysis is a fundamental tool in statistical and econometric studies, serving as a pivotal method for understanding and quantifying the relationships between variables. This literature section aims to provide a comprehensive overview of regression analysis, setting the foundation for the empirical studies that will follow. By exploring the definitions, key concepts, and methodological considerations of regression analysis, including linear and multiple regression models, the role of coefficients, and the importance of assumptions and diagnostics, we establish a solid theoretical basis. Additionally, we delve into advanced topics such as stationarity, unit root tests, and cointegration in time series data, which are crucial for ensuring the validity and reliability of econometric models. This foundational understanding is essential for interpreting empirical results and for the rigorous analysis of economic phenomena in subsequent chapters.

3.1.1 Regression Analysis

Regression analysis is a core statistical method used to explore the relationship between a dependent variable and one or more independent variables. Its main goal is to quantify how the dependent variable changes in response to variations in the independent variables and, in many cases, to predict future values of the dependent variable based on this relationship (Santucci De Magistris, 2023).

Fundamentally, linear regression models the relationship between the dependent variable Y and the independent variable X as a linear function:

$$Y = \alpha + \beta X + \varepsilon$$

Where:

- *Y* is the dependent variable we aim to predict or explain.
- *X* is the independent variable used to explain *Y*.
- α is the intercept, representing the value of Y when X is zero.
- β is the slope coefficient, reflecting the change in Y for a one-unit change in X.
- ε is the error term, capturing the unexplained variation in *Y* due to factors not included in the model

In the case of multiple regression, the relationship between the dependent variable and several independent variables is expressed as:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \varepsilon$$

Where:

- $X_1, X_2, \ldots X_n$ represent the independent variables.
- $\beta_1, \beta_2, \dots, \beta_n$ are the coefficients, each representing the change in Y for a oneunit change in the corresponding independent variable, holding all others constant.

The Role of the Coefficients

Understanding the regression coefficients $(\beta_1, \beta_2, \dots, \beta_n)$ is essential because they quantify the strength and direction of the relationship between each independent variable and the dependent variable. A positive coefficient indicates that an increase in the independent variable is associated with an increase in the dependent variable, while a negative coefficient suggests an inverse relationship.

These coefficients are interpreted under the assumption that all other variables in the model are held constant. For example, in a regression of economic growth on various factors, the coefficient on capital investment would indicate the expected increase in growth for every unit increase in investment, assuming other variables like labor or technology remain unchanged (Santucci De Magistris, 2023).

The Error Term "E"

The error term " ε " in regression captures the effect of all variables that influence the dependent variable but are not included in the model. It accounts for the random noise in the data and any potential measurement errors. The objective in regression analysis is to minimize this error, ensuring that the model provides an accurate estimate of the relationship between the independent and dependent variables.

If the model is well-specified, the error term should have a mean of zero and constant variance (a property known as homoscedasticity). It should also be independent of the independent variables, meaning that the errors are random and do not show any patterns that could indicate a missing variable or model misspecification (Santucci De Magistris, 2023).

Assumptions of Linear Regression

To ensure that the estimates of the regression model are valid and interpretable, several key assumptions must hold:

- 1. Linearity: The relationship between the dependent and independent variables must be linear.
- 2. Independence: The observations should be independent of each other, meaning that one observation does not provide information about another.
- 3. Homoscedasticity: The variance of the residuals (error terms) should be constant across all levels of the independent variables.
- 4. No perfect multicollinearity: The independent variables should not be perfectly correlated with each other, as this would make it impossible to isolate the effect of each variable on the dependent variable.
- 5. Normality of residuals: The residuals should be normally distributed, especially when conducting hypothesis testing and generating confidence intervals.

Goodness-of-Fit: R-Squared and Adjusted R-Squared

A critical metric used to evaluate how well a regression model fits the data is R-squared (R^2) , which measures the proportion of variance in the dependent variable explained by the independent variables. The formula for R^2 is:

$$R^{2} = 1 - \frac{\sum (Y_{i} - \widehat{Y}_{i})^{2}}{\sum (Y_{i} - \overline{Y}_{i})^{2}}$$

Where:

- Y_i is the observed value of the dependent variable.
- \widehat{Y}_{l} is the predicted value from the regression model.
- \overline{Y}_i is the mean of the dependent variable.

 R^2 ranges from 0 to 1, where a value close to 1 indicates that the model explains a large portion of the variation in the dependent variable, while a value close to 0 suggests that the model explains very little of the variation.

In multiple regression, the adjusted R-squared is often used, as it accounts for the number of predictors included in the model, adjusting for the possibility of overfitting. Unlike R^2 , the adjusted R^2 decreases if additional predictors do not significantly improve the model (Santucci De Magistris, 2023).

Model Diagnostics and Validation: Ramsey Regression Equation Specification Error Test (RESET)

The Ramsey Regression Equation Specification Error Test (RESET) is a diagnostic tool used to detect general forms of model misspecification in regression analysis. Developed by James B. Ramsey in 1969, the test assesses whether non-linear combinations of the fitted values help explain the dependent variable, which would suggest that important variables or higher-order terms have been omitted from the model. The RESET test is particularly useful because it does not require specifying the form of the potential misspecification, making it a general test for functional form correctness.

The RESET test is based on the idea that if the model is correctly specified, then no nonlinear functions of the explanatory variables should have any explanatory power beyond what is already captured. Specifically, the test involves augmenting the original regression model with powers of the fitted values and then testing whether the coefficients of these additional terms are jointly zero (Davidson & MacKinnon, 2004).

Consider the original regression model:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_p X_p + \epsilon$$

where:

- *Y* is the dependent variable.
- X_i represents the independent variables.
- β_i are the coefficients to be estimated.
- ϵ is the error term.

The augmented model for the RESET test adds powers of the fitted values \hat{Y}

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k + \gamma_1 \hat{Y}^2 + \gamma_2 \hat{Y}^3 + \dots + u$$

where γ_i are the coefficients of the added terms, and u is the new error term.

The RESET test proceeds in the following steps:

- 1. Estimate the Original Model: Obtain the residuals and the fitted values \hat{Y} from the initial regression.
- 2. Augment the Model: Include higher-order terms of the fitted values, such as \hat{Y}^2 , \hat{Y}^3 , etc., in the regression model.
- 3. Re-estimate the Augmented Model: Run the regression with the additional terms to obtain new estimates and residuals.
- Conduct an F-test: Perform a joint significance test on the coefficients γ_i of the added terms. The null hypothesis H₀ states that all γ_i = 0, implying that the original model is correctly specified. The alternative hypothesis H₁ suggests that at least one γ_i ≠ 0, indicating misspecification.

The F-statistic is calculated as:

$$F = \frac{\{(RSS_0 - RSS_1) / m\}}{\{RSS_1 / (n - k - m)\}}$$

where:

- RSS_0 is the residual sum of squares from the original model.
- RSS_1 is the residual sum of squares from the augmented model.
- *m* is the number of added parameters (number of γ_i terms).
- *n* is the number of observations.
- k is the number of parameters in the original model (including the intercept).

If the calculated F-statistic exceeds the critical value from the F-distribution at a chosen significance level (e.g., 5%), the null hypothesis is rejected, suggesting that the model is misspecified.

Interpretation and Implications

A significant RESET test implies that the model may suffer from one or more of the following issues:

- Incorrect Functional Form: The relationship between the dependent and independent variables may not be adequately captured by the specified model (e.g., a nonlinear relationship might exist).
- Omitted Variables: Important explanatory variables may have been left out of the model, leading to biased and inconsistent estimates.
- Measurement Errors: Errors in the measurement of variables can introduce bias and affect the model's specification.

In the case of a significant test result, the researcher should re-express the model, perhaps by including nonlinear transformations of variables (such as squares or interaction terms) or by adding omitted variables suggested by theory (Davidson & MacKinnon, 2004). The RESET test is a valuable diagnostic tool in econometrics for several reasons:

- General Misspecification Detection: It can detect a wide range of specification errors without the need for specifying alternative models.
- Model Validation: It helps validate the chosen model, ensuring that the conclusions drawn are based on a correctly specified model.
- Improved Model Reliability: By identifying potential misspecifications, researchers can adjust their models accordingly, leading to more reliable and robust results.

Researchers should use the RESET test in conjunction with other diagnostic tools and consider theoretical foundations when interpreting the results.

The application of the Ramsey RESET test in our study was crucial for ensuring the validity of the regression model analyzing the determinants of housing prices. The use of the RESET test exemplifies best practices in econometric modeling, emphasizing the importance of model validation in empirical research.

3.1.2 Stepwise Regression

Stepwise regression is an iterative method used in statistical modeling to select a subset of variables that provide the best fit for a predictive model. It is particularly useful in situations where there is a large set of potential independent variables, and the goal is to identify the most significant predictors of the dependent variable. The method automates the process of variable selection by systematically adding or removing predictors based on specific statistical criteria, such as the significance level of the coefficients.

The stepwise regression process combines elements of both forward selection and backward elimination techniques. In forward selection, the model starts with no variables and adds them one at a time, selecting the variable that has the most statistically significant contribution to the model at each step. Conversely, backward elimination starts with all candidate variables included in the model and removes the least significant variable at each step. Stepwise regression integrates these two approaches by allowing variables to be added or removed at each step, depending on whether they meet the entry or exit criteria (Davidson & MacKinnon, 2004).

Mathematically, consider a multiple linear regression model expressed as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_p X_p + \epsilon$$

where:

- *Y* is the dependent variable.
- X_i represents the independent variables.
- β_i are the coefficients to be estimated.
- ϵ is the error term.

The objective of stepwise regression is to identify a subset of variables $S \subseteq \{X_1, X_2, ..., X_p\}$ that provides the best predictive performance according to a chosen criterion, such as minimizing the Akaike Information Criterion (AIC) or maximizing the adjusted R-squared value.

During each iteration, the algorithm evaluates the potential addition or removal of variables based on their statistical significance, typically assessed using t-tests for individual coefficients. The t-statistic for each coefficient β_i is calculated as:

$$t_i = \frac{\widehat{\beta}_i}{SE(\widehat{\beta}_i)}$$

Where β_i is the estimated coefficient and $SE(\widehat{\beta}_i)$ is its standard error. Variables with tstatistics corresponding to p-values below a predetermined threshold (e.g., 0.05) are considered significant and retained in the model.

Stepwise regression offers several advantages in econometric modeling. It simplifies the model by including only significant variables, enhancing interpretability and potentially improving predictive accuracy. It also helps in identifying the most important predictors among a large set of candidates, which is particularly useful when theoretical guidance on variable selection is limited.

However, there are limitations to this approach. Stepwise regression can be sensitive to random fluctuations in the data, leading to different models if the sample changes slightly. It may also overlook variables that are important when considered jointly with others but not individually significant. Additionally, reliance on automated selection procedures may lead to models that lack theoretical justification, potentially compromising the validity of the conclusions (Davidson & MacKinnon, 2004).

3.1.3 Stationarity in Time Series Data

In time series econometrics, understanding the concept of stationarity is crucial, as many statistical techniques, including regression, assume that the time series data being analyzed is stationary. A stationary time series is one whose statistical properties, such as mean, variance, and autocorrelation, are constant over time. More formally, a time series X_t is said to be stationary if for all time periods t:

- The mean of the series is constant: $E(X_t) = \mu$
- The variance of the series is constant: $Var(X_t) = \sigma^2$
- The autocovariance between values at two time points t and t + k depends only on the time lag k and not on t.

Non-stationary data often exhibit trends, cycles, or varying volatility over time. In these cases, standard regression techniques can produce spurious results, i.e., finding relationships between variables that are not actually related in a meaningful economic sense. Therefore, testing for stationarity is a crucial step before applying time series models (Morelli, 2023).

Testing for Stationarity: Unit Root Tests

One of the most common tests for stationarity in time series data is the Augmented Dickey-Fuller (ADF) test. The ADF test checks for the presence of a unit root, which indicates non-stationarity. The null hypothesis of the ADF test is that the time series has a unit root (i.e., is non-stationary), while the alternative hypothesis is that the series is stationary.

The ADF test model is given by:

$$\Delta X_t = \alpha + \beta X_t - 1 + \sum_{i=1}^p \gamma_i \Delta X_{t-i} + \varepsilon_t$$

Where:

- X_t is the time series being tested.
- ΔX_t is the first difference of X_t .
- α is the constant term.
- β tests for the presence of a unit root.
- γ_i captures the lagged differences to account for autocorrelation.
- ε_t is the error term.

If the test statistic is significantly negative, the null hypothesis of non-stationarity can be rejected, indicating that the series is stationary (Davidson & MacKinnon, 2004).

KPSS Test for Stationarity

The Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test is another widely used test for stationarity, but it differs from the ADF test in a fundamental way. While the ADF test's null hypothesis assumes non-stationarity, the KPSS test assumes stationarity as the null hypothesis. This means that rejecting the null hypothesis in the KPSS test suggests that the series is non-stationary.

The KPSS test breaks the time series into two components: a deterministic trend and a stochastic process. The test checks if the variance of the random walk is zero, implying that the series is stationary around a deterministic trend.

The test model is:

$$X_t = r_t + z_t$$

Where:

- r_t is a deterministic trend.
- z_t is a stationary process.

In the KPSS test, the null hypothesis is that z_t is stationary (i.e., no unit root), and the alternative hypothesis is that the time series contains a unit root (i.e., is non-stationary). A large test statistic leads to the rejection of the null hypothesis, implying non-stationarity (Davidson & MacKinnon, 2004).

3.1.4 Cointegration in Time Series Analysis

Cointegration is a statistical concept used to identify a long-term equilibrium relationship between two or more non-stationary time series. Even though individual time series may be non-stationary, they can move together over time, such that their linear combination is stationary. This long-term relationship is important in econometrics, especially when analyzing economic variables that share common trends.

For example, while variables like income and consumption may each follow a nonstationary process, there may be a stable, long-term relationship between the two, suggesting that they are cointegrated (Davidson & MacKinnon, 2004).

Testing for Cointegration: Johansen Test

The Johansen test is one of the most widely used methods for testing cointegration. It is based on a vector error correction model (VECM), which accounts for both the short-term dynamics and the long-term relationships between the variables.

The Johansen test estimates the following model:

$$\Delta X_t = \Pi X_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \varepsilon_t$$

Where:

- X_t is a vector of non-stationary variables.
- Π is the matrix that contains information about the long-term relationships (cointegration vectors).
- Γ_i captures the short-term dynamics.
- ε_t is the error term. Π

The rank of the Π matrix determines the number of cointegrating relationships among the variables. If the rank is zero, no cointegration exists. If the rank is greater than zero, cointegrating relationships are present, indicating that the variables share a long-term equilibrium (Johansen, 2009).

Detecting Market Bubbles: The GSADF Test

Detecting speculative bubbles in financial markets is essential for understanding market dynamics and preventing potential economic crises. Traditional unit root tests are not sufficiently sensitive to identify explosive behaviors associated with bubbles. To address this limitation, Phillips, Shi, and Yu (2015) introduced the Generalized Supremum Augmented Dickey-Fuller (GSADF) test, a robust statistical tool designed to detect and date-stamp multiple bubbles in time series data.

The GSADF test extends the conventional Augmented Dickey-Fuller (ADF) test by employing a recursive right-tailed unit root testing procedure over a flexible window of subsample periods. This approach involves estimating ADF regressions repeatedly over various subsamples of the data, allowing the test to capture multiple episodes of explosive behavior that may occur at different times.

Mathematically, the GSADF test statistic is defined as the supremum (maximum) of the ADF statistics over all feasible window sizes and starting points:

$$GSADF = \max_{r_2 \in [r_0, 1], r_1 \in [0, r_2 - r_0]} ADF_{r_2}^{r_1}$$

Where:

- r_0 is the minimum window size proportion.
- r_1 and r_2 are the fractions of the total sample size that denote the starting and ending points of the subsample.
- $ADF_{r_2}^{r_1}$ is the ADF test statistic calculated over the subsample from r_1 to r_2

By considering all possible subsample periods, the GSADF test enhances sensitivity to different bubble periods, making it more effective than traditional tests that use fixed or expanding windows.

In their study, Phillips et al. (2015) applied the GSADF test to the S&P 500 stock price index to detect historical episodes of exuberance and collapse. The test successfully identified well-known bubble periods, such as the dot-com bubble of the late 1990s and the housing bubble of the mid-2000s. The ability to date-stamp the origination and termination of these bubbles provides valuable insights into market dynamics and the timing of speculative episodes (Philips, Shi, & Yu, 2015).

The GSADF test has significant implications for investors and policymakers. By providing a rigorous statistical framework for bubble detection, it aids in the early identification of unsustainable price increases, allowing for timely interventions to mitigate potential negative impacts on the economy.

3.2 Data and Variables

During the development of this empirical study on China's real estate market, "Understanding China's Real Estate Market" by Bing Wang and Tobias Just served as a strong foundation for the entire thesis. This comprehensive work revealed that property data in China is surprisingly rich and abundant. According to Robert Ciemniak, Founder-CEO and Chief Analyst of Real Estate Foresight Ltd (REF), China's property data, especially in the housing markets, is not only plentiful and accessible from both government and independent private sources but also nuanced and requires careful interpretation due to its unstructured nature.

While the housing sector provides a wealth of information, other areas like office, retail, industrial, and niche markets have less transparent data, primarily offered by established brokerage firms and industry associations. Ciemniak notes that the increasing competition among developers in a maturing market, the availability of alternative data, and China's significant push towards artificial intelligence are all driving a growing interest in and supply of property data.

This abundance of data is crucial for supporting investment decisions and judgments. It aids investors in determining whether or when to enter or exit a market or city from a topdown perspective and assists in conducting detailed bottom-up due diligence or market feasibility studies on potential transactions. Remarkably, as highlighted by Ciemniak, it can take less than 24 hours from the sale of a new home in China, even in lower-tier cities, for the transaction data to be publicly posted on local government websites. In this sense, China presents a surprisingly transparent market with an abundance of data, particularly in the housing markets, which is the focus of this study (Wang & Just, 2021).

The primary and most consistent official source for data on China's real estate market is the Chinese National Bureau of Statistics (NBS), which offers extensive data on specific industry sectors and macroeconomic indicators such as GDP and population (Wang & Just, 2021). However, a significant limitation of this source is the frequency of the data since it predominantly provides annual figures. Considering the requirements of the regression analysis to be conducted, annual data are insufficient. To overcome this limitation, Bloomberg was used to find the missing data. Bloomberg offers a wide array of indices with more suitable monthly data. The information obtained from Bloomberg was then cross-referenced with data from China's NBS to ensure consistency and coherence between the two sources.

The panel data for the variables in this research, namely HP (Housing Price), GDP, POP (Population), LI (Loan Interest), LP (Land Price), and INV (Investment in RE), are collected monthly for the period between January 2010 and July 2024. The proxy of HP is CHHECRIC Index, equal to the average selling price of commercial residential buildings in the 70 most relevant cities in China, is measured in yuan per square meter. On the demand side, per capita GDP is measured in yuan per person using CNNGPQ Index and dividing it by the population. POP is measured by 10,000 persons at the end of the year in the region, taking official data from China's NBS. The LI is proxied by the one-year Lone Prime Rate (LPR), LP is proxied by the value of land purchased by enterprises for real estate development, in yuan per square meter, which is calculated by dividing the total value of the land purchased by enterprises for real estate development (directly recovered from NBS) by land space purchased by enterprises for real estate development in the month (CHRXLDPR Index). The INV is proxied by the investment actually completed by enterprises for the development of residential buildings in 100 million yuan, which was possible to retrieve directly from NBS. To remove the influence of inflation, all of the nominal data is deflated by the consumer price index to obtain data in real terms. In addition, all of the data are transformed into a log form. Log transformation compresses the scale in which the variables are measured, thereby reducing a tenfold difference between two values to a twofold difference.
3.3 Empirical Analysis of the Chinese Housing Market

Based on the above theoretical framework, logarithmic forms of HP (LHP), GDP per capita (LGDP), population (LPOP), land price (LLP), and investment in housing development (LINV), and LI are entered into a multiple linear panel regression model, and estimated with the Ordinary Least Squares estimation method:

$$LHP_t = \beta_0 + \beta_1 LGDP_t + \beta_2 LPOP_t + \beta_3 LLP_t + \beta_4 LINV_t + \beta_5 LLI_t + \varepsilon_t$$

The purpose of this linear regression was to obtain the residuals necessary for conducting cointegration tests, aiming to assess the long-term equilibrium relationships between housing prices and the selected macroeconomic variables. However, the initial model failed the Ramsey RESET Test, which indicates that the relationship between the dependent and independent variables may not be adequately captured by a purely linear specification. This failure suggests potential issues with model misspecification, such as omitted variables, incorrect functional form, or the presence of nonlinear relationships.

Due to these findings, it was concluded that the model was not suitable for generating reliable residuals for the cointegration analysis. As a result, the decision was made to adopt a Stepwise Regression approach to refine the model. Stepwise Regression is a systematic method of adding or removing variables based on specific statistical criteria, allowing for the exploration of different model specifications that might better capture the complexities inherent in the housing market dynamics. This approach aims to identify a more appropriate model for subsequent cointegration tests by potentially uncovering nonlinear relationships or interactions among variables that a simple linear model might overlook.

3.3.1 Regression Model and Residual Analysis

After applying the Stepwise Regression method, the refined model resulted in the elimination of the variables investment in housing development (LINV) and land price (LLP). The final regression model includes LGDP, LPOP, and LLI as the independent variables influencing housing prices (LHP). This outcome is consistent with the literature reviewed in Chapter 2.1, which identifies the four fundamental determinants of housing prices as GDP, population, interest rates, and government policies. Since government policies are challenging to quantify directly, interest rates often serve as a proxy for policy effects.

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Figura 6 Stepwise Regression Summary
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Final Model Summary:
```

```
Linear regression model:
LHP ~ 1 + LGDP + LPOP + LLI
```

Estimated Coefficients:

	Estimate	SE	tStat	pValue
(Intercept)	-33.581	8.6913	-3.8638	0.00015825
LGDP	0.16699	0.05082	3.2859	0.0012336
LPOP	3.381	0.76466	4.4215	1.7374e-05
LLI	-0.49624	0.052313	-9.486	2.051e-17

Number of observations: 175, Error degrees of freedom: 171
Root Mean Squared Error: 0.0626
R-squared: 0.911, Adjusted R-Squared: 0.909
F-statistic vs. constant model: 582, p-value = 1.79e-89

Interpretation of Results

The variables investment in housing development (INV) and land price (LP) were removed from the model during the stepwise regression process. This suggests that these variables do not significantly contribute to explaining the variation in housing prices when GDP, population, and interest rates are already included. This finding aligns with the literature, which emphasizes GDP, population, interest rates, and government policies as the primary factors influencing housing prices.

GDP (β_1 = 0.16699): The positive coefficient indicates that higher GDP is associated with higher housing prices. Specifically, for every one-unit increase in GDP, housing prices increase by approximately 0.16699 units, holding other variables constant. This reflects the economic principle that increased economic activity and wealth lead to greater demand for housing.

Population ($\beta_2 = 3.381$): The positive and significant coefficient suggests that population growth drives up housing prices. A one-unit increase in population leads to an estimated 3.381-unit increase in housing prices, ceteris paribus. This underscores the impact of demographic factors on housing demand.

Interest Rates ($\beta_3 = -0.49624$): The negative coefficient signifies that higher interest rates are associated with lower housing prices. Specifically, a one-unit increase in interest rates results in a decrease of approximately 0.49624 units in housing prices, all else being equal. This is intuitive, as higher interest rates increase borrowing costs, which can cool down the economy and consequently dampen demand for housing.

Intercept ($\beta_0 = -33.581$): The intercept represents the expected value of housing prices when all independent variables are zero. While this scenario is not practically meaningful, the negative intercept may adjust the regression line to fit the data accurately within the observed range of the variables.

Statistical Significance

All coefficients have p-values less than 0.01, indicating they are statistically significant at the 1% significance level. This means there is strong evidence to suggest that GDP, population, and interest rates are significant predictors of housing prices.

Model Fit

R-squared (0.911): Indicates that 91.1% of the variability in housing prices is explained by the model. This high value suggests a strong fit.

Adjusted R-squared (0.909): Adjusts for the number of predictors and confirms that the model maintains a high level of explanatory power.

F-statistic (582) and p-value (1.79e-89): The large F-statistic and extremely small p-value indicate that the model is statistically significant overall. This means the independent variables collectively have a significant effect on housing prices.

The results of the stepwise regression highlight that GDP, population, and interest rates are significant determinants of housing prices in the Chinese residential market. The elimination of investment in housing development and land price from the model suggests that these variables do not provide additional explanatory power when the key fundamentals are considered. This outcome is coherent with the literature reviewed in chapter 2.1.2, which posits that housing prices are primarily influenced by economic activity (GDP), demographic trends (population), and monetary policy (interest rates).

The high R-squared and adjusted R-squared values indicate that the model fits the data well, explaining over 90% of the variance in housing prices. The statistically significant coefficients and overall model significance support the reliability of the findings.

Figura 7 Residuals Plot Overtime



From the plot in figure 7 we can already see how in the years 2010-2012 and 2018-2022 the distribution of the residuals, coherently with chapter 1.3, suggests an over appreciation of housing. At the same time, we can see how from 2022 the residuals seem to move towards the mean in a white noise fashion, suggesting a return to a long-term equilibrium between the variables.

These results imply that housing prices in China are closely tied to fundamental economic factors. Deviations from these fundamentals could indicate the influence of speculative activities or the formation of a market bubble. This sets the foundation for further analysis, such as cointegration tests, to assess whether housing prices are aligned with their long-term determinants or if they exhibit signs of being inflated due to non-fundamental factors.

Building upon the regression analysis that identified GDP, population, and interest rates as significant determinants of housing prices in China, we extend our investigation by employing the Generalized Supremum Augmented Dickey-Fuller (GSADF) test. This test allows us to detect and date-stamp periods of explosive behavior, commonly associated with speculative bubbles, in the housing market over time.

3.3.2 GSADF Test Results and Speculative Bubble Detection

The GSADF test results are visualized in two figures: one plotting the GSADF test statistics over time, and the other depicting the corresponding p-values. These charts help us identify bubble periods by indicating when the GSADF statistic exceeds critical values and when the p-values rises above the 0.05 significance level.





The first figure displays the GSADF test statistic against time, with the 1%, 5%, and 10% critical value thresholds marked. Surpassing these critical values signals potential bubble periods where housing prices deviate explosively from their fundamental values.

From mid-2019 to early 2022, the GSADF statistic remains consistently above the 1% critical value. This suggests a significant overvaluation in housing prices driven by speculative forces rather than underlying economic fundamentals. This period corresponds with observed market behavior, where housing prices in China escalated rapidly due to excessive leveraging and speculative investments.

By early 2022, the test statistic begins to decline, falling below the critical thresholds by early 2023. This decline indicates the end of the bubble phase and a return to more stable market conditions, reflecting a controlled market correction.

Figura 9 GSADF Test p-Values Over Time



The second figure illustrates the p-values over time. When p-values surpass the 0.05 significance level, it confirms the presence of explosive behavior in the market, reinforcing the GSADF statistic findings.

The p-values mirror the GSADF statistics, raised above the 0.05 threshold between 2019 and 2022, which confirms the existence of a significant bubble during this period. After 2022, the p-values fall below the threshold, indicating that the explosive behavior has subsided and the market is no longer in a bubble phase.

Integration with Regression Analysis

The GSADF test results complement our regression findings by highlighting periods when housing prices deviate from the fundamental determinants identified earlier: GDP, population, and interest rates. While the regression model explains over 90% of the variance in housing prices based on these fundamentals, the GSADF test detects episodes of price exuberance that cannot be explained by these variables alone.

The detection of a bubble between 2019 and 2022 aligns with the regression model's implications regarding deviations from fundamental values. It suggests that during this period, factors other than GDP growth, population increases, and interest rate changes, such as speculative behavior and investor sentiment, played a significant role in driving up housing prices.

Correlation with Government Policies

These findings are consistent with the conclusions presented in chapter 2, which discussed the Chinese government's regulatory interventions to manage the overheated housing market. Policies like the "Three Red Lines" were instrumental in curbing excessive borrowing and speculative development, effectively orchestrating a controlled deflation of the housing bubble.

The GSADF test results substantiate this interpretation by showing how the speculative bubble developed and was gradually deflated through deliberate government action. The sharp decline in the test statistics post-2022 reflects the market's response to these interventions, supporting the notion of a "controlled demolition" rather than an abrupt market collapse.

Current Market Conditions and Future Outlook

The downward trend in both the GSADF statistics and p-values after 2022 suggests market stabilization, aligning with recent government measures aimed at stimulating the housing sector. The easing of down-payment requirements and reduction of mortgage rates in 2023 indicate a policy shift toward encouraging housing demand, potentially signaling a transition from recession to recovery.

These developments imply that speculative forces are currently under control, and the housing market may be on a sustainable path to recovery. However, ongoing monitoring is crucial to assess the durability of this recovery and to identify any new risks that may emerge.

Conclusion

The application of the GSADF test provides quantitative evidence of speculative bubbles in China's housing market between 2019 and 2022, reinforcing the regression analysis's emphasis on fundamental determinants. By capturing deviations from these fundamentals, the GSADF test offers valuable insights into the market's speculative dynamics.

The combined use of regression analysis and the GSADF test enhances our understanding of the housing market's behavior, highlighting the interplay between fundamental economic factors and speculative activities. These findings are crucial for policymakers and stakeholders, as they underscore the importance of regulatory measures in managing market stability and preventing future bubbles.

In summary, the Chinese housing market's experience between 2019 and 2022 illustrates how speculative excesses can inflate asset prices beyond fundamental values, and how targeted government interventions can mitigate these risks. The recent policy shifts suggest a proactive approach to fostering a healthy and sustainable housing market, though vigilance remains necessary to ensure long-term stability.

Coclusion

This thesis succeeded in presenting a global prospective of the crisis in the Chinese real estate market during the post-pandemic era. Adopting both qualitative and quantitative approaches, we analyzed the causes for the collapse of the residential market and further proposed an empirical assessment of the present situation of the industry. This study has thus deepened the understanding of the underlying factors that came together in the formation and consequent bursting of the real estate bubble in China, with a specific focus on excessive leveraging by developers, speculative investment, and government policies for market stabilization.

The first objective was to understand the main drivers of the real estate crisis, including demographic changes, speculation, and policy measures such as the "Three Red Lines" policy. Results show that these factors, in conjunction with general economic uncertainties, have been highly contributory to the market instability. The Evergrande case brought to light the risk of high leverage and the resultant domino effect in the sector. While government policies were necessary, they have reduced financial risks while at the same time exacerbating the liquidity issue amongst developers, leading to widespread defaults and incomplete projects.

The second objective was assessing the current phase of the real estate market cycle and determining where the Chinese residential market stands today. According to the empirical methodologies followed in this study, namely the econometric techniques and the bubble detection tests, we can conclude that the market has crossed the peak of the crisis and may be moving into a recovery phase. However, the remains of unsold inventories and projects, in addition to demographic challenges, remain key stumbling blocks to full recovery. The recent slight easing in mortgage rates and other policy adjustments are signals that the administration is willing to support the sector's bounce-back but will most likely avoid overheating the market this time around.

In conclusion this research contributes not only to the understanding of the causes and present conditions of the crisis within China's real estate market but also frames how markets with similar characteristics may behave during any financial stress, the findings underscore the importance of balancing economic growth with financial prudence, and the role of government intervention in managing speculative bubbles. As China continues to navigate its economic transition, the lessons learned from this crisis will be critical for ensuring long-term stability and resilience in its real estate sector. The hope is that this research will be useful to investors, and researchers as they continue to track the evolving dynamics of one of the world's largest real estate markets.

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