China's Housing Market: Is Demand Sustainable?

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China's Housing Market

Is Demand Sustainable?

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by

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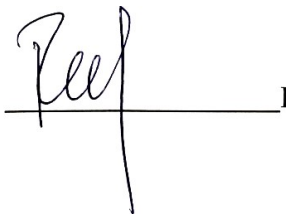
Signature  Date Feb 1, 2020.

Abstract

This paper aims to quantify the contribution of demographics and monetary factors to the overall Chinese housing boom in the 20 years between 1999 and 2018 and to predict the Total Residential Sales in the following three years from 2019 to 2021.

The study indicates that population and urbanization factors did contribute to the growth of the Chinese housing market to a certain degree. However, they are not the main drivers behind the housing market growth in most of the markets examined in this paper. On the other hand, monetary factors, such as Reserve Ratio and Mortgage Loan, and fiscal factors, such as Fiscal Expenditure and structural reform, contributed remarkably to the growth over the 20 years. With the tapering of credit easing and fiscal expenditure under a slower GDP growth target in China, our FGLS model predicts that in the base case the total Chinese residential sales would reduce from RMB 12.6 trillion (USD 1.8 trillion) in 2018 to RMB 10.8 trillion (USD 1.5 trillion) in 2021, growth unsustainable in three years.

Although Mortgage LTV and Mortgage to GDP ratio in China are at moderate levels, households are not necessarily able to borrow further for property investment because their Mortgage Debt Servicing Ratio has reached alarming levels, especially in large cities. Without any structural changes in household income, it is increasingly difficult for Chinese households to expand their already sizeable property investment portfolios.

Overall, the statistics study shows that the key driving factors behind China's housing market growth in the past cannot sustain the same level of growth as 2018 for the following three years. However, regression models may not adequately capture the effectiveness of housing policies and fiscal reform measures. When studying the Chinese housing market, we should not lose sight of the government's role in maintaining short term stability and generating long term sustainability. Successful implementation of fiscal and monetary stimulus policies with long term prospects by the government would help to preserve the stability in China's housing market and provide cushions for the potential structural slowdown in housing demand.

Key words: China housing market; China housing demand sustainability; China household mortgage debt; China housing affordability; China housing policy

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Table of Contents

List of Figures

List of Tables

China's Housing Market – Is Demand Sustainable?

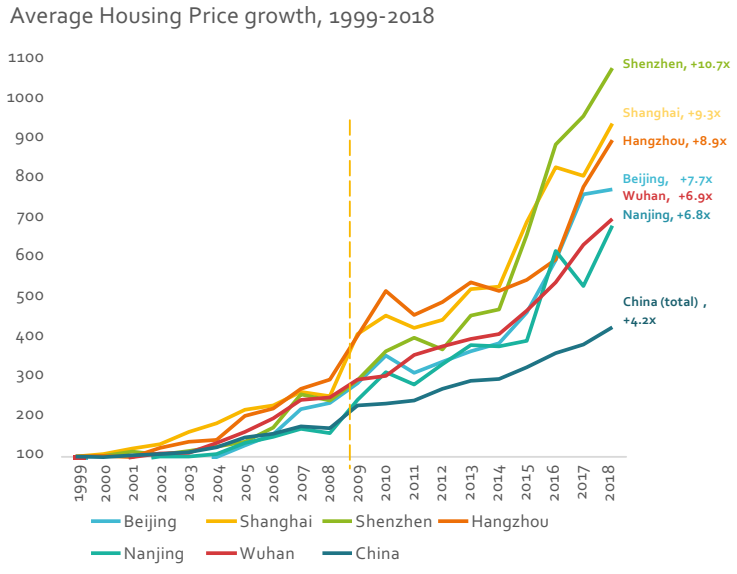
1. Introduction

Studies on China's spectacular housing market growth is hardly a new phenomenon. Many papers have tried to reveal the root causes of growth, and the views are drastically different from "it is a property bubble" to "it is a demand-driven sustainable market."

This paper has examined 31 factors related to the property market, identified the key drivers, quantified their respective value contribution, and predicted the housing market growth in the following three years. In addition, this paper has drilled down to six Chinese cities' property markets and built a healthy score table to benchmark them against each other and the country as a whole.

China's housing market has experienced remarkable growth. Over the 20 years between 1999 and 2018, the average housing price for the country as a whole increased by 4.2 times[2], and the price of a top city such as Shenzhen rose by a staggering 10.7 times[3] in real terms. [Figure 1. 1] Housing GFA sold in the country in the 20 years also expanded rapidly by an average of 13.2%[4] per annum. Living condition for hundreds of millions of Chinese families has been lifted to middle-class comfort. [Figure 1. 2]

Figure 1. 1 China (total) average housing price growth, 1999-2018



* Real price, adjusted by CPI * Data source: Year books

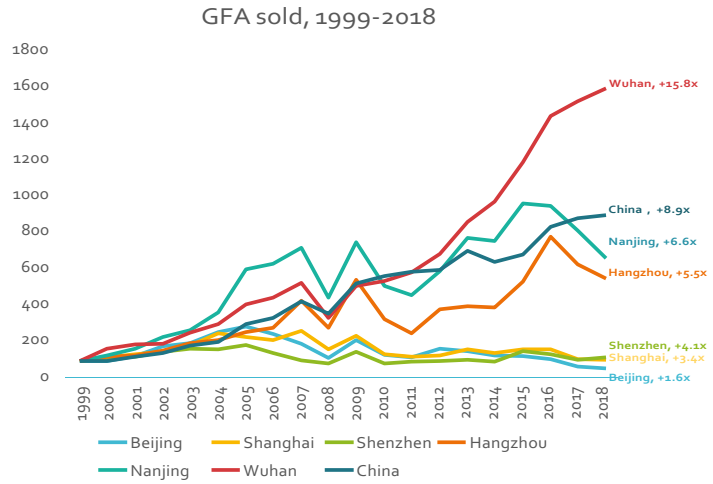
[2] Yearbooks - Beijing, Shanghai, Shenzhen, Hangzhou, Nanjing, Wuhan, China

3 Yearbooks - Beijing, Shanghai, Shenzhen, Hangzhou, Nanjing, Wuhan, China

4 Yearbooks - Beijing, Shanghai, Shenzhen, Hangzhou, Nanjing, Wuhan, China

Figure 1. 2 China (total) growth in GFA sold, 1999-2018

	Beijing	Shanghai	Shenzhen	Hangzhou	Nanjing	Wuhan	China (total)
Average growth rate	1.55%	3.39%	4.11%	14.06%	14.25%	17.57%	13.27%



* Data source: Year books

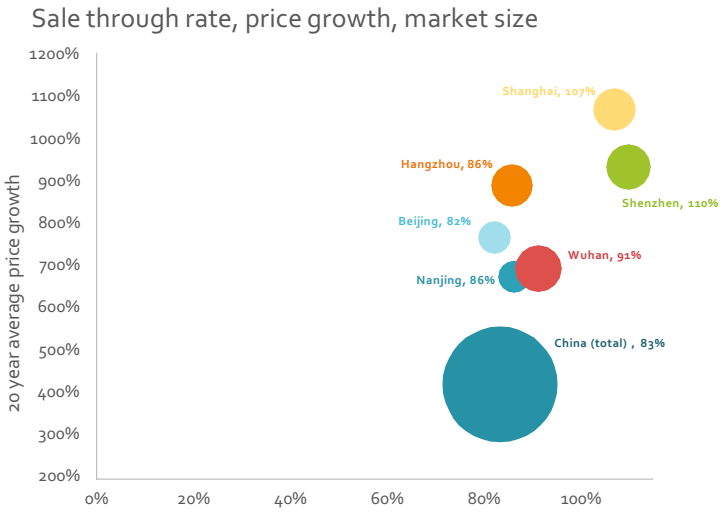
The substantial price and volume growth were bolstered by an impressive average sell-through rate (annual GFA new start/annual GFA sold) of 80%[5] despite the widespread concern of Chinese housing oversupply over the years. Shanghai and Shenzhen were vibrant markets, with over 100% sell-through rate, demonstrating a compelling supply-demand dynamic. Even in the less affluent second-tier city Wuhan, the sale-through rate had reached 91%. [Figure 1. 3]

Many researchers believe that demographics, economics, monetary, and investment factors have all contributed significantly to the Chinese housing market growth. Plotting these factors against the housing market growth does reveal their respective correlation with the growth of the housing market.

For example, urbanization - migration from rural China into cities has grown alongside the housing price growth, especially in tier 1 cities. The population in Shenzhen, Shanghai, and Beijing all recorded substantial growth as a result of urbanization, so did their housing markets in the same period. [Figure 1. 4] Many researchers have highlighted this correlation. (Yang and He 2016) stated that the "urban housing demand is dependent on the family size, total population, and urbanization rate. Housing demand growth is equal to urbanization growth."

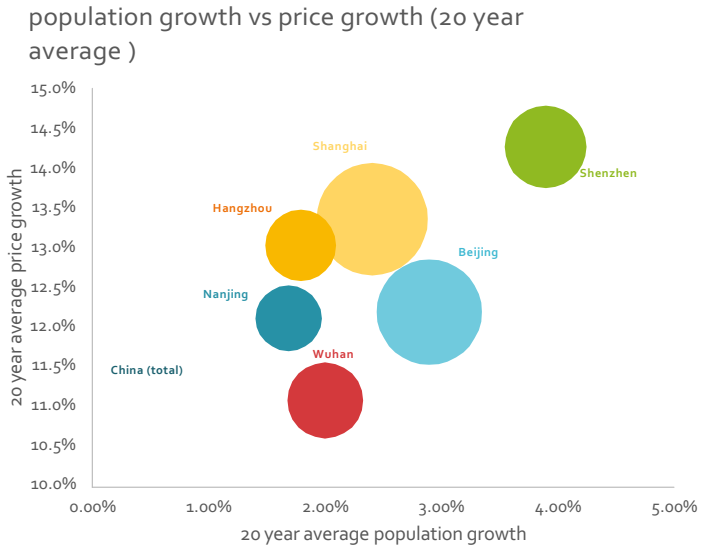
[5] Yearbooks - Beijing, Shanghai, Shenzhen, Hangzhou, Nanjing, Wuhan, China

Figure 1. 3 China (total) 20 years sale through rate, price growth; market size in 2018



* Sale through ratio: annual GFA sold/annual GFA new start * Real price, adjusted by CPI
* Data source: Year books, Yihan Real Estate Research, CEIC, Wind

Figure 1. 4 China (total) population growth vs price growth, 1999-2018

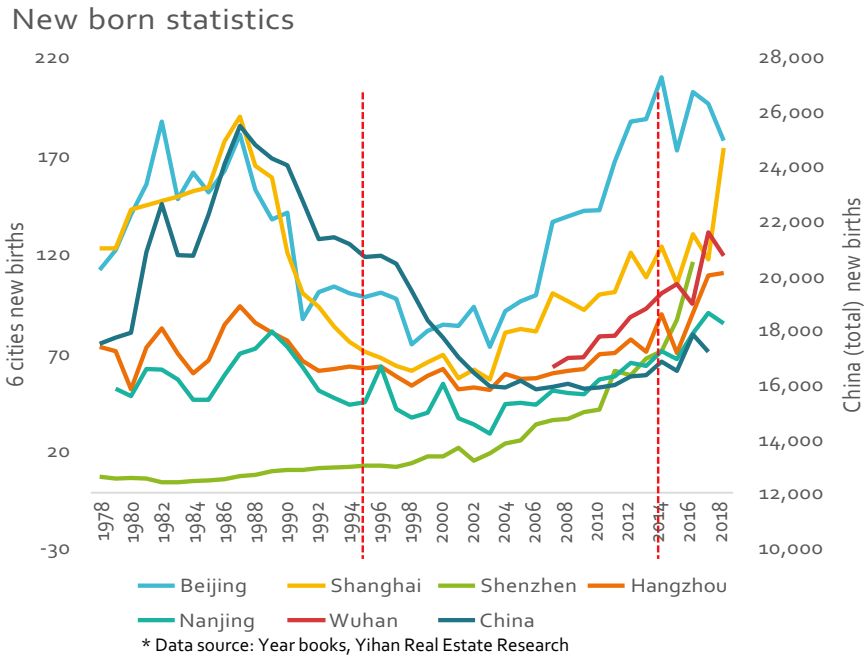


* Data source: Year books, Yihan Real Estate Research, CEIC, Wind
* Real price, adjusted by CPI

In addition to urbanization, the new birth cycle between 1980 and 1990 corresponds with the housing boom 25 years later from 2005 to 2013 across China. (Yang, Wen and He 2015) suggested that there is a marked impact of the demographic transition on the changing of housing prices, as evidenced by the fact that China's housing prices in 2005 had strong upward momentum from the baby boom in the '80s and significant downward pressure from 2014 due to the decline in new births in the '90s. [Figure 1. 5]

By this theory, one would expect that 25 years after the new birth down cycle between 1995 and 2010, housing demand from 2020 and onwards would be under pressure.

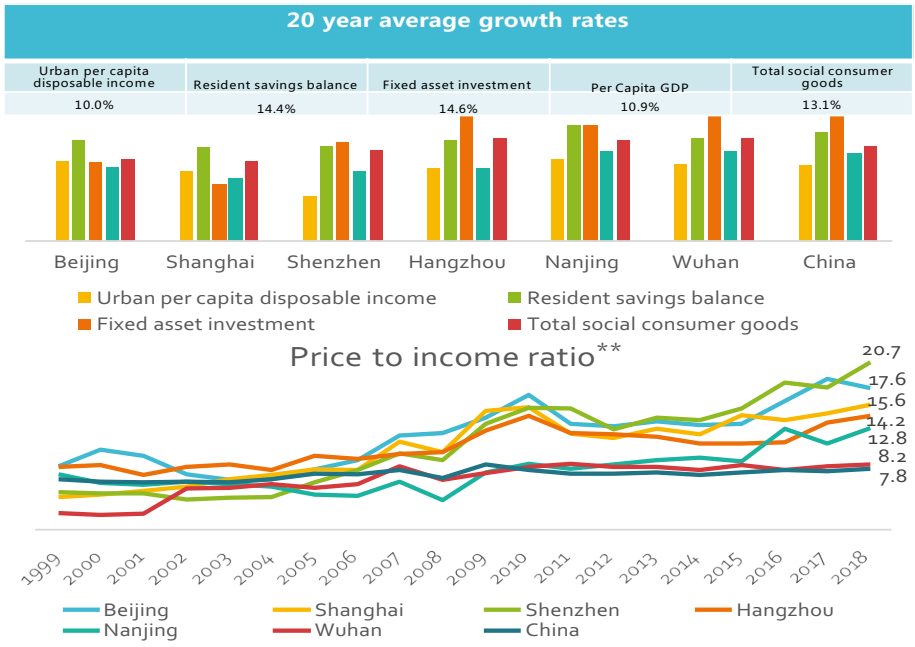
Figure 1. 5 China (total) newborn, 1979-2018



* Data source: Year books, Yihan Real Estate Research

Along with demographic factors, income growth also rises with the housing market expansion. Urban per capita disposable income grew at an average of 10%[6] from 1999 to 2018, building up enormous housing purchase power. However, income growth had not caught up with the spikes in housing prices, resulting in alarming Price to Income ratios. [Figure 1. 6]

Figure 1. 6 China (total) price to income ratio

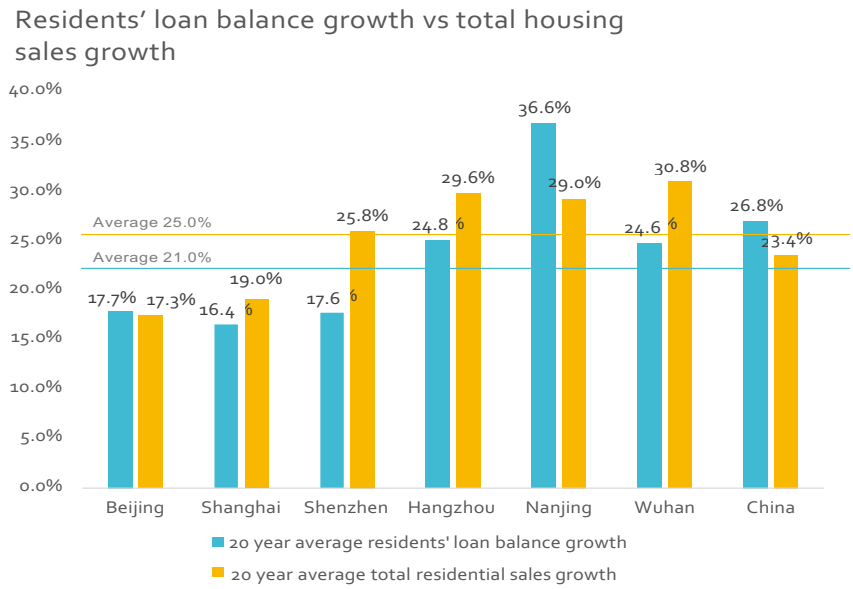


* Data source: Year books, Yihan Real Estate Research, CEIC, Wind *Real price, adjusted by CPI

[6] Data source: Year books, Yihan Real Estate Research, CEIC, Wind

Monetary factors demonstrate a similar growth pattern to housing prices. Residents' loan growth had closely followed total housing sales growth. Total China loan balance had increased faster than housing sales growth, although most tier 1 and 2 cities had seen higher total housing sales increase than residents' loan balance growth. [Figure 1. 7]

Figure 1. 7 China (total) growth of residents' loan vs. growth of total housing sales



* Data source: Year books, Yihan Real Estate Research, CEIC, Wind

With the robust momentum especially in the recent three years, many industry practitioners, including Chief Research Officers from Ehouse, China's largest agency for primary house sales, Homlink, China's largest agency for second-hand house sales, and Evergrande, one of China's top 3 developers, believe that China's real estate market would continue to grow or at least maintain the current level in the next three years.

However, many of these predictions appear to be momentum driven or pro-cyclical thinking (Williams 2013) and derived from a small set of factors, mostly focusing on China's secular demographics and urbanization growth. Few people have tried to review the market outlook based on a comprehensive list of underlying factors across demographics, fiscal, and monetary. Many are envisaging how a resilient housing market could support a downward economy rather than how the housing market would perform if the overall Chinese economy slowdown exacerbates.

This paper is organized through reviewing the existing literature, analyzing underlying data and assumptions, building regression models, and predicting China's Total Residential Sales from 2019 to 2021. The paper also discusses the housing policy direction and market dynamics in six Chinese cities.

2. Literature Review

There is never a lack of pessimistic views in the research field about the Chinese housing market. (Gaulard 2014), for example, wrote that "although some economists have rejected the hypothesis of a real-estate bubble in China, the rise in real-estate prices has gradually become detached from the increase in real salaries, principally in major Chinese cities. Specifically, the exponential growth in bank loans may stir up fears of problems related to over-indebtedness for a considerable number of real-estate developers. However, these difficulties are only the tip of the iceberg of deeper problems within the Chinese economy."

(Wu, Gyourko and Deng 2016) - "The risk of housing even in markets such as Beijing which show no evidence of oversupply is best evidenced by price-to-rent ratios. They are well above 50 in the capital city. (Porterba 1984) user cost model suggests these levels can be justified only if owners have sufficiently high expectations of future capital gains. Even a modest one percentage point drop in expected appreciation (or increase in interest rates) would result in a drop in prices of about one-third, absent an offsetting increase in rents."

(Chen and Wen 2017) The combination of these features—namely, (i) real housing prices outpacing income for a decade; (ii) a high vacancy rate, and (iii) a high rate of return to capital—is puzzling.

Yet, for some, such as (Glaeser, et al. 2017), the gloomy outlook is far from certain. "Chinese home buyers appear to be investing for the long run and are unlikely to sell voluntarily even if home prices decline. Nor are they heavily leveraged, so repossessions and liquidations of homes are unlikely."

(Glaeser, et al. 2017, 23) further elaborates, "Chinese developers are more leveraged, but are cozy with state banks, so their loans are likely to be restructured. Even if banks repossess properties from developers, they are unlikely to dump them on the market. Compared to Chinese stocks, more inertia is built into the housing market."

"And then there is the critical role of the Chinese government in housing markets. The demand for urbanization in China is so large that if the government acts to restrict new supply, it can probably maintain prices at close to current market levels. If the government buys up excess inventory, perhaps to convert it to social housing as it has started to do in 2015, it can further bolster softening prices."

Moreover, (Fang, et al. 2015) claimed that "Our analysis leads us to take a more balanced stand between these two contrasting views. On the comforting side, the rapid income growth, which accompanied the enormous housing price appreciation, helped support the steady participation by low- income households in the housing market. On the concerning side, high expectations about future income growth might have motivated low- income households to buy homes by undertaking substantial financial burdens, causing them to be particularly vulnerable to future sudden stops in the Chinese economy."

There are many more examples from (Tian and Nie 2018) (Yang, Wen and He 2015) (Yang 2017) (Yu 2010) (Yang and He 2015) (Chen, Wang and Wang 2019) and (Zhu 2016), which examined the market from both demand and supply angles, offering evidence from income growth, household saving, household leverage ratio, and demographics/culture perspectives to support the strong fundamental demand. These papers led to a view that the Chinese housing sector appears to have good fundamentals based on a demand-driven housing market and potential government intervention to turn excess supply into social housing.

In an environment where the overall economy is slowing down both structurally and cyclically while transiting to a less capital-intensive growth model and compounded by the weakening exports and manufacturing, do we still see a path towards housing market growth or even maintaining its stability? What are the key drivers behind the housing market growth? How would a softening monetary and fiscal policy environment impact these factors? Between stabilizing the short-term volatility and maintaining long-term sustainability, what is the focus of the Chinese government? Can the Chinese government balance the two?

This paper attempts to discuss these issues and evaluate the housing market outlook by conducting both statistics and housing policy analyses. In addition, the paper examines the housing markets of six Chinese cities and zooms in on the different submarkets instead of staying at the country level for a broad overview.

3. Methodology

3.1. Data Sources

This paper has studied 31 sets of factors in the Chinese housing market over a 20-year horizon covering demographics, economics, fiscal, and monetary parameters.

The table below summarizes the data for China as a whole as well as six cities, being Beijing, Shanghai, Shenzhen, Hangzhou, Nanjing, and Wuhan.

Table 3. 1 List of demographics, economics, investment, and monetary parameters

Demographics	Economics, fiscal, and monetary	Supply/demand
1. Population ('000) 2. Population between age 16-64 3. College graduates ('000) 4. Marriage registration 5. New born ('000) 6. Urbanization rate	7. CPI (Previous year = 100) 8. Urban per capita disposable income (RMB） 9. M2 Rebase 10. Residents loan balance (RMB m) 11. Mortgage loan balance (RMB m) 12. Consumption loan balance (RMB m) 13. Fixed asset investment (RMB m) 14. Infra investment Real estate investment (RMB m) Total social consumer goods (RMB m) 15. Per Capita GDP (RMB) 16. Resident savings balance (RMB m) 17. Total market cap Shanghai Ex & Shenzhen Ex 18. Local tax revenues (RMB m) 19. Local fiscal income (RMB m) 20. Local fiscal expenditure (RMB m)	21. Per capita housing area (sqm) 22. Average area for new home sales (sqm) 23. New home units approved for presale 24. Residential land sale GFA ('000 sqm) 25. Residential GFA new start ('000 sqm) 26. Residential GFA under construction ('000 sqm) 27. Residential GFA completed ('000 sqm) 28. Residential area sold ('000 sqm 29. Average selling price (RMB/sqm) 30. Total residential sale (RMB m) 31. Resi area sold / New home approve for sale

The raw historical data were extracted directly from yearbooks from 1998 to 2018, which are available in the China State Statistics Bureau and its local branches in Beijing, Shanghai, Shenzhen, Hangzhou, Nanjing, and Wuhan. For data not included in these yearbooks, for example, mortgage loan balance, we went to wind.com, Sofun.com, and UBS Research for cross-reference. For industry consensus formulas to calculate key ratios, such as Mortgage Debt Servicing Ratio, we followed the practice of prominent research houses, such as China Securities, which produces comprehensive analyses on China household credit review. For forecast information, we chose Oxford Economics database.

3.2. Assumption Preparation

The regression analysis in this study has been conducted on Growth Rates of different variables (factors) rather than Levels because many variables are drastically different in size, e.g., total GDP of China vs. average housing price, new birth vs. total housing sales volume, or CPI vs. total mortgage loan balance. Using Growth Rates as the basis allows comparison among different periods and across different markets. All the historical price data have been converted into Real Terms.

For most of the economic and housing market data, there are only yearly statistics available in China's statistics bureaus. Multiple rounds of efforts through different channels have been taken to search for monthly or quarterly data, but none of the sources offers monthly or quarterly records in full over the 20 years. All real estate related monthly/quarterly data available in the market are compiled by private research/business organizations, which apply different methodologies and often offer little explanation of the data layering and organizing process. Reconciliation of the data from various private sources for different periods will further distort the already weak stability of the statistics and reduce the reliability of the prediction.

Therefore, we have decided to accept the 20 lines yearly data as the research basis but perform a Multiple Imputation data expansion in SPSS for each of the seven markets (six cities and China as a whole) to increase from 20 lines yearly data to 80 lines quarterly data to enhance the statistical flexibility.

Multiple Imputation narrows the uncertainty by calculating four different scenarios for each line of data. Four sets of the data have been created for each year, which are then combined to make the "best" values and allow us to analyze the data with regular statistical analysis tools such as t-test or ANOVA.

3.3. Model Construction

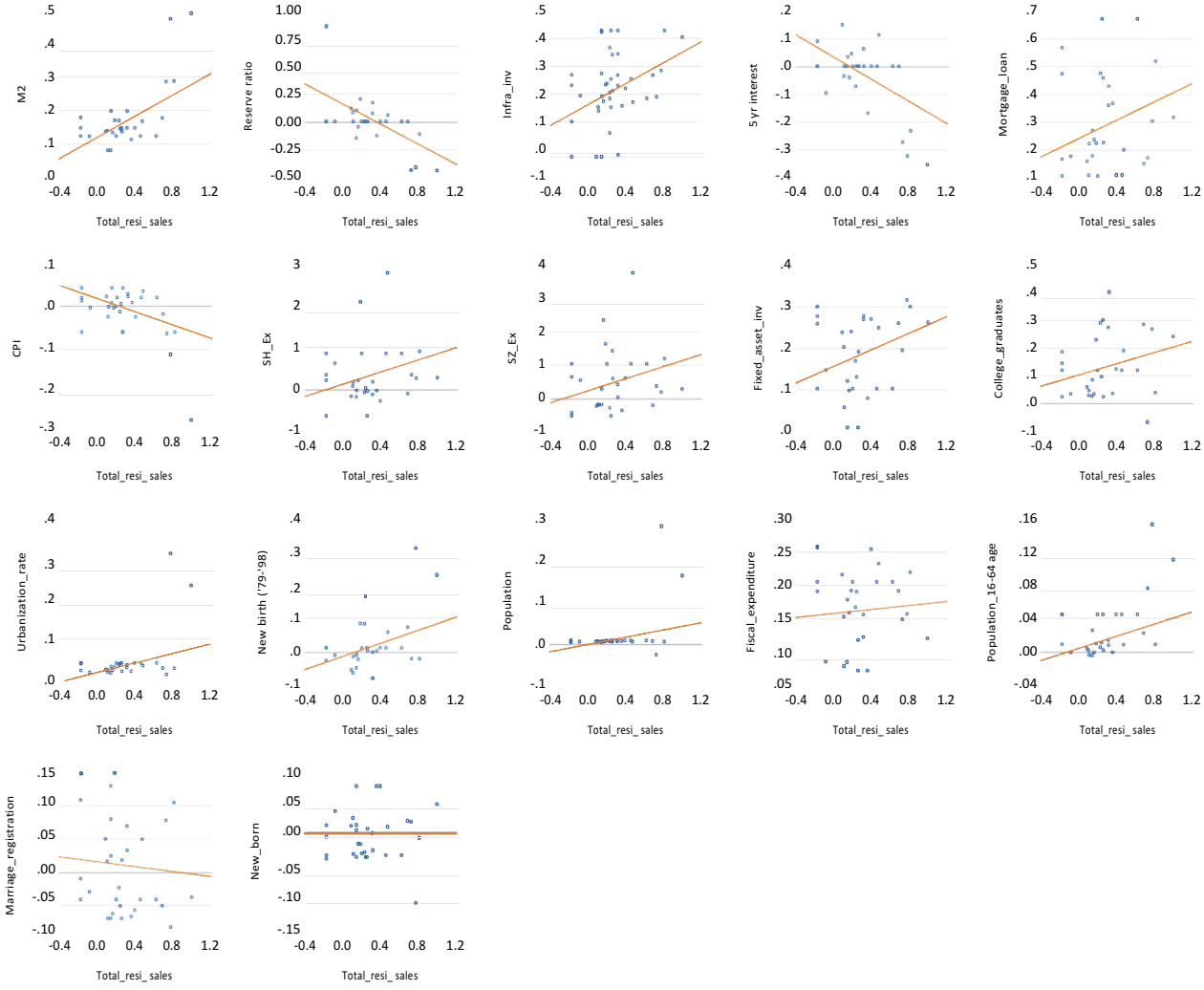
A. Identify key factors

It is not meaningful to run a model for 31 factors altogether because many may not correlate with the dependent variable, and many potentially contain co-linearity among themselves. We plan to perform graphical and statistical tests to identify a shortlist of critical drivers out of a total of 31 variables.

Through the scatter charts for the data on Total Residential Sales against every independent variable, we observe that many of the variables lack a pattern of correlation (neither linear nor non-linear) with Total Residential Sales, such as SZ_Ex, SH_Ex, Fixed Asset Investment, and Marriage Registration. In contrast, some other variables demonstrate a certain level of linear correlation, such as Reserve Ratio, population, and CPI.

Below is a summary of the charts visualizing the relationships: [Figure 3.1]

Figure 3. 1 Scatter charts for key factors against the China Total Residential Sales



Source: Yearbooks - Beijing, Shanghai, Shenzhen, Hangzhou, Nanjing, Wuhan, China

Data file reference: Output_correlation_Oct27.xlsx, processed by Eview

After conducting a series of linear and non-linear tests for data relationships, we have the table below [Table 3.2] listing the top 15 variables that are correlated with Total Residential Sales in each market, ranked by their respective correlation values.

Table 3. 2 Top 15 factors correlated with Total Residential Sales

Top 15 factors most correlated with Total Resi Sales

	Beijing	Correl value	Shanghai	Correl value	Shenzhen	Correl value	Hangzhou	Correl value
1	5 yr interest	-51%	M2	44%	Fiscal_expenditure	62%	5 yr interest	-58%
2	CPI	-48%	5 yr interest	-44%	Disposable_income	-62%	CPI	-54%
3	Fixed_asset_inv	46%	Reserve ratio	-43%	Mortgage_loan	51%	M2	52%
4	M2	44%	Marriage_registration	38%	College_graduates	39%	Mortgage_loan	45%
5	Reserve ratio	-43%	CPI	-37%	Reserve ratio	-31%	SH_Ex	43%
6	GDP	32%	Fixed_asset_inv	36%	Fiscal_income	30%	SZ_Ex	40%
7	Infra_inv	30%	SZ_Ex	35%	Real_estate_inv	-29%	Reserve ratio	-39%
8	Population	30%	Mortgage_loan	35%	Marriage_registration	-28%	Real_estate_inv	-31%
9	Real_estate_inv	29%	New birth ('79-'98)	33%	GDP	-27%	GDP	-23%
10	Per_Capita_GDP	28%	Population	-29%	CPI	-25%	Tax_revenues	-19%
11	New birth ('79-'98)	-28%	Tax_revenues	27%	Social_consumer_goo	-24%	Population	-19%
12	College_graduates	24%	Fiscal_expenditure	27%	M2	23%	New birth ('79-'98)	12%
13	Fiscal_expenditure	20%	Infra_inv	25%	5 yr interest	-22%	Fiscal_income	-12%
14	Urbanization_rate	20%	Population_16-64 age	23%	Per_Capita_GDP	-17%	Per_Capita_GDP	-11%
15	SH_Ex	16%	SH_Ex	21%	Tax_revenues	16%	Fiscal_expenditure	-11%

Top 15 factors most correlated with Total Resi Sales

Nanjing	Correl value	Wuhan	Correl value	China	Correl value
CPI	-65%	Reserve ratio	-64%	M2	49%
5 yr interest	-59%	SZ_Ex	39%	Reserve ratio	-44%
M2	51%	Per_Capita_GDP	-38%	Infra_inv	40%
Reserve ratio	-48%	SH_Ex	34%	5 yr interest	-36%
New birth ('79-'98)	32%	GDP	-34%	Mortgage_loan	32%
Urbanization_rate	19%	Social_consumer_goo	-31%	CPI	-27%
Disposable_income	19%	5 yr interest	-29%	SH_Ex	27%
Infra_inv	-18%	Marriage_registration	29%	SZ_Ex	27%
SZ_Ex	17%	Savings	-23%	Fixed_asset_inv	26%
Fixed_asset_inv	16%	M2	23%	College_graduates	24%
Mortgage_loan	15%	Real_estate_inv	21%	Urbanization_rate	22%
Savings	13%	Urbanization_rate	18%	New birth ('79-'98)	22%
SH_Ex	11%	Fiscal_income	15%	Population	16%
College_graduates	9%	Disposable_income	-14%	Fiscal_expenditure	12%
Per_Capita_GDP	-8%	Fiscal_expenditure	12%	Population_16-64 age	11%

Source: Yearbooks - Beijing, Shanghai, Shenzhen, Hangzhou, Nanjing, Wuhan, China; Data file reference: Output_correlation_Oct27.xlsx

Green color: demographics factors; Blue color: economic and investment factors; Red color: credit factors

Then we conduct multicollinearity analyses to eliminate those variables that can be linearly predicted by the others with a substantial degree of accuracy. Through this exercise, we have rejected several multicollinear factors, such as GDP growth vs. per capita GDP growth, and total household loan growth vs. total household mortgage loan growth. Also, those variables with P-value over 0.5% are rejected from the regression model.

B. Reduce series correlation

With the correlated independent variables identified and multicollinearity minimized, we start to build regression models by a commonly used Ordinary Least Squares (OLS) method. However, in the exercise, we discover that the data points in the series are not independent of each other, and the residuals from the data points are correlated with residuals of the previous points. A Durbin-Watson test detects autocorrelation in residuals, and the Durbin-Watson statistics value is distant from 2.0. This problem of correlation between residuals violates the Ordinary Least Squares model assumptions. Therefore, we

cannot rely on the regression results from an OLS model.

While the OLS model minimizes the linear distance between residuals, Generalized Least Squares (GLS) model minimizes the distance relative to the covariance of residuals. GLS method works on the underlying theory that the residuals can be transformed, so the variances are equal and uncorrelated. The challenge of the GLS model is that we can only compute the GLS estimator if the error covariance matrix is known. In practice, that will typically be difficult to learn, and the error covariance matrix will have to be estimated first. This is where an implementable version of GLS known as the Feasible Generalized Least Squares (FGLS) estimator comes in.

Feasible GLS estimation of a multivariate model is technically complicated, but academics have thoroughly tested the method[7]. Feasible GLS proceeds in two steps: (1) Estimate the system of equations by OLS, obtain the error covariance matrix $\Sigma\ \hat{}\ (2)$ Use the inverse of the error covariance matrix, $\Sigma\ \hat{}^{-1}$ as the weighting matrix in GLS estimation.

In reality, we can take advantage of powerful statistical analysis tools such as StataIC 16 to perform the FGLS estimation. In StataIC 16, "Prais" function uses the Generalized Least Squares method to estimate the parameters in a linear regression model in which the errors are serially correlated.

Syntax in StataIC 16: Prais Y X1-Xi, [option]

In the formula, Y is Total Residential Sales, X1 to Xi are the independent variables such as Reserve Ratio, CPI, Mortgage Loan, and Population.

In [Option], we chose [corc], which specifies the Cochrane–Orcutt transformation to be used to estimate the equation. With this [corc] option, the "Prais" transformation of the first observation is not performed, and the first observation is dropped when estimating the transformed equation.

Please refer to the FGLS model output in [Table 3.3] with China and Shanghai as examples. The Durbin-Watson stat has been transformed from 1.00 to 2.09 for China and 1.05 to 1.77 for Shanghai. Series correlation has been identified and meaningfully reduced.

7 https://www.mathworks.com/help/econ/fgls.html

Table 3. 3 FGLS Multi regression model for China and Shanghai Total Residential Sales

China

Cochrane-Orcutt

Source	SS	df	MS	Number o =	79
				F(6, 72) =	32.52
Model	2.937673	6	0.489612	Prob > F =	0
Residual	1.084098	72	0.015057	R-squared =	0.7304
				Adj R-squ =	0.708
Total	4.021771	78	0.051561	Root MSE =	0.12271

y	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Reserve ratio	-0.96693	0.107341	-9.01	0.000	-1.18091	-0.75294
Mortgage_loan	0.580805	0.119764	4.85	0.000	0.34206	0.81955
CPI	-1.91559	0.558079	-3.43	0.001	-3.0281	-0.80308
Population	171.9017	24.87233	6.91	0.000	122.3196	221.4838
College_graduates	1.975795	0.427433	4.62	0.000	1.123723	2.827867
Fiscal_expenditure	2.04325	0.642338	3.18	0.002	0.762773	3.323727
_cons	-1.22107	0.322252	-3.79	0.000	-1.86346	-0.57867
rho	0.945602					

Durbin-Watson statistic (original) 1.001594
Durbin-Watson statistic (transformed) 2.098348

Shanghai

Cochrane-Orcutt AR(1) regression

Source	SS	df	MS		79
					87.49
Model	7.8075	12	0.6506		0.000
Residual	0.4908	66	0.0074		0.941
					0.930
Total	8.2983	78	0.1064		0.086

y	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
CPI	-7.09649	0.832193	-8.53	0.000	-8.75802	-5.43496
Mortgage_loan	0.193793	0.077937	2.49	0.015	0.038188	0.349399
M2	4.999279	0.554542	9.02	0.000	3.892101	6.106457
5 yr interest	-2.32249	0.329424	-7.05	0.000	-2.98021	-1.66477
Marriage_registration	-0.42026	0.141868	-2.96	0.004	-0.7035	-0.13701
SZ_Ex	0.319657	0.029904	10.69	0.000	0.259952	0.379362
Infra_inv	-1.16989	0.154344	-7.58	0.000	-1.47805	-0.86174
New birth ('79-'98)	1.365914	0.369353	3.7	0.000	0.628477	2.103352
Fiscal_expenditure	-1.44881	0.431628	-3.36	0.001	-2.31058	-0.58704
SH_Ex	-0.39352	0.048688	-8.08	0.000	-0.49073	-0.29631
Population	-3.20891	0.35926	-8.93	0.000	-3.9262	-2.49163
Tax_revenues	4.077132	0.400434	10.18	0.000	3.277639	4.876624
_cons	-0.85683	0.10576	-8.1	0.000	-1.06799	-0.64567
rho	0.638457					

Durbin-Watson statistic (original) 1.050499
Durbin-Watson statistic (transformed) 1.777781

Source: Yearbooks - Beijing, Shanghai, Shenzhen, Hangzhou, Nanjing, Wuhan, China;

Processed by StataIC 16

3.4. Predict Model Output

On model prediction, we have explored three different methods and discussed the results from each process:

a) Monte Carlo Simulation

b) ARIMA Method

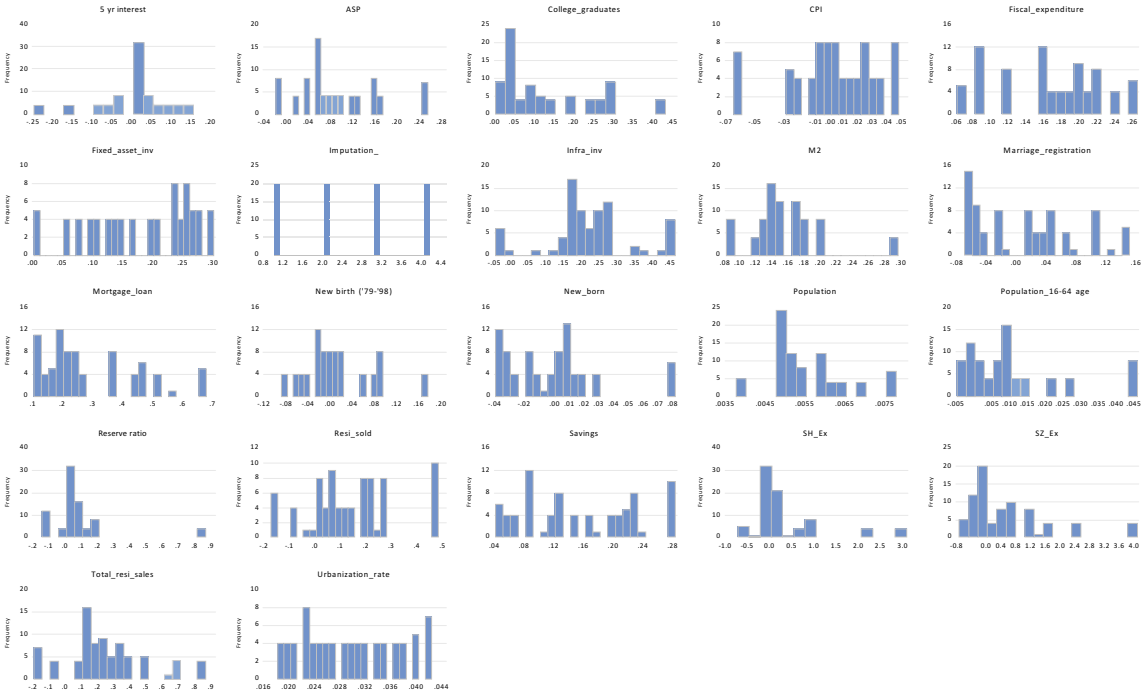
c) Scenario Analysis

A. Monte Carlo Simulation

Monte Carlo simulation is a method commonly used to understand the impact of risk and uncertainty in forecasting models. A Monte Carlo simulator helps one visualize most or all of the potential outcomes to have a better idea regarding the risk of a decision.

However, when examining the distribution of the independent variables, we find out that most of the independent variables in the Chinese market are NOT normally distributed due to the instability of policy movement. [Figure 3.2] Therefore, a projection based on Monte Carlo simulation is unfounded. We will not adopt the results from Monte Carlo Simulation.

Figure 3. 2 Distribution charts for key factors



Source: Yearbooks - Beijing, Shanghai, Shenzhen, Hangzhou, Nanjing, Wuhan, China; Excel reference table: Output_regression_forecast_final.xlsx, processed by Eview

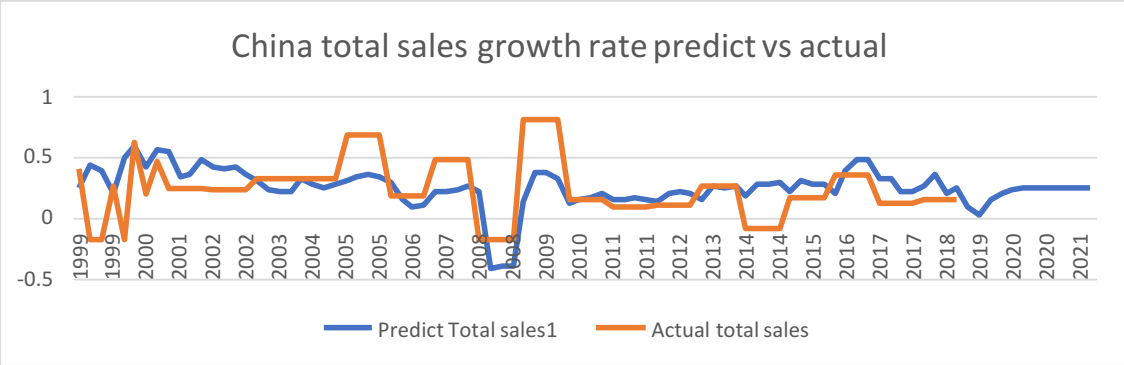
B. ARIMA Prediction

ARIMA, 'Auto Regressive Integrated Moving Average,' is a type of model that explains a given time series based on its past values, that is, its own lags and the lagged forecast errors, so that the equation can be used to forecast future values.

We use this method to predict the future value of the key independent variables and apply them to regression models to forecast the value of dependent variables. In this exercise, we have tested the stability of time series for each of the independent variables to ensure our forecast is built on variables with a certain degree of stability. College Graduate and Fiscal expenditure have been removed during the stability test process.

Below is a chart showing the predicted value vs. actual. [Figure 3.3] The prediction largely simulates the actual evolvement of Total Residential Sales over the last 20 years. The growth rate in 2019 for China's Total Residential Sales is predicted to fall to 8.7% and then accelerate to 22.5% and 24.8% for 2020 and 2021, respectively. Please refer to Appendix A for a detailed ARIMA model output.

Figure 3. 3 China (total) residential sales rate predict vs actual (ARIMA model)



Source: Output_regression_forecast_final.xlsx, tabs: _forecast

C. Scenario Analysis

This method chooses “arbitrarily” the path of the independent variables and predicts the dependent variables based on different scenarios.

No statistical methods will bypass the use of qualitative work or reality checking. We make assumptions based on market consensus predictions and build scenarios for analysis.

In this exercise, we first examine the available macro statistics projections by various

major investment banks in the region and research institutions globally. In the end, we choose Oxford Economics[8] as the forecast data source. Oxford Economics is a leading global organization in forecasting and quantitative analysis. Over 1,500 international institutions adopt Oxford Economics data for macro studies and analysis. Using the Oxford data will allow consistencies between this paper and other researches on the Chinese housing market.

In the Oxford Economics China database, we only found projections for Mortgage Loan balance, CPI, and Population, no forecast of the Reserve Ratio is available in Oxford.

With Oxford's data as the basis, we have structured three scenarios:

1) **Base case:** take the growth rates of Mortgage Loan, CPI, and Population directly from Oxford Economics projection and have Reserve Ratio cut 50 bps per annum for three years.
2) **Downside case:** apply a 10% reduction on Oxford Economics' growth rates of Mortgage Loan and Population, a 10% increase in Oxford Economics' CPI growth rate, and no Reserve Ratio cut for three years.
3) **Upside case:** apply a 10% increase in Oxford Economics' growth rates of Mortgage Loan and Population, a 10% drop on Oxford Economics' CPI growth rate, and Reserve Ratio cut for 100 bps per annum for three years.

Table 3. 4 Sensitivity table for Oxford Economics projection

Base case

	Mortgage_loan (bn)	Mortgage Growth	CPI	CPI Growth	Population ('000)	Population Growth	Reserve ratio	Reserve ratio bps
2018*	27,583.9	17.79%	121.5	2.13%	1,428,392	0.38%	14.50%	
2019	32,413.3	17.51%	124.7	2.63%	1,434,512	0.43%	14.00%	(50)
2020	36,956.9	14.02%	128.1	2.73%	1,439,935	0.38%	13.50%	(50)
2021	41,394.2	12.01%	131.5	2.65%	1,444,662	0.33%	13.00%	(50)

Downside case

	Mortgage_loan (bn)	Mortgage Growth	CPI	CPI Growth	Population ('000)	Population Growth	Reserve ratio	Reserve ratio bps
2018*	27,583.9	17.79%	121.5	2.13%	1,428,392	0.38%	14.50%	
2019	31,930.4	15.76%	125.0	2.90%	1,433,900	0.39%	14.50%	-
2020	35,958.7	12.62%	128.8	3.00%	1,438,779	0.34%	14.50%	-
2021	39,844.4	10.81%	132.5	2.92%	1,443,030	0.30%	14.50%	-

Upside case

	Mortgage_loan (bn)	Mortgage Growth	CPI	CPI Growth	Population ('000)	Population Growth	Reserve ratio	Reserve ratio bps
2018*	27,583.9	17.79%	121.5	2.13%	1,428,392	0.38%	14.50%	
2019	32,896.2	19.26%	124.4	2.37%	1,435,124	0.47%	14.00%	(100)
2020	37,968.7	15.42%	127.4	2.45%	1,441,092	0.42%	13.00%	(100)
2021	42,983.3	13.21%	130.5	2.39%	1,446,296	0.36%	12.00%	(100)

* actual

Source: Oxford Economics; Output_regression_forecast_final.xlsx, tabs: _forecast

8 Oxford Economics is a leader in global forecasting and quantitative analysis, with the world's only fullyintegrated economic model and 250 full-time economists; https://www.oxfordeconomics.com

For the Reserve Ratio cut, we have taken into account that over the past five years, Reserve Ratio has moved in a range of -50 bps to -100 bps and that the most recent rate cut in January 2019 was 50 bps. The actual Reserve Rate levels from these three scenarios have come out to be 12.0%, 13.0%, and14.0% in three years from best to base and to worst cases. The historical average Reserve Ratio in China is 14.8%[9].

The primary risk associated with an annual 50-100 bps reserve rate cut over three years is, of course, inflation. Nevertheless, histories in China economic growth tell us that even though M2 in the country has consistently grown faster than nominal GDP over the past decades, China's core CPI has hovered below 3%, and its producer price index has often fallen below zero. Two main reasons can explain this: 1) capital sunk in real estate, which CPI does not capture. This is precisely the topic in this paper - monetary factors drive the housing market, and 2) the Chinese saving culture and saving is not inflationary.

With the potential room in CPI growth, the Central government should have the policy space to pursue further Reserve Ratio cuts when necessary, especially when potentially facing double dips in the housing market over the coming three years.

After confirming the three assumptions under three scenarios, we apply these assumptions into the FGLS equation for China market as a whole to forecast Total Residential Sales growth rates and the absolute value for the following three years. Please refer to the forecast results in [Table 3.5].

In the base case, Total Residential Sales increase by 3.4% from 2018 to 2019 but then reduce by 4.9% in 2020 and further drop by 12.3% in 2021. Total Residential Sales in 2021 is projected to be RMB 10.8 trillion (USD 1.5 trillion).

In the downside case, Total Residential Sales in 2021 drop to RMB 8.7 trillion (USD 1.2 trillion) by precipitous decreases in three years from -4.09% in 2019 to -11.76% in 2020 and -18.37% in 2021.

In the upside case, Total Residential Sales in 2019 increase to RMB 13.3 trillion (USD 1.9 trillion) with a spike of 11.04% in growth rate, continuing the growth trajectory from 2015 to 2018. Growth momentum slows down to 1.78% in 2020 and drops to 6.39% in 2021.

9 UBS Asia Research; Wind.com financial and macroeconomic portal; People's Bank of China

From the outcomes of the three scenarios, we have several observations:

1) Total Residential Sales growth is no longer sensitive to further Reserve Ratio cuts after reaching a certain level.
2) Even in the upside case with all macro factors adjusted favorably by 10% and Reserve Ratio cut by 100 bps per annum for three years, Total Residential Sales can only sustain for two years and then fall by 6.39% in 2021.
3) In the downside case, Total Residential Sales can go down to RMB 8.7 trillion (USD 1.2 trillion), which is close to 45% below the 2018 level. Given the significance of the real estate industry in China's economy, this could be catastrophic to the overall GDP growth. We consider that this scenario is unlikely, and the government would have stepped in with massive monetary and fiscal stimulus to prevent the housing market from dragging the overall economy to a hard landing. (Please refer to further discussion in section 4 Policy Discussion)

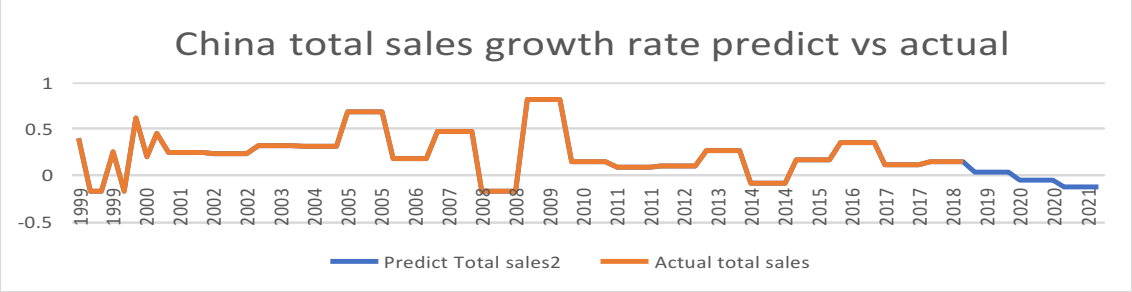
Table 3. 5 China (total) residential sales projection (Scenario Analysis)

	Annual total resi sales growth rate			Actual total resi sales (Rmb m)		
	Downside case	Base case	Upside case	Downside case	Base case	Upside case
2019 total sales growth rate	-4.09%	3.47%	11.04%	12,121,911	13,078,415	14,034,919
2020 total sales growth rate	-11.76%	-4.99%	1.78%	10,696,910	12,425,915	14,284,363
2021 total sales growth rate	-18.37%	-12.38%	-6.39%	8,731,830	10,887,815	13,372,195

Source: Oxford Economics; Output_regression_forecast_final.xlsx, tabs: _forecast

Below is a chart mapping the actual growth rate from 1999 to 2018, and the base case projected growth rates from 2019 to 2021.

Figure 3. 4 China (total) residential sales predict vs. actual (Base Case)



Source: Oxford Economics; Output_regression_forecast_final.xlsx, tabs: _forecast

D. Results and discussion

ARIMA model predicts Total Residential Sales to grow by over 20% per annum in 2020 and 2021, driven primarily by two forecasted scenarios: 1) mortgage loan balance growing at over 20% rate per annum from 2019 to 2021, and 2) Reserve Ratios reducing by 5.7%, 2.6% and 0.4% in 2018, 2019 and 2020 respectively.

Mortgage loan balance could theoretically maintain the high growth pace from the past, but as the country is undergoing deleveraging and liquidity tightening, it is practically challenging for commercial banks to expand the lending book to households as aggressively as they used to.

On Reserve Ratio, from 1987 to 2018, there was only one time with a 5% reduction, which was during the Asia Financial Crisis in 1997 when the country's reserve size was much smaller. The most recent Reserve Ratio cut in 2019 was -0.5%, which already unleashed approximately RMB 700 billion (USD 106 billion) of liquidity into the banking system. A more than tenfold larger Reserve Ratio cut is inconceivable, potentially bringing an enormous impact on the overall economy and creating a tsunami to the financial system.

On the other hand, this also tells us how unlikely the housing market is to continue to grow by over 20% a year because it would potentially require a tenfold bigger Reserve Ratio cut. (holding all other housing policies equal)

Table 3. 6 Prediction results and underlying assumptions

ARIMA method

	Dependent variable	**Independent variables**			
	Total resi sales	Mortgage_loan	CPI	Population	Reserve ratio
2018	**25.77%**	24.09%	0.34%	0.53%	-5.72%
2019	**8.76%**	21.26%	0.06%	0.40%	-2.66%
2020	**22.56%**	26.53%	0.20%	0.42%	-0.41%
2021	**24.87%**	27.70%	0.15%	0.45%	2.37%

Scenario method (base case)

	Dependent variable	**Independent variables**			
	Total resi sales	Mortgage_loan	CPI	Population	Reserve ratio
2018*	**14.65%**	17.79%	2.13%	0.38%	-1.50%
2019	**3.47%**	17.51%	2.63%	0.43%	-0.50%
2020	**-4.99%**	14.02%	2.73%	0.38%	-0.50%
2021	**-12.38%**	12.01%	2.65%	0.33%	-0.50%

* actual

Comparably speaking, the underlying assumptions in the **Scenario Analysis** resonate better with reality.

In the Scenario Analysis model, the base-case of the 50 bps Reserve Ratio cut in a year is within the historical average, following the pattern in the last five years. Further rate cuts from 2019 and onwards are widely expected for the central and local fiscal authorities to step up their on-budget spending on infrastructure investment growth to ensure the economy achieves the 6.0-6.5% GDP growth target.

Mortgage growth rates in the model are declining as forecast by Oxford Economics. While the past Reserve Ratio cuts were unconditional capital injection into all industries, the latest round of monetary easing was designed to support corporate deleveraging and lending to small and medium-sized enterprises. Real estate industry, especially Home Mortgage, is less likely to be a primary beneficiary in the new rounds of liquidity easing.

CPI in three years is on the rise due to higher food prices and potential global oil costs spike amid recent geopolitical tensions, but they are kept within 3%, consistent with the historical range. Population growth stays steady, albeit with birthrate falling and population aging.

Under the Scenario Analysis method, 2019 total sales growth rate is forecast to be 3.4%. To do a reality check, we have reached out to Yihan.com, a leading property research institute. According to Yihan.com, China's Total Residential Sales in 2019 is estimated to be slightly higher than that of 2018[10], corresponding to our Scenario Analysis results.

With the above, we believe that the assumptions in the **Scenario Analysis** method better reflect the overall economic outlook. And among the results from the three forecast methods, we have a higher degree of confidence in the results from the **Scenario Analysis** method, which is - in the base-case, Total Residential Sales in China are forecasted to increase by 3.4% to RMB 13.0 trillion (USD 1.8 trillion) in 2019, then drop by 4.9% to RMB 12.4 trillion (USD 1.7 trillion) in 2020 and fall by another 12.3% to RMB 10.8 trillion (USD 1.5 trillion) in 2021.

10 2019 official statistics has not been published. This is based on unofficial statistics from Yihan.com, a leading property sector research institute, which publishes the well-recognized annual top developers listby total sales every January.

4. Policy Discussion

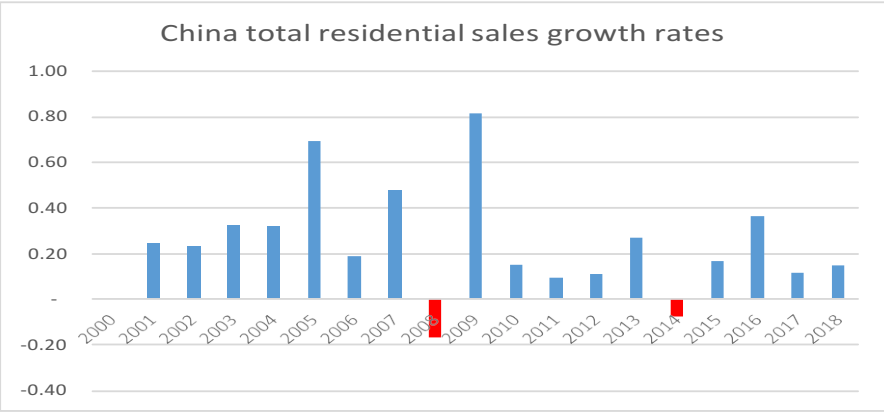
Does an adverse outlook trigger the Central Government's concern? How would the government react if Total Residential Sales were to tumble for two consecutive years? Furthermore, how would a new stimulus policy generate near term growth but not create long term sustainability concerns? These are the questions we would ask ourselves after learning the possible market reality in three years.

To answer these questions, we first discuss the importance of the real estate industry in the overall economy and how effective the Chinese housing policies have been through the past cycles.

According to (Ding, et al. 2017), "residential real estate contributes roughly 9.5 percent of GDP, estimates suggest that the deceleration of real estate investment growth alone would reduce GDP growth by 0.6 percentage points. Upstream sectors, such as steel, cement, and construction machinery, would be more affected." Moreover, "a sharp correction in the housing market may pose risks to financial stability through the following channels: private consumption, fiscal impact, capital outflow, banking sector, and non-banking financing sector."

Because of the significance of the real estate industry, it is not surprising that every time when the housing market tumbled, the government acted swiftly to intervene in the market and preserve stability. In the 20 years' history of the Chinese real estate market, the residential sales had only experienced two dips, one in 2008 and the other in 2014. [Figure 3.5] It never fell for two consecutive years, as this paper predicts in the base case of what would happen in 2020 and 2021.

Figure 4. 1 China (total) residential sales growth rate, 1999-2018



Source: Yearbooks - Beijing, Shanghai, Shenzhen, Hangzhou, Nanjing, Wuhan, China

Following the drop in 2008, an RMB 4 trillion (USD 580 billion) broader economic stimulus package was put in to combat the global financial crisis. Housing sales in 2009 rebounded immediately. And then, shortly after the market adjustment in 2014, the Chinese government launched a new stimulus policy - "Relocation with monetary incentives" program (please refer to Appendix A for policy details). Again, the market gradually rebounded in 2015 after the dip in the previous year.

It is complex to mathematically quantify the effectiveness of housing policies and fiscal reform measures and benchmark them with real estate activities during the same period. Many analysts have attempted to conduct the analysis, and I found that the scoring system developed by Morgan Stanley China Property Research team provides a revealing picture of how the policy up and down cycles corresponds with housing market evolvement over an extended period. Please refer to the details in [Figure 4.2]

In the Morgan Stanley scoring table, with the 2012 policy relaxation process as an example, local governments took eight months to turn from subtle relaxation to noticeable relaxation (Oct 2011 to May 2012) , major easing during that period was on the housing provident fund policies. The housing market recovered from a red zone downcycle to a green zone upcycle six months later. (Chen, Liu and Zhu 2019)

In 2014, local authorities took five months (Dec 2013 to April 2014) to roll out various relaxation policies, and the Central government announced in Dec 2013 that the policy direction is "to focus on de-stocking in cities with high inventory levels". Housing market activities eventually recovered 18 months later after a prolonged process digesting the inventory piled up from the previous cycles. (Chen, Liu and Zhu 2019)

Overall, unless massive liquidity directly injected into the market as what the government did in 2009, most of the policy movement usually takes a process to take effect, during which time other macroeconomic factors could also influence the housing actictivies. It is difficult to measure the direct impact of individual policy movement on the housing market. However, from the Morgan Stanley policy scoring table, we can observe a broad correlation between policy movement and the housing activities, which demonstrates the effectiveness of the housing policies through multiple cycles over an extended period.

Figure 4. 2 Morgan Stanley China Property Research – Policy and Housing activities table

	Policy	Credit	Monthly property sales volume y-y				ASP m-m	Land y-y	Monthly property new starts volume y-y			
		(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
	Score	1m repo	Tier 1	Tier 2	Tier 3-5	National	CREIS 100 cities	CREIS 300 cities	Tier 1	Tier 2	Tier 3-5	National
2011-01	-3.0	5.96%	-10.8%	18.0%	16.3%	13.8%	1.4%	74%	18.3%	24.8%	23.2%	27.9%
2011-02	-1.5	4.68%	-10.8%	18.0%	16.3%	13.8%	0.9%	-25%	18.3%	24.8%	23.2%	27.9%
2011-03	-1.5	3.81%	-10.8%	18.0%	16.3%	15.8%	0.8%	-15%	18.3%	24.8%	23.2%	19.5%
2011-04	-1.0	3.99%	-32.8%	-21.6%	-0.6%	-9.9%	0.7%	4%	25.2%	18.3%	31.3%	26.9%
2011-05	-1.0	4.48%	-8.9%	12.8%	24.3%	18.5%	0.7%	37%	29.5%	25.1%	20.3%	22.2%
2011-06	-1.0	6.21%	25.0%	15.9%	30.3%	25.4%	0.5%	35%	29.9%	10.9%	29.4%	22.8%
2011-07	-1.0	6.14%	49.4%	3.0%	24.4%	17.8%	0.4%	25%	10.2%	23.0%	41.8%	34.0%
2011-08	-1.0	5.17%	-6.2%	4.2%	21.4%	13.5%	0.1%	32%	121.1%	22.9%	30.8%	32.0%
2011-09	-1.0	5.58%	-25.0%	0.0%	17.5%	9.5%	0.0%	-29%	54.9%	-5.3%	14.0%	8.9%
2011-10	-0.5	5.35%	-35.2%	-11.2%	-6.8%	-9.9%	-0.3%	-15%	11.7%	6.3%	-1.2%	2.2%
2011-11	0.5	4.97%	-36.2%	-10.1%	5.9%	-1.7%	-0.6%	-41%	54.2%	4.0%	8.1%	9.1%
2011-12	0.5	4.83%	7.1%	-6.1%	-7.8%	-6.7%	-0.3%	-45%	-23.7%	-19.3%	-17.9%	-18.9%
2012-01	1.0	6.81%	-20.6%	-12.9%	-13.4%	-14.0%	-0.2%	-67%	-15.0%	8.3%	-2.2%	5.1%
2012-02	1.5	4.95%	-20.6%	-12.9%	-13.4%	-14.0%	-0.4%	-14%	-15.0%	8.3%	-2.2%	5.1%
2012-03	1.0	4.14%	-20.6%	-12.9%	-13.4%	-13.3%	-0.3%	-54%	-15.0%	8.3%	-2.2%	-4.2%
2012-04	1.5	4.06%	9.2%	1.5%	-21.0%	-12.9%	-0.4%	8%	-37.2%	-9.7%	-15.0%	-14.6%
2012-05	2.0	3.34%	26.1%	20.0%	-26.0%	-9.2%	-0.7%	-30%	16.0%	1.9%	-9.4%	-4.6%
2012-06	2.0	3.26%	12.0%	2.3%	-6.7%	-3.3%	0.3%	-24%	-23.9%	-17.5%	-15.2%	-16.3%
2012-07	1.5	3.45%	24.4%	28.8%	4.5%	13.3%	0.4%	-17%	0.3%	-23.7%	-29.8%	-26.7%
2012-08	1.5	3.58%	21.7%	20.9%	7.9%	12.9%	0.3%	-7%	-29.4%	5.3%	24.6%	13.9%
2012-09	1.0	4.05%	10.2%	9.3%	-10.1%	-3.6%	0.3%	2%	-50.7%	-18.8%	-24.0%	-24.0%
2012-10	1.0	3.98%	62.1%	24.9%	19.8%	23.2%	0.1%	39%	-26.0%	0.1%	-8.4%	-6.4%
2012-11	1.0	3.77%	82.9%	30.4%	27.7%	30.4%	0.4%	32%	-16.4%	-15.2%	24.8%	7.1%
2012-12	1.0	4.28%	3.4%	-11.1%	-0.5%	-3.7%	0.2%	64%	-26.5%	-5.0%	4.2%	-1.4%
2013-01	1.0	3.94%	62.3%	39.4%	33.7%	49.5%	1.0%	182%	2.1%	-0.7%	-4.1%	14.7%
2013-02	-2.5	4.02%	62.3%	39.4%	33.7%	49.5%	0.8%	47%	2.1%	-0.7%	-4.1%	14.7%
2013-03	-2.0	3.39%	62.3%	39.4%	33.7%	26.6%	1.1%	114%	2.1%	-0.7%	-4.1%	-20.2%
2013-04	-1.0	3.77%	41.8%	43.9%	37.8%	40.2%	1.0%	35%	25.4%	26.4%	8.1%	14.5%
2013-05	-0.5	3.93%	2.7%	7.2%	48.1%	28.3%	0.8%	98%	-6.6%	-11.9%	5.0%	-1.5%
2013-06	-2.0	7.81%	27.6%	13.7%	8.3%	10.8%	0.8%	71%	28.0%	23.0%	9.1%	14.2%
2013-07	-0.5	5.34%	1.8%	3.9%	18.8%	12.4%	0.9%	86%	-15.7%	68.7%	39.6%	45.2%
2013-08	0.5	4.77%	19.7%	1.1%	14.5%	10.1%	0.9%	50%	4.2%	-22.2%	-20.9%	-20.1%
2013-09	-2.0	5.31%	18.4%	14.6%	27.6%	22.8%	1.1%	86%	81.7%	46.3%	36.1%	41.3%
2013-10	-2.0	5.47%	7.8%	6.2%	15.6%	12.1%	1.2%	35%	-15.7%	-16.3%	6.9%	-3.4%
2013-11	-2.0	6.07%	0.9%	12.2%	17.0%	14.8%	0.7%	53%	31.0%	59.7%	60.7%	58.6%
2013-12	-1.0	6.41%	-18.6%	6.1%	-0.2%	0.7%	0.7%	20%	82.9%	21.4%	41.0%	35.1%
2014-01	0.0	6.93%	-14.3%	-6.4%	-1.1%	-0.1%	0.6%	51%	-19.4%	-27.3%	-24.4%	-27.4%
2014-02	0.5	5.03%	-14.3%	-6.4%	-1.1%	-0.1%	0.5%	14%	-19.4%	-27.3%	-24.4%	-27.4%
2014-03	0.5	4.36%	-14.3%	-6.4%	-1.1%	-7.5%	0.4%	-25%	-19.4%	-27.3%	-24.4%	-21.9%
2014-04	1.0	4.27%	-34.6%	-13.4%	-12.6%	-14.3%	0.1%	29%	-30.9%	-12.4%	-15.4%	-15.0%
2014-05	1.5	3.83%	-24.5%	-8.6%	-10.7%	-10.7%	-0.3%	-23%	-25.3%	-4.4%	-8.3%	-7.9%
2014-06	1.5	4.48%	-24.2%	3.6%	-0.2%	-0.2%	-0.5%	-23%	-17.0%	-7.9%	-9.6%	-9.3%
2014-07	3.0	4.59%	-19.5%	-18.4%	-14.9%	-16.3%	-0.8%	-46%	23.7%	0.9%	11.6%	8.2%
2014-08	2.0	4.27%	-40.0%	-5.2%	-13.4%	-12.4%	-0.6%	-36%	-31.6%	10.1%	8.0%	6.2%
2014-09	1.5	4.18%	-13.5%	-5.4%	-12.5%	-10.3%	-0.9%	-63%	1.9%	-3.1%	1.3%	-0.2%
2014-10	2.0	3.97%	-17.5%	4.5%	-3.3%	-1.6%	-0.4%	-45%	72.3%	44.5%	39.7%	42.9%
2014-11	3.0	4.29%	5.2%	-11.5%	-12.0%	-11.1%	-0.4%	-41%	-22.3%	-24.4%	-34.9%	-31.2%
2014-12	1.0	5.93%	21.3%	1.2%	-8.1%	-4.1%	-0.4%	-37%	-18.0%	-26.3%	-26.8%	-26.1%
2015-01	1.0	4.89%	-12.0%	-8.3%	-9.5%	-16.3%	0.2%	-47%	-16.7%	-22.4%	-16.5%	-17.7%
2015-02	1.5	5.51%	-12.0%	-8.3%	-9.5%	-16.3%	-0.2%	-54%	-16.7%	-22.4%	-16.5%	-17.7%
2015-03	3.0	5.21%	-12.0%	-8.3%	-9.5%	-1.6%	-0.2%	-18%	-16.7%	-22.4%	-16.5%	-19.5%
2015-04	2.0	4.19%	26.5%	7.5%	5.1%	7.0%	0.0%	-62%	52.6%	-21.6%	-14.7%	-14.9%
2015-05	2.0	2.77%	41.3%	17.2%	11.8%	15.0%	0.4%	-44%	-11.2%	-7.7%	-15.5%	-12.8%
2015-06	1.5	3.36%	54.7%	12.8%	15.4%	16.0%	0.6%	16%	-1.3%	-22.4%	-11.8%	-15.0%
2015-07	1.0	3.10%	33.9%	24.2%	14.9%	18.9%	0.5%	5%	7.9%	-18.4%	-24.7%	-21.3%
2015-08	3.0	2.73%	47.4%	15.1%	12.3%	14.7%	1.0%	-6%	-18.7%	-17.2%	-16.4%	-16.7%
2015-09	3.0	3.11%	27.6%	4.5%	10.1%	9.0%	0.3%	76%	18.4%	15.4%	15.0%	15.3%
2015-10	2.0	2.99%	12.8%	8.4%	3.5%	5.5%	0.3%	25%	-27.5%	-22.9%	-25.1%	-24.5%
2015-11	1.0	2.71%	15.5%	17.7%	3.8%	8.6%	0.5%	43%	-6.9%	-14.4%	-25.5%	-20.9%
2015-12	1.0	3.16%	-12.6%	5.7%	0.6%	1.6%	0.7%	26%	0.2%	5.7%	-15.2%	-6.7%
2016-01	1.0	3.31%	30.3%	41.5%	28.5%	28.2%	0.4%	-7%	18.2%	38.9%	9.7%	13.7%
2016-02	3.0	2.99%	30.3%	41.5%	28.5%	28.2%	0.6%	41%	18.2%	38.9%	9.7%	13.7%
2016-03	-1.0	3.05%	30.3%	41.5%	28.5%	37.7%	1.9%	26%	18.2%	38.9%	9.7%	26.9%
2016-04	-0.5	2.89%	18.4%	52.2%	41.5%	44.1%	1.5%	113%	3.0%	27.4%	27.2%	25.9%
2016-05	-0.5	2.81%	10.7%	30.6%	21.4%	24.2%	1.7%	162%	39.0%	16.7%	5.3%	10.6%
2016-06	-0.5	3.05%	0.9%	16.7%	14.6%	14.6%	1.3%	19%	18.0%	13.6%	-0.3%	4.9%
2016-07	-0.5	2.82%	10.9%	24.4%	16.3%	18.7%	1.6%	35%	-15.8%	27.0%	-0.6%	8.1%
2016-08	-1.0	2.82%	8.0%	23.0%	18.9%	19.8%	2.2%	131%	16.5%	18.2%	-4.9%	3.3%
2016-09	-2.0	3.19%	18.9%	45.4%	29.4%	34.0%	2.8%	35%	-1.4%	-19.0%	-21.2%	-19.4%
2016-10	-3.0	3.04%	8.0%	28.9%	26.4%	26.4%	1.6%	-24%	45.4%	10.4%	23.3%	20.0%
2016-11	-1.5	3.08%	-30.6%	5.3%	12.6%	7.9%	0.9%	24%	-17.1%	7.6%	3.1%	3.3%
2016-12	-1.5	4.75%	13.3%	3.0%	16.5%	11.8%	0.7%	34%	-22.9%	-7.2%	32.5%	12.5%
2017-01	-1.0	4.03%	-11.0%	8.8%	29.0%	25.1%	0.5%	43%	-4.6%	4.1%	17.7%	10.4%
2017-02	-0.5	4.21%	-11.0%	8.8%	29.0%	25.1%	0.5%	86%	-4.6%	4.1%	17.7%	10.4%
2017-03	-3.0	4.82%	-11.0%	8.8%	29.0%	14.7%	1.0%	64%	-4.6%	4.1%	17.7%	13.1%
2017-04	-2.0	4.15%	-37.4%	-3.5%	18.9%	7.7%	0.8%	48%	8.8%	3.2%	14.0%	10.1%
2017-05	-1.0	4.40%	-46.3%	1.3%	20.8%	10.2%	0.7%	-15%	-28.2%	3.3%	9.4%	5.2%
2017-06	-0.5	5.14%	-25.9%	22.1%	24.4%	21.4%	0.6%	63%	-0.1%	21.0%	11.2%	14.0%
2017-07	-0.5	4.21%	-41.2%	-6.6%	11.2%	2.0%	0.6%	72%	-19.9%	-22.4%	9.1%	-4.9%
2017-08	-0.5	4.08%	-28.3%	-3.6%	11.6%	4.3%	0.6%	4%	-4.9%	3.1%	7.4%	5.3%
2017-09	-1.5	4.96%	-43.0%	-6.5%	4.1%	-1.5%	0.5%	38%	-61.4%	-1.5%	9.8%	1.4%
2017-10	-0.5	4.40%	-37.5%	-14.2%	0.7%	-6.0%	0.4%	165%	-24.4%	1.4%	-5.1%	-4.3%
2017-11	-0.5	4.47%	-20.9%	5.0%	6.8%	5.3%	0.4%	21%	16.8%	11.3%	23.6%	18.8%
2017-12	0.5	5.71%	-22.3%	3.3%	9.3%	6.1%	0.4%	30%	26.4%	0.6%	11.5%	8.6%
2018-01	0.5	4.33%	-30.1%	0.7%	7.3%	4.1%	0.4%	40%	-36.5%	8.3%	13.9%	2.9%
2018-02	0.0	4.58%	-30.1%	0.7%	7.3%	4.1%	0.4%	22%	-36.5%	8.3%	13.9%	2.9%
2018-03	-0.5	4.98%	-30.1%	0.7%	7.3%	3.2%	0.4%	45%	-36.5%	8.3%	13.9%	17.8%
2018-04	-0.5	4.12%	-21.0%	-4.7%	-3.0%	-4.1%	0.4%	15%	-11.8%	1.4%	4.7%	2.9%
2018-05	-0.5	3.86%	-0.3%	4.8%	10.0%	8.0%	0.5%	60%	61.4%	10.5%	24.1%	20.5%
2018-06	-1.5	5.19%	-1.8%	7.7%	3.1%	4.5%	0.5%	-6%	18.0%	-1.3%	24.8%	15.0%
2018-07	-0.5	3.30%	17.2%	9.3%	9.8%	9.9%	0.4%	14%	11.7%	24.4%	33.1%	29.4%
2018-08	0.0	2.71%	-16.1%	-3.9%	6.7%	2.4%	0.5%	9%	11.4%	5.9%	39.7%	26.6%
2018-09	-0.5	3.42%	16.6%	-6.7%	-2.8%	-3.6%	0.4%	-29%	117.3%	18.1%	17.6%	20.3%
2018-10	0.5	3.13%	-9.5%	-1.8%	-3.5%	-3.1%	0.5%	-24%	1.2%	11.2%	17.9%	14.7%
2018-11	1.0	2.74%	-5.8%	-0.1%	-7.4%	-5.1%	0.3%	-17%	8.6%	22.9%	22.2%	21.7%

Source: CEIC, Wind, CREIS, Morgan Stanley Research. Note: Red means downcycle, and green means upcycle.

Under the current environment where the overall economy has undergone structural deleveraging, the government has less policy ammunition to manipulate credit and liquidity and less capital resource to roll out massive fiscal investment. We believe that, compared to previous stimulus policies, new policies are likely to be more constrained and embed new features.

1) The scale of the credit stimulus will not be as large as before, as the government tries to preserve the outcomes from the earlier efforts in deleveraging and supply-side reforms
2) The nature of the stimulus will change incrementally, with less focus on credit support to the housing market but with more help to low-income households via tax cuts and more borrowing constraints on high-income households for investment demand
3) The new stimulus will likely go together with reforms in the urbanization process, transaction tax framework, land supply mechanism, and social housing system [12]

Overall the quality of the new round of stimulus should improve from the previous ones, although its effectiveness in generating rebound may not be as forceful and swift as before.

Some new policies launched to the market in the last 12 months have already reflected these latest policy directions. For example, in December 2019, the Central Government announced to cancel the "Hu Kou" system (a household registration system in existence for 70 years since 1949) in cities with fewer than 3 million population, granting migrant workers full access to these cities' public services. Apart from eliminating the Hukou requirement, the Central Government also plans to reduce permanent residency requirements for larger cities. All of these indicate shifts of direction in stimulus policies from straight monetary easing to urbanization system reform in order to manage the housing market risk associated with debt and asset bubbles.

Our FGLS regression model has not factored in any of these unprecedented reforms and policies, and would not have reflected the demand generated from them. However, when studying the Chinese housing market, we should not lose sight of the impact of government policies on both near and long-term housing market growth.

Listed in Appendix A is a summary of housing market policies the government has

12 The housing policy discussion made reference to the macropolicy analysis by Aidan Yao, Senior EmergingAsia economist at AXA, https://www.scmp.com/comment/insight-opinion/united- states/article/2163745/why-us-trade-war-less-blame-chinas-economic

imposed over the years. It demonstrates a broad scope of diversity, from monetary, fiscal, social welfare to urbanization.

With the above policy discussions, we believe that the Central Government has sufficient policy measures and the ability to effectively address the housing market slowdown, as it has proved over the last cycles. However, due to the constraint to preserve long term sustainability, new policies might not position to reaccelerate the market with vigorous sales rebounds, as seen in the past cycles.

Therefore, in reality, the downward trend predicted in our regression model would more likely play out in a soft manner over an extended period, less likely to be an aggravated double-dip in three years, nor should we expect an immediate rebound after the first dip and then a sharp turn for higher growth afterward.

Successful implementation of fiscal and monetary stimulus policies with long term prospects by the government would help to preserve the stability in China's housing market and provide cushions for the potential structural slowdown in housing demand.

5. City Analysis and Factor Contribution

To further understand the value contribution by demographics and monetary factors in each city, we went on to analyze each city market by taking the following steps:

1. Eliminate multi-collinearity,
2. Remove the variables with low stationarity, and
3. Build FGLS model to identify key growth drivers

Please refer to the table below for the regression output summary: [Table 5.1]

Table 5. 1 Regression for Beijing, Shanghai, Shenzhen, Hangzhou, Nanjing, Wuhan

Beijing

Cochrane-Orcutt AR(1) regression

Source	SS	df	MS		
				Number o =	79
				F(8, 70) =	30.99
Model	4.2452	7	0.606457	Prob > F =	0
Residual	1.389556	71	0.019571	R-squared =	0.7534
	=			Adj R-squ =	0.7291
Total	5.634756	78	0.07224	Root MSE =	0.1399

y	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
CPI	-5.01808	1.067894	-4.7	0.0000	-7.1474	-2.88876
Reserve ratio	-1.23061	0.1371852	-8.97	0.0000	-1.50415	-0.95707
Per_Capita_GDP	-1.34313	0.6567387	-2.05	0.0450	-2.65263	-0.03363
New birth ('79-'98	-0.40913	0.182322	-2.24	0.0280	-0.77267	-0.04559
Real_estate_inv	-0.80132	0.1669243	-4.8	0.0000	-1.13416	-0.46849
Population	5.482544	1.393779	3.93	0.0000	2.703427	8.261661
Fiscal_expenditure	0.747941	0.2278643	3.28	0.0020	0.293593	1.202289
_cons	0.230991	0.1658055	1.39	0.1680	-0.09962	0.561598
rho		0.900759				

Durbin-Watson	statistic	(original)	0.606565
Durbin-Watson	statistic	(transformed)	1.583031

Shanghai

Cochrane-Orcutt AR(1) regression -- iterated estimates

Source	SS	df	MS		
				Number o =	79.00
				F(12, 66) =	48.51
Model	6.237947	4	1.559487	Prob > F =	0.00
Residual	2.379149	74	0.032151	R-squared =	0.724
				Adj R-squ =	0.709
Total	8.617096	78	0.110476	Root MSE =	0.179

y3	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
5 yr interest	-3.64701	0.392126	-9.3	0.0000	-4.42834	-2.86568
SZ_Ex	0.121181	0.030299	4	0.0000	0.060809	0.181554
Population	-2.18258	0.551092	-3.96	0.0000	-3.28066	-1.08451
Tax_revenues	2.95106	0.385526	7.65	0.0000	2.182882	3.719238
_cons	-0.32051	0.105148	-3.05	0.0030	-0.53002	-0.111
rho		0.750347				

Durbin-Watson	statistic	(original)	0.607175
Durbin-Watson	statistic	(transform	1.99338

Shenzhen

Cochrane-Orcutt AR(1) regression -- iterated estimates

Source	SS	df	MS		
				Number of	79
					37.21
Model	9.100645	3	3.033548	Prob >	0
Residual	6.113714	75	0.081516	R-squared =	0.5982
	=				0.5821
Total	15.21436	78	0.195056	Root MSE	0.28551

y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	
Fiscal_expenditure	1.174555	0.28891	4.07	0.0000	0.599018	1.750093
Disposable_income	-2.80978	0.609498	-4.61	0.0000	-4.02396	-1.5956
Mortgage_loan	1.157425	0.25518	4.54	0.0000	0.649082	1.665769
_cons	0.011136	0.110556	0.1	0.9200	-0.2091	0.231374
rho		0.603745				

Durbin-Watson	statistic	(original)	0.745096
Durbin-Watson	statistic	(transforme	1.753316

Hangzhou

Cochrane- AR(1) regression -- iterated estimates

Source	SS	df	MS		
				Number of =	79
				F(4, 74) =	95.69
Model	8.985206	4	2.246302	Prob >F =	0
Residual	1.737181	74	0.023475	R-squared =	0.838
				Adj R-squa=	0.8292
Total	10.72239	78	0.137466	Root MSE =	0.15322

y	Coef.	Std. Err	t	P>|t|	[95% conf.	interval]
5 yr interes	-2.63949	0.356573	-7.4	0.000	-3.34998	-1.929
Reserve rat	-1.35385	0.141606	-9.56	0.000	-1.63601	-1.0717
Real_estate	-2.28313	0.289359	-7.89	0.000	-2.85969	-1.70657
Per_Capita	2.351142	0.539641	4.36	0.000	1.275885	3.4264
_cons	0.500555	0.30837	1.62	0.109	-0.11389	1.114996
rho	0.942992					

Durbin-Wa	statistic	(original)	0.462659
Durbin-Wa	statistic	(transforme	1.875261

Nanjing

Cochrane-Orcutt regression -- iterated estimates

Source	SS	df	MS		
				Number of obs =	79
				F(4,74) =	72.33
Model	8.176369	4	2.044092	Prob > F =	0
Residual	2.091428	74	0.028263	R-squared =	0.7963
				Adj R-squared =	0.7853
Total	10.2678	78	0.131638	Root MSE =	0.16811

y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CPI	-10.1886	0.936092	-10.88	0.000	-12.0538	-8.32338
Reserve ratio	-1.01984	0.150552	-6.77	0.000	-1.31982	-0.71985
New birth ('79-'98)	0.609786	0.170199	3.58	0.001	0.270658	0.948915
Disposable_income	1.692638	0.621873	2.72	0.008	0.45353	2.931747
_cons	0.18324	0.104978	1.75	0.085	-0.02593	0.392413
rho	0.769323					

Durbin-Watson	(original)	0.521058
Durbin-Watson	(transforme	2.218368

Wuhan

Cochrane-Orcutt regression -- iterated estimates

Source	SS	df	MS		
				Number of obs =	79
F(5, 73)				=	68.84
Model	2.472482	5	0.494496	Prob > F =	0
Residual	0.524342	73	0.007183	R-squared =	0.825
				Adj R-squared =	0.8131
Total	2.996824	78	0.038421	Root MSE =	0.08475

y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Reserve ratio	-0.64342	0.089327	-7.2	0.000	-0.82145	-0.46539
Per_Capita_GDP	-2.22673	0.364429	-6.11	0.000	-2.95304	-1.50043
Real_estate_inv	1.00798	0.162226	6.21	0.000	0.684663	1.331297
Urbanization_rate	1.991013	0.495846	4.02	0.000	1.002793	2.979233
Fiscal_income	0.172833	0.072586	2.38	0.020	0.028169	0.317496
_cons	0.349192	0.072758	4.8	0.000	0.204186	0.494198
rho	0.847686					

Durbin-Watson	statistic	(original) 0.48041
Durbin-Watson	statistic	(transforme 1.850088

Source: Output_regression_forecast_final.xlsx, tabs: _reg

Then we standardize the variables by constructing new variables series using the original series to subtract the mean and be divided by the standard deviation and build new regression models with the standardized variables.

The table below summarizes the Standard Beta and R-square statistics in each market.

Table 5. 2 Standard Beta for Beijing, Shanghai, Shenzhen, Hangzhou, Nanjing, Wuhan

Beijing_regression		Shanghai_regression		Shenzhen_regression		Hangzhou_regression	
Variables	Std Beta	Variables	Std Beta	Variables	Std Beta	Variables	Std Beta
Reserve ratio	-68.6%	5 yr interest	-79.0%	Disposable_income	-46.2%	Reserve ratio	-61.6%
CPI	-37.0%	Tax_revenues	63.0%	Fiscal_expenditure	34.8%	Real_estate_inv	-58.6%
Population	36.3%	SZ_Ex	32.3%	Mortgage_loan	30.4%	5 yr interest	-51.9%
Real_estate_inv	-34.9%	Population	-25.3%			Per_Capita_GDP	27.8%
Fiscal_expenditure	24.1%						
New birth ('79-'98)	-15.3%						
Per_Capita_GDP	-13.0%						
R-square	75.3%	R-square	72.4%	R-square	59.8%	R-square	83.8%
Adjusted R-square	72.9%	Adjusted R-square	70.9%	Adjusted R-square	58.2%	Adjusted R-square	82.9%

Nanjing_regression		Wuhan_regression		China_regression	
Variables	Std Beta	Variables	Std Beta	Variables	Std Beta
CPI	-58.7%	Real_estate_inv	68.8%	Reserve ratio	-67.8%
Reserve ratio	-47.4%	Per_Capita_GDP	-64.3%	Population	53.6%
New birth ('79-'98)	24.5%	Reserve ratio	-49.7%	CPI	-27.5%
Disposable_income	23.1%	Urbanization_rate	49.0%	Mortgage_loan	26.1%
		Fiscal_income	22.2%		
R-square	79.6%	R-square	81.5%	R-square	63.3%
Adjusted R-square	78.5%	Adjusted R-square	80.2%	Adjusted R-square	61.3%

Source: Output_regression_forecast_final.xlsx, tab: reg_sum

Observations from the summary table are:

Demographics factors

In general, demographic factors, such as population, new birth, college graduate, urbanization rate and marriage registrations, are ranked low in the table, contributing less value than others in the list to the Total Residential Sales growth in most of the six cities studied in this paper, other than Wuhan where urbanization rate has a 49% contribution.

In the model for the Chinese market as a whole, the impact of total population growth on the overall housing volume is notable. However, in most of the six cities, although demographics growth contributed a certain value to the housing market growth, it does not sufficiently explain the much faster growth in housing markets.

Monetary factors

Monetary factors, especially Reserve Ratio, consistently stay as top factors contributing to the Total Residential Sales across the country and the top cities. Credit factors alone in China as a whole, as well as in Beijing and Shanghai, explain 70-80% of the housing market growth.

Economy factors

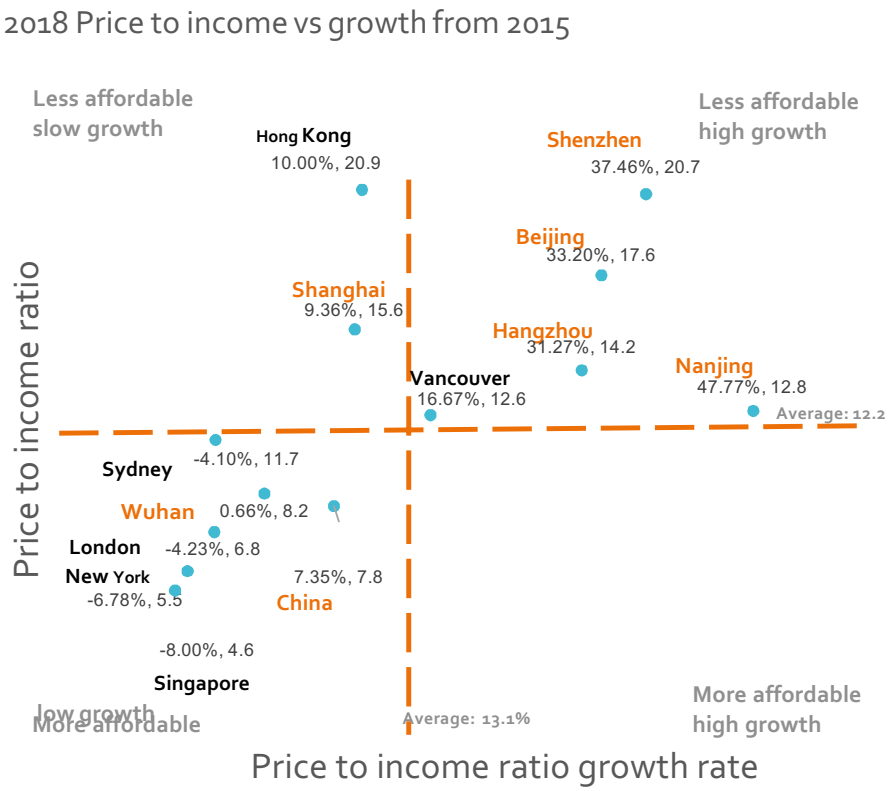
Income factors contribute to the overall housing market growth but at a much less degree than the monetary factors. Local fiscal expenditure and tax revenues are also noticeable in the contribution list. CPI consistently contributes negative value to the housing growth as households choose to compromise on consumption spending for property investment. In Chinese culture, people tend to be frugal in consumption spending while generous in investment, especially when it comes to property investment. [Figure 5.1]

In terms of price to income ratio, tier 1 cities and major tier 2 cities have stayed in the "Severely Unaffordable" [13] zone for many years, and they have continued to rise rapidly in recent years. Without any structural change in income growth in the near future, these

13 Data source: Demographia International Housing Affordability Survey: 2019, 2016; SeverelyUnaffordable P/I = 5.1x and over

markets are likely to remain under affordability pressure.

Figure 5. 1 2018 Price to income vs growth from 2015



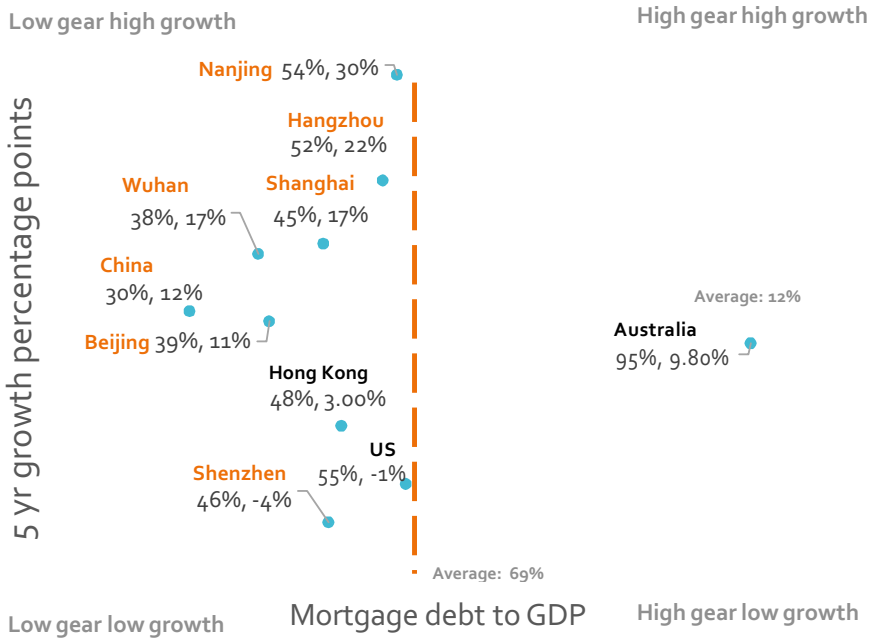
* Data source: Year books, Yihan Real Estate Research, CEIC, Wind
* Data source: Demographia International Housing Affordability Survey: 2019, 2016; Severely Unaffordable P/I = 5.1x and over

Gearing level

Although mortgage to GDP ratios for most of the Chinese cities studied in this paper are at relatively healthy levels, many have experienced rapid growth in gearing ratios in recent years. If the credit growth persists, these markets will enter the high gearing area in the following three years. [Figure 5.2]

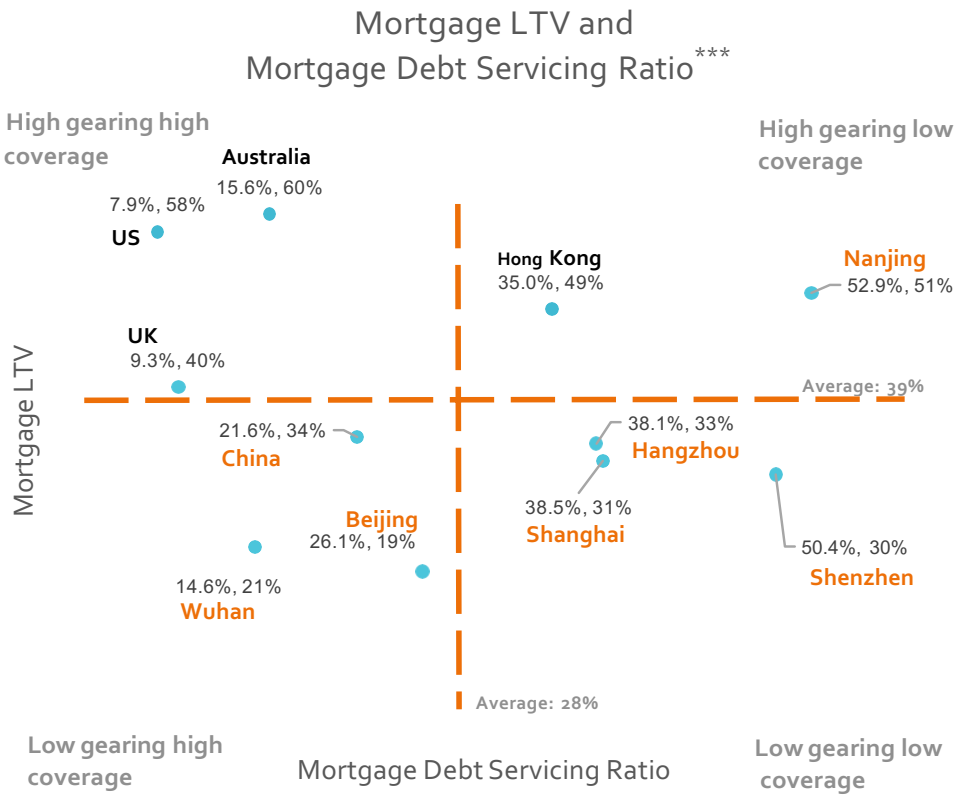
For household mortgage LTV, Chinese residents overall are not highly geared. However, the portion of their income spent on servicing the mortgage is increasingly high. The stretched mortgage servicing capability limits the housing price and transaction volume growth, putting a constraint on the housing market growth. [Figure 5.3]

Figure 5. 2 2018 Mortgage debt to GDP vs 5-year growth percentage points



* Data source: Year books, Yihan Real Estate Research, CEIC, Wind
** China housing market credit review, Liu lu, China Securities Company

Figure 5. 3 Mortgage LTV and Mortgage Debt Servicing Ratio



* Mortgage LTV = (new mortgage + Provident fund loan)/(new home sales secondary home sales)
* Mortgage Debt Servicing Ratio: Mortgage annual payment/disposable income; assuming 20 years mortgage at 4.9% interest rate
* Data source: Year books, Yihan Real Estate Research, CEIC, Wind
*China housing market credit review, Liu lu, China Securities Company

City market overview

In **Beijing**, the market is driven by a balanced mix of factors, including Reserve Ratio, population growth/birth cycle, and fiscal expenditure. Regulators have tightly watched the Beijing market over the years. Multiple austerity measurements have been put in place to prevent the housing price from overheating. From this perspective, Beijing's market is relatively healthy.

In **Shanghai**, local tax revenues growth has been an essential contributor to the housing market growth, demonstrating a strong fundamental economic base. In addition, Shanghai housing market growth is correlated with the stock exchange returns, which is not surprising given Shanghai's status in the Chinese financial market. However, both the Mortgage to GDP ratio and Mortgage Debt Servicing Ratio in Shanghai are well above the country average, and they have been expanding rapidly in recent years. In terms of the Price to Income Ratio, Shanghai is also high in the chart.

In **Shenzhen**, its core city is economically vibrant, with rapidly growing technology, financial, and manufacturing sectors. Moreover, fiscal expenditure has played an important role. The city government has been aggressively investing in infrastructure, building a more substantial base for housing market growth. This trend is expected to continue with the newly launched Greater Bay Area policy, which aims to integrate Hong Kong, Macau, Shenzhen, and six other cities in Guangdong Province.

Household income growth is negatively correlated with housing growth because there were several rounds of territory expansions by the Shenzhen government to incorporate less affluent adjacent towns into the greater Shenzhen city, lowering the average income of the overall city while housing prices in the city have been growing.

On the leverage side, Shenzhen household Mortgage Debt Servicing Ratio was already above 50% in 2018[14]. The alarming Mortgage Debt Servicing Ratio is expected to place strain on the market growth in Shenzhen in the next three years.

In **Hangzhou**, although the city hosts IT giants such as Alibaba, the Hangzhou housing market appears to have been driven mainly by monetary and investment factors. Per capita

14 Wind.com financial and macroeconomic porta

GDP only contributed less than 30% of the housing market growth.

In **Nanjing**, households appear to be over-investing in housing to the extent that they have to lower their spending. They have been borrowing to a greater extent than people in other cities such that the pattern has become statistically noticeable. Nanjing household Mortgage Debt Service Ratio had reached 52.9% in 2018, indicating that households in Nanjing face significant cash flow pressure, echoing the negative CPI correlation effect. In this regard, Nanjing is a less favorable market.

In **Wuhan**, this city is currently suffering severely under the COVID-19 epidemic outbreak. Historically the Wuhan housing market has been driven by investment, GDP growth, credit ratio, and urbanization. This city is a good proxy of a typical tier 2 city in China where there is no apparent economic growth catalyst. Government spending is the primary source of economic growth. In the meantime, urbanization and demographic growth are also the bases for housing market growth in Wuhan.

The table below summarizes the actual rates and ratios for the different markets.

Table 5. 3 Key economic and credit parameters for China and the six cities, 1999-2018

	Annual population growth	Annual Infra Investment growth	Annual mortgage debt growth	Mortgage/GDP	Annual income growth	Mortgage Debt Servicing Ratio	Annual housing price growth
Beijing	3%	13%	15%	36%	11%	26%	12%
Shanghai	2%	9%	23%	43%	10%	39%	13%
Shenzhen	4%	10%	20%	45%	6%	50%	15%
Hangzhou	2%	15%	21%	51%	11%	38%	13%
Nanjing	2%	10%	26%	52%	11%	53%	12%
Wuhan	2%	NA	25%	37%	11%	15%	11%
China	1%	20%	28%	29%	11%	22%	9%

The housing market healthy score table is based on the analysis above.
Rank (1 extremely bad, 5 extremely good)

Table 5. 4 Real estate market healthy score chart

	Demogra-phics factors	Investment factors	Credit factors	Leverage ratio	Income growth	Mortgage servicing capability	Housing price growth	Overall healthy score
Beijing	4	3	3	3	4	3	3	3.29
Shanghai	3	2	2	2	4	3	3	2.71
Shenzhen	4	2	3	2	3	2	3	2.71
Hangzhou	3	4	2	2	4	3	3	3.00
Nanjing	3	3	2	2	4	2	3	2.71
Wuhan	3	3	2	3	4	4	3	3.14
China	2	4	2	3	4	4	4	3.29

Source: cross-referenced with industry experts

6. Conclusion

Regression model results suggest that monetary and fiscal factors predominantly drove China's residential market growth over the 20 years between 1999 and 2018 and conclude that in the base case, the RMB 12.6 trillion (USD 1.9 trillion) Total Residential Sales in China in 2018 is unsustainable in the following three years.

Over the 20 years history of the Chinese housing market, the Central Government's effort in monetary easing and credit expanding, local authorities' fiscal spending and infrastructure building, as well as Chinese "obsessive" culture in property investment, have contributed remarkably to the housing market growth. However, the growth outlook of these factors is dwindling under a structurally deleveraging economy.

For fundamental demand, although demographic factors have played a notable role in the overall housing market growth, the impact of demographics changes is not statistically significant in most of the markets. Moderate demographic growth cannot justify the rapid increase in housing markets in many of the top Chinese cities. Only in tier 2-3 cities or China country as a whole, where the housing market has grown at lower rates, its correlation with demographic growth has become noticeable.

For investment demand, Chinese households appear to have the debt headroom to further gear up for more investment in property, with mortgage debt to GDP ratio for China as a whole at 30%[15] in 2018, compared to the 2018 ratios of 55%[16] and 95%[17]in the US and Australia, respectively. However, households in large cities face an increasing burden in debt servicing. Mortgage Debt Service ratios in Shenzhen, Hangzhou, Shanghai, and Nanjing were ranging from 38.5% and 52.9%[18] in 2018, setting a cash flow constraint on households' ability to further invest in property.

Beyond the statistical study, we have also discussed that the Chinese government has a variety of policy tools to preserve short term stability and build long term sustainability.

However, can the Chinese government achieve this daunting task of balancing the short

15 Wind.com financial and macroeconomic portal
16 https://www.ey.com/Publication/vwLUAssets/ey-credit-market-barometer-2019-issue-one/$File/ey- credit-market-barometer-2019-issue-one.pdf
17 https://www.clime.com.au/weekly-investing-report/housing-correction-have-to-have/
18 Wind.com financial and macroeconomic portal; Reference to China housing market credit review, Liu lu,China Securities Company

term and long term amidst the current domestic economy downcycle and global geopolitics backdrop? On March 5, 2019, Premier Li Ke Qiang argued in his annual government work report at the National People's Congress that Beijing would do well to safeguard the near-term growth without destabilizing the long-term sustainability of the economy. In the report, he cut the GDP growth target from 6.5% in 2018 to 6.0%-6.5% for 2019.

This adjusted GDP growth target indicates that the Central Government acknowledges the short-term economic challenges and has become more tolerant of slower growth in exchange for higher-quality growth. A lower GDP target allows the government greater flexibility to manage the economy under the current uncertain macro environment and leaves less pressure on the government to stimulate the economy aggressively.

With the prospect of slower GDP growth gained acceptance and more emphasis placed on growth quality, real estate policymakers are likely to follow the broader policy direction and be pragmatic in setting the near-term growth target, addressing the market in a structured way without compromising the long-term goal of market sustainability.

Therefore, although our base case regression model suggests that the RMB 12.6 trillion (USD 1.9 trillion) total residential sales in 2018 are unsustainable, we believe that the government has a variety of policy measures to boost demand or to inject liquidity when necessary. These policies would be placed carefully to manage the long-term sustainable growth goal.

Overall, the risk of a hard landing in the housing market in three years is low, but the long-term sustainability of the market is not without concern, and the risk of near-term volatility cannot be downplayed. The real estate journey ahead will not be as easy as the past two decades, and we all need to be prepared for the bumps along the way.

Notes on the latest development: At the time of finalizing this paper, China is experiencing a severe outbreak of epidemic disease, COVID-19. To fight against the coronavirus will undoubtedly be costly and will likely reverse some of the structural reform achievements. Expansionary monetary and fiscal policies are regaining momentum, by which the real estate market may well be benefited.

However, as analyzed in this paper, although the Chinese government has the policy space to implement a powerful stimulus package to spur the economic growth sharply, we believe that Chinese policymakers recognize that the economics shock is temporary, the epidemic will be conquered, and the country needs to continue to preserve market stability and ensure its economy functions in a long-term sustainable manner.

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Appendix A: Data Source and Methodology

ARIMA model output

	Reserve ratio	Mortgage_loan	CPI	Population	Predict Total sales1	Actual total sales
t	x_hat1	x_hat2	x_hat3	x_hat4		
1	4.98%	28.32%	0.16%	0.54%	24.87%	39.99%
2	1.36%	18.91%	0.16%	0.70%	42.86%	-17.09%
3	1.57%	38.04%	0.16%	0.65%	38.47%	-17.09%
4	1.86%	32.08%	0.16%	0.49%	19.84%	26.03%
5	2.29%	49.27%	1.06%	0.74%	49.83%	-17.09%
6	1.08%	32.74%	2.15%	0.74%	59.44%	62.31%
7	1.08%	37.10%	-1.03%	0.74%	42.24%	20.25%
8	1.08%	16.31%	2.15%	0.74%	55.84%	45.84%
9	1.08%	35.62%	-0.35%	0.74%	53.66%	24.55%
10	1.08%	37.11%	-0.35%	0.72%	34.55%	24.55%
11	1.08%	35.53%	-0.35%	0.68%	36.01%	24.55%
12	1.08%	70.57%	-0.35%	0.68%	47.85%	24.55%
13	1.08%	66.30%	0.12%	0.68%	41.75%	23.29%
14	1.08%	28.63%	0.12%	0.67%	39.53%	23.29%
15	1.08%	33.45%	0.12%	0.64%	42.21%	23.29%
16	1.08%	53.86%	0.12%	0.64%	35.58%	23.29%
17	1.08%	46.10%	0.68%	0.64%	30.66%	31.98%
18	15.91%	27.19%	0.68%	0.63%	22.92%	31.98%
19	15.91%	35.99%	0.68%	0.60%	21.79%	31.98%
20	15.91%	48.45%	0.68%	0.60%	21.04%	31.98%
21	5.31%	38.29%	-0.41%	0.60%	32.75%	31.73%
22	5.67%	25.72%	-0.41%	0.59%	27.86%	31.73%
23	5.67%	34.95%	-0.41%	0.58%	25.08%	31.73%
24	5.67%	40.32%	-0.41%	0.58%	28.19%	31.73%
25	11.72%	30.88%	-0.61%	0.58%	31.37%	68.97%
26	0.32%	18.34%	-0.61%	0.58%	33.33%	68.97%
27	0.32%	22.12%	-0.61%	0.59%	34.83%	68.97%
28	0.32%	19.40%	-0.61%	0.59%	33.78%	68.97%
29	4.86%	16.39%	0.84%	0.59%	28.44%	18.70%
30	18.87%	22.70%	0.84%	0.57%	14.29%	18.70%
31	18.87%	26.94%	0.84%	0.53%	9.43%	18.70%
32	18.87%	25.03%	0.84%	0.53%	9.84%	18.70%
33	6.16%	21.42%	0.31%	0.53%	21.51%	47.88%
34	3.90%	22.78%	0.31%	0.53%	21.83%	47.88%
35	3.90%	25.04%	0.31%	0.52%	23.63%	47.88%
36	3.90%	21.77%	0.31%	0.52%	25.36%	47.88%
37	13.08%	20.24%	-0.79%	0.52%	21.81%	-17.09%
38	75.43%	19.42%	-0.79%	0.52%	-40.77%	-17.09%
39	75.43%	17.57%	-0.79%	0.51%	-40.48%	-17.09%
40	75.43%	12.58%	-0.79%	0.51%	-39.95%	-17.09%
41	25.44%	15.23%	-0.11%	0.51%	12.80%	81.32%
42	-18.00%	37.89%	-0.11%	0.51%	37.60%	81.32%
43	-18.00%	46.45%	-0.11%	0.49%	36.27%	81.32%
44	-18.00%	50.30%	-0.11%	0.49%	32.35%	81.32%
45	42.78%	41.49%	2.15%	0.49%	11.49%	14.80%
46	10.90%	28.33%	2.15%	0.49%	15.28%	14.80%
47	10.90%	29.86%	2.15%	0.49%	16.48%	14.80%
48	10.90%	25.85%	2.15%	0.49%	19.12%	14.80%
49	-2.52%	25.14%	-1.03%	0.49%	14.67%	9.24%
50	10.52%	24.15%	-1.03%	0.49%	14.95%	9.24%
51	10.52%	20.89%	-1.03%	0.49%	15.87%	9.24%
52	10.52%	15.25%	-1.03%	0.49%	15.45%	9.24%
53	9.19%	19.40%	-0.41%	0.49%	14.22%	10.93%
54	6.86%	21.72%	-0.41%	0.49%	19.85%	10.93%
55	6.86%	15.42%	-0.41%	0.50%	21.61%	10.93%
56	6.86%	11.05%	-0.41%	0.50%	19.14%	10.93%
57	9.32%	17.87%	1.04%	0.50%	15.19%	26.61%
58	0.24%	26.05%	1.04%	0.50%	25.57%	26.61%
59	0.24%	22.47%	1.04%	0.50%	24.46%	26.61%
60	0.24%	22.99%	1.04%	0.50%	25.51%	26.61%
61	5.26%	26.32%	-1.03%	0.50%	18.27%	-7.81%
62	1.08%	23.00%	-1.03%	0.50%	27.24%	-7.81%
63	1.08%	18.56%	-1.03%	0.52%	27.66%	-7.81%
64	1.08%	19.35%	2.15%	0.52%	28.91%	-7.81%
65	1.08%	23.45%	0.40%	0.52%	20.98%	16.60%
66	-3.27%	24.62%	0.40%	0.52%	30.73%	16.60%
67	-3.27%	22.75%	0.40%	0.50%	26.96%	16.60%
68	-3.27%	25.89%	0.40%	0.50%	26.93%	16.60%
69	-0.16%	27.09%	0.40%	0.50%	19.41%	36.13%
70	-9.82%	29.72%	0.40%	0.52%	38.25%	36.13%
71	-9.82%	33.06%	0.40%	0.58%	48.32%	36.13%
72	-9.82%	38.44%	0.40%	0.58%	48.03%	36.13%
73	-4.77%	34.23%	0.03%	0.58%	31.58%	11.28%
74	2.43%	23.35%	0.03%	0.57%	32.55%	11.28%
75	2.43%	23.85%	0.03%	0.53%	21.66%	11.28%
76	2.43%	24.74%	0.03%	0.53%	21.09%	11.28%
77	-5.72%	24.09%	0.34%	0.53%	25.77%	14.65%
78	-12.01%	21.41%	0.34%	0.50%	35.66%	14.65%
79	-12.01%	20.87%	0.34%	0.40%	20.48%	14.65%
80	-12.01%	20.72%	0.34%	0.40%	23.98%	14.65%
81	-2.66%	21.26%	0.06%	0.40%	8.76%	
82	0.26%	22.87%	0.06%	0.40%	2.90%	
83	2.86%	24.10%	0.06%	0.41%	15.26%	
84	5.18%	25.75%	0.06%	0.41%	20.33%	
85	-0.41%	26.53%	0.20%	0.42%	22.56%	
86	-0.87%	26.58%	0.20%	0.43%	24.86%	
87	-1.38%	27.22%	0.20%	0.43%	24.87%	
88	-1.93%	27.87%	0.20%	0.44%	24.87%	
89	2.37%	27.70%	0.15%	0.45%	24.87%	
90	3.52%	27.70%	0.15%	0.45%	24.87%	
91	4.62%	28.22%	0.15%	0.46%	24.87%	
92	5.68%	28.25%	0.15%	0.46%	24.87%	

Multiple Imputation Sample sheet (China)

Imputation_	Year	M2	Infra_inv	Reserve ratio	Mortgage_loa	CPI	5 yr interest	Fixed_asset_in	Population_16	Urbanization_	SH_Ex	SZ_Ex	College_gradua	New birth ('79-'	Savings	Population	Marriage_regist	New_born	Fiscal_expendi	Resi_sold	ASP	Total_resi_ sale
1	1999	0.147000	0.219205	0.000000	0.105000	-0.027170	0.000000	0.269825	0.044072	0.041405	-0.284484	0.596461	0.122271	0.012218	0.049966	0.007608	-0.057188	0.079222	0.253310	-0.025370	-0.019102	0.399946
2	1999	0.147000	0.100472	0.000000	0.565951	-0.062323	0.000000	0.276430	0.044072	0.041405	0.213256	-0.529450	0.184371	0.012218	0.106275	0.003813	0.148099	-0.009061	0.190255	-0.154779	-0.019102	-0.170924
3	1999	0.147000	-0.044023	0.000000	0.472019	0.040282	0.000000	0.299548	0.044072	0.039495	0.342428	0.636803	0.022411	0.012218	0.273797	0.007608	-0.010324	-0.039678	0.255789	0.460969	0.240659	-0.170924
4	1999	0.147000	0.339850	0.000000	0.457259	-0.062323	0.000000	0.006919	0.044072	0.041405	-0.639593	1.419627	0.299452	0.012218	0.273797	0.007608	-0.069741	-0.039678	0.067532	-0.010283	-0.019102	0.260336
1	2000	0.123000	0.266897	0.000000	0.165730	0.018256	0.000000	0.102598	0.044072	0.041405	0.847050	1.032007	0.117647	0.010813	0.161200	0.007608	-0.041568	-0.034376	0.204648	0.066858	-0.019102	-0.170924
2	2000	0.123000	0.183683	0.000000	0.657709	0.018256	0.000000	0.102598	0.044072	0.041405	0.847050	1.032007	0.117647	0.010813	0.161200	0.007608	-0.041568	-0.034376	0.204648	-0.154779	0.247179	0.623127
3	2000	0.123000	0.236811	0.000000	0.105000	0.018256	0.000000	0.102598	0.044072	0.041405	0.847050	1.032007	0.117647	0.010813	0.161200	0.007608	-0.041568	-0.034376	0.204648	0.238504	0.059583	0.202457
4	2000	0.123000	0.253673	0.000000	0.105000	0.018256	0.000000	0.102598	0.044072	0.041405	0.847050	1.032007	0.117647	0.010813	0.161200	0.007608	-0.041568	-0.034376	0.204648	0.466233	0.247179	0.458385
1	2001	0.144000	0.252610	0.000000	0.657709	0.002988	0.000000	0.130500	0.010561	0.039757	0.024496	-0.529450	0.094737	0.164173	0.084383	0.006975	-0.051267	-0.039678	0.189852	0.203284	0.035066	0.245478
2	2001	0.144000	0.426599	0.000000	0.657709	0.002988	0.000000	0.130500	0.010561	0.039757	0.024496	-0.529450	0.094737	0.164173	0.084383	0.006975	-0.051267	-0.039678	0.189852	0.203284	0.035066	0.245478
3	2001	0.144000	0.426599	0.000000	0.657709	0.002988	0.000000	0.130500	0.010561	0.039757	0.024496	-0.529450	0.094737	0.164173	0.084383	0.006975	-0.051267	-0.039678	0.189852	0.203284	0.035066	0.245478
4	2001	0.144000	0.151448	0.000000	0.657709	0.002988	0.000000	0.130500	0.010561	0.039757	0.024496	-0.529450	0.094737	0.164173	0.084383	0.006975	-0.051267	-0.039678	0.189852	0.203284	0.035066	0.245478
1	2002	0.168000	0.364458	0.000000	0.474290	-0.014896	-0.072464	0.168929	0.005042	0.037973	-0.080710	-0.292671	0.288462	0.082363	0.086372	0.006472	-0.023602	-0.032644	0.166674	0.188756	0.037171	0.232943
2	2002	0.168000	0.182943	0.000000	0.474290	-0.014896	-0.072464	0.168929	0.005042	0.037973	-0.080710	-0.292671	0.288462	0.082363	0.086372	0.006472	-0.023602	-0.032644	0.166674	0.188756	0.037171	0.232943
3	2002	0.168000	0.059110	0.000000	0.474290	-0.014896	-0.072464	0.168929	0.005042	0.037973	-0.080710	-0.292671	0.288462	0.082363	0.086372	0.006472	-0.023602	-0.032644	0.166674	0.188756	0.037171	0.232943
4	2002	0.168000	0.205190	0.000000	0.474290	-0.014896	-0.072464	0.168929	0.005042	0.037973	-0.080710	-0.292671	0.288462	0.082363	0.086372	0.006472	-0.023602	-0.032644	0.166674	0.188756	0.037171	0.232943
1	2003	0.196000	0.342340	0.166667	0.427328	0.020161	0.000000	0.277396	0.007464	0.036850	0.175100	0.023548	0.401493	-0.081736	0.215537	0.006026	0.032316	-0.029178	0.117752	0.256369	0.050500	0.319816
2	2003	0.196000	0.426599	0.166667	0.427328	0.020161	0.000000	0.277396	0.007464	0.036850	0.175100	0.023548	0.401493	-0.081736	0.215537	0.006026	0.032316	-0.029178	0.117752	0.256369	0.050500	0.319816
3	2003	0.196000	-0.021033	0.166667	0.427328	0.020161	0.000000	0.277396	0.007464	0.036850	0.175100	0.023548	0.401493	-0.081736	0.215537	0.006026	0.032316	-0.029178	0.117752	0.256369	0.050500	0.319816
4	2003	0.196000	0.229358	0.166667	0.427328	0.020161	0.000000	0.277396	0.007464	0.036850	0.175100	0.023548	0.401493	-0.081736	0.215537	0.006026	0.032316	-0.029178	0.117752	0.256369	0.050500	0.319816
1	2004	0.147000	0.266494	0.071429	0.358460	0.026680	0.062500	0.268341	0.013278	0.030342	-0.127180	0.404939	0.273163	-0.001456	0.123969	0.005889	0.068770	-0.003838	0.155657	0.135702	0.159857	0.317252
2	2004	0.147000	0.266494	0.071429	0.358460	0.026680	0.062500	0.268341	0.013278	0.030342	-0.127180	0.404939	0.273163	-0.001456	0.123969	0.005889	0.068770	-0.003838	0.155657	0.135702	0.159857	0.317252
3	2004	0.147000	0.266494	0.071429	0.358460	0.026680	0.062500	0.268341	0.013278	0.030342	-0.127180	0.404939	0.273163	-0.001456	0.123969	0.005889	0.068770	-0.003838	0.155657	0.135702	0.159857	0.317252
4	2004	0.147000	0.266494	0.071429	0.358460	0.026680	0.062500	0.268341	0.013278	0.030342	-0.127180	0.404939	0.273163	-0.001456	0.123969	0.005889	0.068770	-0.003838	0.155657	0.135702	0.159857	0.317252
1	2005	0.176000	0.266278	0.000000	0.149835	-0.020212	0.000000	0.259604	0.021837	0.029454	-0.112177	-0.216775	0.283982	0.072423	0.200088	0.005908	-0.050853	0.014911	0.191084	0.466233	0.152378	0.689655
2	2005	0.176000	0.266278	0.000000	0.149835	-0.020212	0.000000	0.259604	0.021837	0.029454	-0.112177	-0.216775	0.283982	0.072423	0.200088	0.005908	-0.050853	0.014911	0.191084	0.466233	0.152378	0.689655
3	2005	0.176000	0.266278	0.000000	0.149835	-0.020212	0.000000	0.259604	0.021837	0.029454	-0.112177	-0.216775	0.283982	0.072423	0.200088	0.005908	-0.050853	0.014911	0.191084	0.466233	0.152378	0.689655
4	2005	0.176000	0.266278	0.000000	0.149835	-0.020212	0.000000	0.259604	0.021837	0.029454	-0.112177	-0.216775	0.283982	0.072423	0.200088	0.005908	-0.050853	0.014911	0.191084	0.466233	0.152378	0.689655
1	2006	0.169000	0.231787	0.200000	0.222826	-0.002947	0.044118	0.239087	0.009247	0.031473	2.100622	1.628042	0.228013	0.082743	0.222757	0.005292	0.148099	-0.019840	0.191347	0.117672	0.062067	0.187043
2	2006	0.169000	0.231787	0.200000	0.222826	-0.002947	0.044118	0.239087	0.009247	0.031473	2.100622	1.628042	0.228013	0.082743	0.222757	0.005292	0.148099	-0.019840	0.191347	0.117672	0.062067	0.187043
3	2006	0.169000	0.231787	0.200000	0.222826	-0.002947	0.044118	0.239087	0.009247	0.031473	2.100622	1.628042	0.228013	0.082743	0.222757	0.005292	0.148099	-0.019840	0.191347	0.117672	0.062067	0.187043
4	2006	0.169000	0.231787	0.200000	0.222826	-0.002947	0.044118	0.239087	0.009247	0.031473	2.100622	1.628042	0.228013	0.082743	0.222757	0.005292	0.148099	-0.019840	0.191347	0.117672	0.062067	0.187043
1	2007	0.167000	0.169669	0.055556	0.198592	0.032512	0.112676	0.248420	0.008047	0.034870	2.768048	3.750722	0.188329	0.057472	0.273797	0.005181	0.049101	0.006012	0.231519	0.265466	0.168608	0.478835
2	2007	0.167000	0.169669	0.055556	0.198592	0.032512	0.112676	0.248420	0.008047	0.034870	2.768048	3.750722	0.188329	0.057472	0.273797	0.005181	0.049101	0.006012	0.231519	0.265466	0.168608	0.478835
3	2007	0.167000	0.169669	0.055556	0.198592	0.032512	0.112676	0.248420	0.008047	0.034870	2.768048	3.750722	0.188329	0.057472	0.273797	0.005181	0.049101	0.006012	0.231519	0.265466	0.168608	0.478835
4	2007	0.167000	0.169669	0.055556	0.198592	0.032512	0.112676	0.248420	0.008047	0.034870	2.768048	3.750722	0.188329	0.057472	0.273797	0.005181	0.049101	0.006012	0.231519	0.265466	0.168608	0.478835
1	2008	0.178000	0.230341	0.842105	0.105000	0.010496	0.088608	0.258545	0.008838	0.023976	-0.639593	-0.441196	0.142857	-0.026007	0.193324	0.005094	0.107827	0.008416	0.257352	-0.154779	-0.019102	-0.170924
2	2008	0.178000	0.230341	0.842105	0.105000	0.010496	0.088608	0.258545	0.008838	0.023976	-0.639593	-0.441196	0.142857	-0.026007	0.193324	0.005094	0.107827	0.008416	0.257352	-0.154779	-0.019102	-0.170924
3	2008	0.178000	0.230341	0.842105	0.105000	0.010496	0.088608	0.258545	0.008838	0.023976	-0.639593	-0.441196	0.142857	-0.026007	0.193324	0.005094	0.107827	0.008416	0.257352	-0.154779	-0.019102	-0.170924
4	2008	0.178000	0.230341	0.842105	0.105000	0.010496	0.088608	0.258545	0.008838	0.023976	-0.639593	-0.441196	0.142857	-0.026007	0.193324	0.005094	0.107827	0.008416	0.257352	-0.154779	-0.019102	-0.170924
1	2009	0.285000	0.426599	-0.114286	0.517202	-0.062323	-0.232558	0.299548	0.008316	0.028777	0.898731	1.185844	0.037305	-0.020735	0.127422	0.004879	0.103706	-0.010848	0.218992	0.453853	0.247179	0.813215
2	2009	0.285000	0.426599	-0.114286	0.517202	-0.062323	-0.232558	0.299548	0.008316	0.028777	0.898731	1.185844	0.037305	-0.020735	0.127422	0.004879	0.103706	-0.010848	0.218992	0.453853	0.247179	0.813215
3	2009	0.285000	0.426599	-0.114286	0.517202	-0.062323	-0.232558	0.299548	0.008316	0.028777	0.898731	1.185844	0.037305	-0.020735	0.127422	0.004879	0.103706	-0.010848	0.218992	0.453853	0.247179	0.813215
4	2009	0.285000	0.426599	-0.114286	0.517202	-0.062323	-0.232558	0.299548	0.008316	0.028777	0.898731	1.185844	0.037305	-0.020735	0.127422	0.004879	0.103706	-0.010848	0.218992	0.453853	0.247179	0.813215
1	2010	0.197000	0.190579	0.096774	0.268447	0.040282	0.033670	0.120593	0.025173	0.033262	-0.030587	0.273634	0.083412	-0.009991	0.222717	0.004803	0.023758	0.000599	0.177906	0.083445	0.059575	0.147992
2	2010	0.197000	0.190579	0.096774	0.268447	0.040282	0.033670	0.120593	0.025173	0.033262	-0.030587	0.273634	0.083412	-0.009991	0.222717	0.004803	0.023758	0.000599	0.177906	0.083445	0.059575	0.147992
3	2010	0.197000	0.190579	0.096774	0.268447	0.040282	0.033670	0.120593	0.025173	0.033262	-0.030587	0.273634	0.083412	-0.009991	0.222717	0.004803	0.023758	0.000599	0.177906	0.083445	0.059575	0.147992
4	2010	0.197000	0.190579	0.096774	0.268447	0.040282	0.033670	0.120593	0.025173	0.033262	-0.030587	0.273634	0.083412	-0.009991	0.222717	0.004803	0.023758	0.000599	0.177906	0.083445	0.059575	0.147992
1	2011	0.136000	-0.044023	0.117647	0.158338	0.020329	0.148208	0.237605	0.003452	0.026439	-0.171116	-0.237162	0.057004	-0.053349	0.141192	0.004803	0.049476	0.007336	0.215564	0.033754	0.056752	0.092421
2	2011	0.136000	-0.044023	0.117647	0.158338	0.020329	0.148208	0.237605	0.003452	0.026439	-0.171116	-0.237162	0.057004	-0.053349	0.141192	0.004803	0.049476	0.007336	0.215564	0.033754	0.056752	0.092421
3	2011	0.136000	-0.044023	0.117647	0.158338	0.020329	0.148208	0.237605	0.003452	0.026439	-0.171116	-0.237162	0.057004	-0.053349	0.141192	0.004803	0.049476	0.007336	0.215564	0.033754	0.056752	0.092421
4	2011	0.136000	-0.044023	0.117647	0.158338	0.020329	0.148208	0.237605	0.003452	0.026439	-0.171116	-0.237162	0.057004	-0.053349	0.141192	0.004803	0.049476	0.007336	0.215564	0.033754	0.056752	0.092421
1	2012	0.138000	0.152125	0.078947	0.107501	-0.026565	-0.035461	0.202930	0.001197	0.025352	0.069568	-0.184513	0.027129	-0.062384	0.119834	0.004965	0.016278	0.019286	0.152911	0.020088	0.087471	0.109316
2	2012	0.138000	0.152125	0.078947	0.107501	-0.026565	-0.035461	0.202930	0.001197	0.025352	0.069568	-0.184513	0.027129	-0.062384	0.119834	0.004965	0.016278	0.019286	0.152911	0.020088	0.087471	0.109316
3	2012	0.138000	0.152125	0.078947	0.107501	-0.026565	-0.035461	0.202930	0.001197	0.025352	0.069568	-0.184513	0.027129	-0.062384	0.119834	0.004965	0.016278	0.019286	0.152911	0.020088	0.087471	0.109316
4	2012	0.138000	0.152125	0.078947	0.107501	-0.026565	-0.035461	0.202930	0.001197	0.025352	0.069568	-0.184513	0.027129	-0.062384	0.119834	0.004965	0.016278	0.019286	0.152911	0.020088	0.087471	0.109316
1	2013	0.136000	0.210314	0.000000	0.225144	0.040282	0.000000	0.191087	0.001783	0.022057	-0.047468	0.588454	0.022411	0.003169	0.049966	0.004933	0.017604	0.003272	0.113210	0.175237	0.077317	0.266103
2	2013	0.136000	0.210314	0.000000	0.225144	0.040282	0.000000	0.191087	0.001783	0.022057	-0.047468	0.588454	0.022411	0.003169	0.049966	0.004933	0.017604	0.003272	0.113210	0.175237	0.077317	0.266103
3	2013	0.136000	0.210314	0.000000	0.225144	0.040282	0.000000	0.191087	0.001783	0.022057	-0.047468	0.588454	0.022411	0.003169	0.049966	0.004933	0.017604	0.003272	0.113210	0.175237	0.077317	0.266103
4	2013	0.136000	0.210314	0.000000	0.225144	-0.062323	0.000000	0.191087	0.001783	0.022057	-0.047468	0.588454	0.022411	0.003169	0.049966	0.004933	0.017604	0.003272	0.113210	0.175237	0.077317	0.266103
1	2014	0.122000	0.193240	0.000000	0.176000	-0.005848	-0.095588	0.147272	-0.001123	0.019370	0.613956	0.537981	0.032410	-0.010554	0.081682	0.005218	-0.029846	0.029350	0.082543	-0.091036	0.014280	-0.078056
2	2014	0.122000	0.193240	0.000000	0.176000	-0.005848	-0.095588	0.147272	-0.001123	0.019370	0.613956	0.537981	0.032410	-0.010554	0.081682	0.005218	-0.029846	0.029350	0.082543	-0.091036	0.014280	-0.078056
3	2014	0.122000	0.193240	0.000000	0.176000	-0.005848	-0.095588	0.147272	-0.001123	0.019370	0.613956	0.537981	0.032410	-0.010554	0.081682	0.005218	-0.029846	0.029350	0.082543	-0.091036	0.014280	-0.078056
4	2014	0.122000	0.193240	0.000000	0.176000	-0.005848	-0.095588	0.147272	-0.001123	0.019370	0.613956	0.537981	0.032410	-0.010554	0.081682	0.005218	-0.029846	0.029350	0.082543	-0.091036	0.014280	-0.078056
1	2015	0.133000	0.172191	-0.048780	0.235849	-0.005882	-0.040650	0.097612	-0.001075	0.024274	0.209941	2.340006	0.032605	-0.022511	0.054379	0.004971	-0.062754	-0.019401	0.158725	0.068682	0.091043	0.165978
2	2015	0.133000	0.172191	-0.048780	0.235849	-0.005882	-0.040650	0.097612	-0.001075	0.024274	0.209941	2.340006	0.032605	-0.022511	0.054379	0.004971	-0.062754	-0.019401	0.158725	0.068682	0.091043	0.165978
3	2015	0.133000	0.172191	-0.048780	0.235849	-0.005882	-0.040650	0.097612	-0.001075	0.024274	0.209941	2.340006	0.032605	-0.022511	0.054379	0.004971	-0.062754	-0.019401	0.158725	0.068682	0.091043	0.165978
4	2015	0.133000	0.172191	-0.048780	0.235849	-0.005882	-0.040650	0.097612	-0.001075	0.024274	0.209941	2.340006	0.032605	-0.022511	0.054379	0.004971	-0.062754	-0.019401	0.158725	0.068682	0.091043	0.165978
1	2016	0.113000	0.157165	-0.128205	0.366412	0.005945	-0.169492	0.079121	-0.001006	0.022279	-0.035863	-0.366521	0.034219	0.002206	0.060278	0.005885	-0.066874	0.079222	0.067532	0.223531	0.112629	0.361336
2	2016	0.113000	0.157165	-0.128205	0.366412	0.005945	-0.169492	0.079121	-0.001006	0.022279	-0.035863	-0.366521	0.034219	0.002206	0.060278	0.005885	-0.066874	0.079222	0.067532	0.223531	0.112629	0.361336
3	2016	0.113000	0.157165	-0.128205	0.366412	0.005945	-0.169492	0.079121	-0.001006	0.022279	-0.035863	-0.366521	0.034219	0.002206	0.060278	0.005885	-0.066874	0.079222	0.067532	0.223531	0.112629	0.361336
4	2016	0.113000	0.157165	-0.128205	0.366412	0.005945	-0.169492	0.079121	-0.001006	0.022279	-0.035863	-0.366521	0.034219	0.002206	0.060278	0.005885	-0.066874	0.079222	0.067532	0.223531	0.112629	0.361336
1	2017	0.081000	0.138397	0.000000	0.221257	-0.003949	0.000000	0.057337	-0.004299	0.020400	0.164146	-0.205063	0.044874	-0.014283	0.273797	0.005330	-0.069741	-0.035038	0.081650	0.052704	0.057096	0.112809
2	2017	0.081000	0.138397	0.000000	0.221257	-0.003949	0.000000	0.057337	-0.004299	0.020400	0.164146	-0.205063	0.044874	-0.014283	0.173432	0.005330	-0.069741	-0.035038	0.081650	0.052704	0.057096	0.112809
3	2017	0.081000	0.138397	0.000000	0.221257	-0.003949	0.000000	0.057337	-0.004299	0.020400	0.164146	-0.205063	0.044874	-0.014283	0.049966	0.005330	-0.069741	-0.035038	0.081650	0.052704	0.057096	0.112809
4	2017	0.081000	0.138397	0.000000	0.221257	-0.003949	0.000000	0.057337	-0.004299	0.020400	0.164146	-0.205063	0.044874	-0.014283	0.231902	0.005330	-0.069741	-0.035038	0.081650	0.052704	0.057096	0.112809
1	2018	0.081000	0.426599	-0.147059	0.177924	0.004921	0.000000	0.006919	-0.004728	0.018123	-0.186554	-0.189802	0.023784	-0.047460	0.273797	0.003813	-0.069741	0.008513	0.087749	0.021691	0.122186	0.146527
2	2018	0.081000	-0.044023	-0.147059	0.177924	0.004921	0.000000	0.006919	-0.004728	0.018123	-0.186554	-0.189802	0.023784	-0.047460	0.273797	0.003813	-0.069741	0.079222	0.087749	0.021691	0.122186	0.146527
3	2018	0.081000	0.272219	-0.147059	0.177924	0.004921	0.000000	0.006919	-0.004728	0.018123	-0.186554	-0.189802	0.023784	-0.047460	0.273797	0.003813	0.078930	-0.039678	0.087749	0.021691	0.122186	0.146527
4	2018	0.081000	0.420421	-0.147059	0.177924	0.004921	0.000000	0.006919	-0.004728	0.018123	-0.186554	-0.189802	0.023784	-0.047460	0.217661	0.003813	0.128762	-0.039678	0.087749	0.021691	0.122186	0.146527

The 2015 "Relocation with Monetary Incentives" Program

The policy purpose was to provide a cash payment to low-income families living in poor living conditions, supporting them to upgrade from old communities to new properties. The program is primarily for the housing reform in tier 2, tier 3, or lower-tier cities, where there is a greater need for "urban renewal" or "living standard upgrading."

Under this "Relocation with monetary incentives" scheme, the Central Bank introduced a program, Pledged Supplementary Lending ("PSL"), in 2014, through which funding was lent from the Central Bank to China Development Bank, then to the various local authorities for them to compensate residents for relocation from their old communities.

After the relocation is completed, local authorities upgrade the infrastructure, expand the road, and prepare the underground watering and sewering system, then put the land to the auction market for public bidding. Land sale proceeds will be used to repay the loans. Local families who used to live in low-quality housing will use the cash compensation to buy bigger and better houses in the same location after redevelopment or in other parts of the cities. This process has unleashed an enormous amount of new housing demand.

The amount of PSL launched to the market grew from RMB 1.0 trillion (USD 140 billion) in 2015 to RMB 2 trillion (USD 280 billion) in 2017[19], expanding at a monthly pace of approximately RMB 40 billion (USD 5.8 billion), actively supporting the urban renewal efforts operated by the local authorities.

The program has started to slow down in 2018. For example, Shandong province has reduced the incentive amount for relocation compensation, and Henan province has lowered the percentage of cash compensation to local families. In April 2019, the Minister of Finance announced that the budgeted number of relocation homes would reduce to 2.8 million for 2019, 54.2% down from the 5.8 million actual levels in 2018[20]. This indicates that the "Relocation with monetary incentives" program has come to a slower pace and entered into a moderate urban renewal stage from 2019.

19 Mingyuan Real Estate Research Institution; https://36kr.com/p/5156433
20 Minister of Finance website

Chinese Housing Policy Summary

	Housing Market Policies	Policy Category	Policy Outlook
1	**Monetary policy:** adjustment of the Reserve Ratio and interest rates	Monetary	Stable, trending tightening
2	**Credit policy:** mortgage loan availability and down payment requirement	Monetary	Tightening
3	**Purchase restriction:** non-local residents required to pay social insurance and tax for three years before purchasing properties	Supply-demand	Strict in tier 1 and most of the tier 2 cities
4	**Sale restriction:** delaying in approving pre-sale permits	Supply-demand	Starting to loosening
5	**Price cap:** cap the sale prices for new property launched to the market	Supply-demand	Strict in tier 1 cities but loosening in lower tier cities
6	**Tax policies:** adjustment of the transaction tax and income tax for properties transacted within a short holding period.	Fiscal	Strict in tier 1 cities but starting to loosening in lower tier cities
7	**Developer financing:** restriction to lend for land acquisition	Monetary	Tightening
8	**Land supply policy:** land sale schedule and relocation schedule	Supply-demand	Loosening
9	**Social housing:** relocation with monetary incentives, low-income housing, and collective ownership housing; government to purchase houses for low-income families	Social welfare	Expanding and encouraging
10	**Tax-deductible:** home mortgage interest payments to be income tax-deductible	Fiscal	Policies in the early 2000's but no longer in place

Source: https://baike.baidu.com/item/房地产调控/914877?fr=aladdin

Resume of the Author

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