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The Factors that Impact the Housing Price: An Empirical Study Based on Chinese Provinces

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Abstract

This paper examines the trend of housing prices in 31 provinces and cities in China from 1999 to 2018, and uses fixed-effect estimates to analyze the impact of GDP, income level, CPI, unemployment rate and population on housing prices, and finds that GDP and income have positive impacts on housing prices. In addition, housing prices in the eastern region are much higher than those in the central and western regions, and over time, the gap between housing prices in the central region and western region are both growing. In order to study this phenomenon, the fixed effects of housing prices in the eastern, central and western regions will be used. Finally, it is found that the increase in unit income in the eastern region leads to a much higher rate of housing prices than in the central and western regions. The higher marginal buying tendency of consumers in the eastern region is an important reason for the higher growth rate of housing prices in the eastern region than in other regions.

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Chapter 1: Introduction

1.1 Background and reasons for research

The development of China's residential market is not long - it was only in 1998 that China abolished the urban housing distribution system and began to enter the embryonic stage of the residential market (Chen *et al*., 2003). With the establishment of China's national policy of reform and opening up, China's economy has developed unprecedentedly, and the market economy has gradually penetrated into various fields, including the residential market. After 20 years of development, China's residential market has been transformed from a new industry into one of the important industries of the national economy. As China's domestic residential market has reached its present level only after more than ten years of development, the potential and space for the future development of the industry can be seen. At the same time, China's residential market is not mature now, which is especially show at the huge price in the eastern, central and western regions. The first and second-tier metropolitan's housing prices show a rapid rise in the characteristics of a serious economic burden on buyers, and many people questioned whether there is a real estate bubble in China, and required the government that the policy of curbing excessive housing prices should be introduced as soon as possible to relieve the burden of ordinary consumers (Gaulard, 2011).

The Chinese real estate market has developed rapidly in the past few decades, and the asset prices in the residential market have also changed a lot. The issue of controlling housing prices has become a key issue for the Chinese government, and many scholars are also studying this issue to identify factors that contribute to the decline in the real estate market (Zhang and Fung, 2006). Since the residential market and price changes will have a major

impact on the living standards and life of residents, it is an important task to analyze the factors affecting the housing prices in China.

In addition, the high price of housing price in China is not a common phenomenon in all parts of the country, but a part of the faster-growing and better-developed areas of excessive housing prices, that is, the central, eastern and western price trends are very different. Therefore, we need to study the factors affecting housing prices more in-depth, rather than just suppress the housing prices by policy. At present, the government has formulated and implemented many policies to ensure the healthy development of the real estate industry (Qiu, 2011).

For the research, if the relevant theoretical research lacks relevant data to verify, the credibility of the article is not high. Therefore, it is necessary to analyze the feasibility of research before doing research. In this paper, the regional factors affecting housing prices as a starting point for analysis and research, data acquisition is not difficult, so there is a certain degree of feasibility.

1.2 Aim and objectives

The main aim of this paper is to explore the following questions. First, the factors affecting Chinese housing prices need to be found and how these factors affect housing prices. In addition, it is important to explore whether these factors affecting housing prices will have different effects in different regions. Based on the aims, factors that may affect house prices and data need to be collected. In addition, through regression methods, the objective is to

explore what factors will have an impact on housing prices. Finally, understanding the differences in the relationship between factors and housing prices in different regions is also important.

1.3 Research ideas and methods

Since the marketization of China's real estate industry in 1998, the investment structure of the residential market has changed a lot. The proportion of residential investment has shown an upward trend, rising from 60% in 1999 to 71% in 2010 (National Bureau of Statistical, 2018). Along with the reform and opening up, China's residents' income level is constantly improving, the economy is developing at high speed, the land transfer system is reformed, and the bank credit conditions are reformed. China's residential market is deepening. China's real estate industry has developed rapidly, but there are still various problems. The uneven development of the region, the excessive housing prices in some big cities, and the fact that the proportion of overall housing prices in the income exceeds the reasonable range have not only brought huge pressure on the purchase of ordinary consumers, but also an important part of the instability of the financial market (Yunfang, 2007).

Since China's residential market entered the market-oriented operation in 1998, the real estate industry has become the engine of China's economic growth and an important basic industry (Song, 2010). It has become the leading force to accelerate the realization of industrialization and urbanization. The contribution of the real estate industry to the national economy has become increasingly prominent. Especially since the marketization of real estate, under the guidance of macroeconomic policies such as expanding domestic

demand and comprehensively promoting housing system reform, China's real estate industry has boomed and there has been a rapid growth trend, but it must be objectively seen that there is currently a residential market in China. The housing prices in some areas have risen too much. The country has adopted a series of macro-control measures to control the real estate's price, such as insisting on moderately tight land supply policies for real estate, actively adjusting land supply, and increasing the proportion of real estate development funds (Ding, 2010). It can be seen that the impact of national macro-control policies on real estate prices is significant, but it is not completely effective. Therefore, before analyzing the factors affecting the regional differences in real estate prices in China, it is necessary to combine the development status of China's residential market with the residential market prices in China. The regional differences in evolution also need to be analyzed.

Since the degree of development of China's residential market is different from that of the internationally mature residential market, different countries have different perspectives and focus on the housing market's research. China's residential market and stock market have not developed completely, and the price movements of the two are not completely regulated by the market. The trend of China's current housing prices and the government's relevant regulatory measures have also prompted many studies to dig deeper into the reasons for housing prices. In order to provide some good advice to help keep China's housing prices in a healthy and stable track, this paper focuses on the growing housing price gap between China's eastern, central and western regions and the sharp rise in China's housing prices. Through analysis of housing price changes and its influencing factors in 31 provinces and cities in China, attempts to identify properties affecting different parts of China. Finally, the robustness of the results of fixed-effect models will be compared, to analyze the regional differences in the factors affecting housing prices, and provide

constructive advice for policy development.

1.4 Summary of the structure

In general, housing prices are closely related to regional economic development levels, economic growth, demographics, geographic location, and social stability (Glossop, 2008). Therefore, this paper will analyze the housing prices of 31 provinces in China from 1999 to 2016, and study the impact of unemployment, GDP, CPI, income level and population on the housing prices.

This paper will be divided into five parts. The first part introduces the research background and current situation of the article. According to the research status of the real estate industry and the changing characteristics of the housing price in China, the research direction and data selection of this paper will be divided. The second part will sort out the relevant literature. Based on previous research, some relevant factors which may have an important impact on housing prices will be found. Therefore, these variables can be as the influencing factors of housing prices in the empirical analysis section below. The third part will introduce the method and principle. This article will select panel data, so some estimation methods for panel data will be introduced. The fourth part will sort out the data and make a brief description of the data and correlation analysis of data in order to better understand the data. Regression analysis will be made later. Finally, in Chapter 5, the conclusion will be proposed to reflect the aim of the research, and discussion, recommendation and limitations will be included as well.

Chapter 2 Literature Review

This chapter will be divided into three parts. First, the importance of the residential market and housing prices should be understood. According to previous researches, factors affecting the housing prices will also be reviewed. In addition, the final part will review some researches about housing prices in China.

2.1 Importance of the Residential market and Housing Prices

In history, foreign scholars' research on the residential market was gradually derived and developed from related studies such as land economics and urban economics. Scholars such as Smith (1987) and Ricardo (1971) conducted research on land issues and housing issues, and laid the foundation for early theoretical research for residential market theory. At the beginning of the 20th century, Yelly and Morehouse conducted a systematic study on the development of land and real estate in their book Elements of Land Economics (1924). In addition, Alonso (1964), Wingo (1961), and Evans (1973) conduct research on the residential market from the perspective of land and city, and provide a basic theoretical basis for the balance of supply and demand in the residential market and the regulation of the residential market. It points out that real estate prices and regional economic development interact, and real estate price instability will be affected. Regional image, reducing the attractiveness of investors and affecting the coordinated development of the entire region.

The real estate industry has the special characteristics of consumer goods and investment products, making it a research object of many scholars at home and abroad. Storper (2011)

believes that real estate is formed by relying on land, and houses depend on the environment of the land. Changes in the surrounding environment of the land will drive changes in real estate prices, thus forming a regional characteristic of real estate prices. Ortalo-Magne and Rady (2004) analyzed the impact of macroeconomic fluctuations on housing transactions in England and Wales, and found that the impact of financial liberalization and demographic changes on real estate trading volume, the key factor in the change in trading volume is the fluctuation of real estate demand. The difference in real estate demand has formed regional differences in real estate prices.

Residential is one of the most important assets in the daily life of the citizens, and it is also an important industry for the national economy as well. When the residential market is at boom, it can promote the economy growth and encourage the development of other related industries. For example, when the housing market is prosperous, real estate-related building materials, decoration, electrical products and other physical industries will also benefit, which is to say, the residential market has the function of both directly and indirectly increasing the national economy. To be more specific, the investment in real estate is generally accounting for more than 20% of the total fixed investment, and the percentage of the real estate is higher than 10% in the GDP (Shuping, 2006). With the development of society and economy, the real estates are not only consumptions for the people, but also the investment that can bring the appreciation of asset values. However, in China, the residential market is still not mature, and there is high volatility in the price changes, which lead to many problems. To be more specific, there is speculative behavior in the residential market, which increases the prices in the residential market and causes the instability in the market. That also leads to the problem of income inequality and distribution (Yue and Hongyu, 2004). In large cities such as Beijing and Shanghai, the increase in the residential market is exceeding the increase in economy, which makes it

difficult for the average citizens to afford the real estates. Even in smaller cities, the prices in real estate are also increasing rapidly in the past decades, and that is why the price in real estate in China has become a serious social problem that needs to be handled.

Besides, the housing price and the housing market will affect the economy as a whole, since the rising housing prices will have influences over the spending of the consumers, which lead to higher economic growth. However, the condition is that the housing prices should be maintained at a reasonable and affordable level, otherwise the high housing prices will be a threat to the economy, and it will lower the desire of the consumers to purchase houses (DiPasquale and Wheaton, 1994). At the same time, if the housing prices decrease, it will also have negative influences over the economy, since the confidence of the consumers will decrease, and the amount of investment and construction in the economy will be adversely affected as well. Therefore, it can be seen that the housing prices should be maintained at a certain level (According to international practice, the current prevailing argument is that the ratio of house price to income may be between three and six times. If considering the housing loan factor, the proportion of housing consumption to household income should be less than 30%.), and too high or too low housing prices will both have negative effects over the economy. Since the housing market is important to the economy, governments have also paid a lot of attention to make sure that the housing market can develop stably.

The importance of the housing prices can also be reflected through the wealth effect, which refers to the impact of the rising value of the assets over the consumer spending (Case, Quigley and Shiller, 2005). To be more specific, when the housing prices increase, it is

equivalent to an increase in the wealth for those who already hold real estate, but more difficult for those who have not yet bought. In this way, the householders will have higher wealth and tend to make more consumptions, which is called the wealth effect. And the consumers also tend to be more confidence in the housing market and the entire economy, leading to the increase in consumption. According to the multiplier effect, if there is an increase in the total demand from the increasing housing prices, there will be a higher increase in the aggregate demand in the end, and that increase will be higher than the initial effect (Straszheim, 1975). On the other hand, if the housing prices fall, the consumers' confidence will fall as well, leading to the economy downturn and the lower willingness of spending and investment. In general, it can be seen that the housing market and housing prices are essential for the economy, and for China where the population is high and where the economic growth in significant, the housing prices also play an important role.

2.2 Influencing Factor of Housing Prices

The residential market in developed countries started earlier and the market maturity is higher. It has experienced a complete development cycle. Housing prices in various regions have also experienced fluctuations in different ranges. This phenomenon has aroused the attention of all sectors of society. The study of differences mainly focuses on the regional differences in real estate prices and their influencing factors. This section will provide a literature review of empirical research on regional differences in residential market prices.

As a major component of the national economy, there are also many factors that will affect the housing prices in China. In order to find the factors that will influence the housing

prices, many researches have done empirical analysis and identify the key factors. Therefore, the important factors that will impact the housing prices will also be reviewed, with the support of previous researches. Those factors will also be used as the independent variables in this study as well.

First, the macroeconomic factors will influence the real estate prices (Xu, 2017). One example is the GDP. In general, the increase in GDP will lead to the increase of the income level and the living standards, and thus the demand for real estate will also increase accordingly, and that will result in the increase in the real estate prices. In addition, the study of Xu (2017) has analyzed the relationship between GDP growth, interest rates, income and housing prices, which is an important paper as a reference. In this study, the author used the data in China and the finding is that the control power of the interest rate over the housing prices is limited. That is to say, though there are some people believe that a higher interest rate may lead to the decreasing of the housing prices, the effects are limited at least in China. When the interest rate level increases, the relative costs for buying a house will be higher since the interest payment of the mortgage will be higher. However, it seems that in the China market, the effects of interest rate are limited due to the government regulations. Besides, in terms of the relationship between GDP growth and the housing prices, the author has also found that the growth of housing price and the GDP growth have an inseparable relationship, and they are interacting with each other. The last finding of the study is that when the income level increases, the demand for housing will also increase, leading to the situation of buying pressures since the house prices are too high.

The study of Aizenman, Jinjarak and Zheng (2016) intends to find the relationship between

real estate valuation, economic growth and the cost of housing cycles, which is also the study of GDP and housing market essentially. The paper finds that the booms and busts of the housing market will trigger the ups and downs in the real business cycle and the entire economy, and the paper intends to examine the relationship in an international context. The authors have taken into account the heterogeneity in housing policies in different countries and try to find the relationship between economic growth and housing price valuation. The finding of the paper is that large housing price depreciations will be positively associated with economic growth, and this type of positive relationship will be more significant in countries where there are civil law legal systems.

Besides, the price level and the price inflation in a country will also influence the real estate prices, and the price level is measured by CPI to some extent (Liya, 2008). The higher the CPI, the price level in the real estate industry will also tend to be higher. The reason is that even when asset prices are not directly included in the CPI, there is a close relationship between CPI and house prices. In general, when house prices continue to rise, rents will rise slowly and CPI will be affected by them. In addition, when the loan interest rate is included in the CPI, when the government raises interest rates to control the rapid growth of real estate, it will inevitably lead to an increase in mortgage interest rates, which will push up the CPI. The foreign direct investment is also likely to be linked with the price change in the residential market since part of the foreign direct investment might flow into the residential market, and thus cause the price changes. For instance, if the Chinese residential market is regarded as a profitable market for the foreign investors, capital inflows will increase and the demand for the real estates will raise (Yongqiang and Tien, 2004). The demand does not only contain the domestic demand, but also the foreign demand made by the foreign investors. In this way, the price of the real estates will be pushed even higher.

As for the relationship between housing price and the unemployment, it is said that there is an interaction between the two variables, which is to say, they are influencing each other. To be more specific, when the housing prices are high, the development in the housing market will be faster, which will bring more construction and new investment (Miller and Peng, 2006). Those new projects and constructions can lower down the unemployment rate in the society since more labor force are needed for those new construction. Therefore, in this sense, the rising in the housing price will lead to the lowering of the unemployment rate in the local places. On the other hand, there is also impact from the unemployment rate to the housing prices. For instance, if the unemployment rate is high, it generally represents that the economy may be in a bad situation, and the overall confidence in the market is low. With many people become unemployed, the aggregate spending in the market will be lower, and thus the demand in the housing market and the price will fall. Therefore, it can be said that there is the negative relationship between housing prices and the local unemployment rate.

Another factor that people have investigated quite often in the income level, which is the measurement of the consumption ability of the individuals. The average income level of a region can reflect its overall consumption level, and it can also influence the housing price. One important study is by Goodman (1988), who studies the relationship between housing price, permanent income, tenure choice and housing demand using the econometric model. In this paper, the issues of the determination of housing price have been addressed. The finding is that full housing demand elasticities can incorporate the different interactive effects among four stages of the model. To be more specific, the price of the housing market and the permanent income of the individuals will have influence over the choice

about tenure. Besides, other sociodemographic variables including age will also have complex effects in the model. The research of Carliner (1973) also deals specifically with the problem of income elasticity of housing demand, which describes how the housing demand will change according to the changes in income. The traditional literatures are supporting the idea that the demand in the housing market is inelastic, but this paper offers new evidence. The data used in this paper are four-year panel data where the permanent income was defined and calculated in two different ways. Then the researchers have run the regression, where the housing value is the dependent variable and the permanent income, price, age, race and sex are the dependent variables. The results of the study are robust, and the author has shown that the income elasticity for housing demand is around 0.6 to 0.7 for house owners, which is relatively higher than the previous study. Besides, it also finds that the income elasticity for housing demand is around 0.5 for renters.

The measure of housing affordability should also be mentioned here, which is a widely used measurement of the ratio of the housing ratio to the income level. To be more specific, in the UK, the housing affordability can be used to reflect the ability to rent or buy the property. Following the measurement of housing affordability in the UK, the housing affordability in China can also be defined as the ratio of the housing prices to annual earnings. That is to say, dividing the housing prices by the annual earnings can yield the housing affordability. Gan and Hill (2009) have pointed out that housing affordability is a good measure in practice, and the median house-price-to-income ratio can also be used for considering the housing price issues.

For population factors, Downs (1993) found that the difference in market conditions will lead to regional differences in real estate prices. For example, Downs finds a positive

correlation between population growth rate and real estate prices in market conditions. In areas with rapid population growth, real estate prices change rapidly. In areas with slow population growth, real estate prices have changed little. However, by analyzing National Council of Real Estate Investment Fiduciaries (NCREIF) data between 1985 and 1993, Shilton and Stanley (1995) concluded that population size and employment rate do not lead to regional differences in real estate prices, and that market conditions such as personal income, urban transport convenience, and property levels form residential price area differences. Downs, Shilton and Stanley hold the opposite view, so the population factor needs to be tested in this paper.

The research of McCue and Kling (1994) explores the relationship between the macroeconomic factors and the residential market, and they use the equality Real Estate Investment Trust (REIT) data as the proxy for real estate returns. The results of their study show that prices, nominal interest rates, output of the national economy and the amount of investment into the residential market all have significant impacts over the residential market return, and their study confirms the view that the interest rates have influences over the residential market. And their important finding is that the interest rate can explain more of the variation in the real estate prices, which means that the interest rate is one of the most essential factor in determining the real estate prices. The study conducted by Sivitanidou and Sivitanides (1999) tries to find the relationship between the residential markets and the capital market influences. The capital market refers to the stock market and bond market where there are capital inflows and outflows. They focus on the office capitalization rate, and there are two main approaches in this paper. One is that they focus on the importance of local-fixed and time-variant components of the office capitalization rate, and they try to find whether there is time persistency in the trends. The second approach is that they study the local office capitalization rate and the national capital market separately and intend to

find the influence. The finding is that both local fixed and time-variant effects exist.

2.3 Researches about Housing Prices in China

The residential market in China has developed rapidly during the past decades, and the asset prices in the residential market have also changed a lot. The problem of controlling the housing price has become a key issue for the Chinese government, and many scholars are also working on this topic in order to find out the factors that will contribute to the increase of decrease in the residential market (Zhang and Fung, 2006). Since the residential market and the price changes can influence the living standard and the lives of the citizens, it is an important task to analyze the factors that will impact the housing price in Chinese cities. Besides, since there are many cities in China, and each of them has different development level and price level of the real estate, it is better to study the cities in groups (Li, 2009). To be more specific, large cities such as Shanghai and Beijing might have quite high real estate prices, while in smaller cities the prices might be moderate, and that was caused by the large demand in large cities.

There are many scholars who are working on this topic in order to find out the factors that will contribute to the increase of decrease in the residential market in China and other Asian markets. For instance, the study by Lin (2011) has investigated into the six Asian economies in order to find whether the stock markets and the residential markets are correlated or not. Their finding shows that in some countries the surges in the residential market might lead to the increase in the stock market, while in other countries the relationship might be the opposite. It seems that the relationship will also depend on the economic and political policies. The study of Tsatsaronis and Zhu (2004) tries to use

cross-country data to find the factors that drive the housing price changes and dynamics. They found that the housing price tends to depend on inflation, the yield curve of the bonds, the bank credit and the mortgage market. It has been found that the housing prices are quite sensitive to short-term interest rates than long-term ones. The interest rate will contribute to the price changes in residential market because people need to apply for loans and mortgage from the banks to pay for the real estate assets, and thus the level of interest rate will influence the demand. On the other hand, the interest rate determines the return rate that the investors are requiring, and thus the investment in real estate will also be impacted by the interest rates.

Another important article is by Yunfang and Tiemei (2007), who conducted empirical analysis towards the real estate prices in China, and in their study, the Chinese cities are divided into groups according to the provinces they belong to. And through the study of each province and the price fluctuation in different provinces, the two authors have important findings. They have found that in China, real estate prices in different provinces share similar trend, but the growth rates are different. The authors have divided 28 provinces into three regions, and then analyze the factors that lead to the real estate price fluctuation. The conclusion is that in eastern regions, the fluctuations are stronger, and the responses towards the credit policy are also stronger. The credit policy plays an important role, as well as the interest rate policy.

One similar study with this dissertation is the paper by Shun and Kangping (2004), who intends to find the causality relationship between the residential market and the economic growth. They also use the empirical approach, and they focus on the Chinese economy as well. They believe that the residential market has gradually become the core component of

China's economy, and the residential market can boost the national economy. They have built a Granger Causality model, which is to test whether the past economic growth rate has an impact on the current housing prices and whether the past housing prices have an impact on the current economic growth rate. Additionally, they used panel data from 1994 to 2002, and the results show that there is two-way Granger Causality relationship between the two. That means that the residential market in China and the economy growth will influence each other and they are the Granger cause for each other.

2.4 Summary of the Chapter

Through this chapter of the literature review, it can be seen that the residential market is an important industry, and there are many factors influencing the real estate price in China. It has been found that the GDP growth rate, the inflation, the CPI and the foreign investment are factors that will influence the residential real estate price in China. Besides, there will also be regional differences, since large cities generally witness the higher level of prices.

Research questions:

(1) What are the factors affecting housing prices in Chinese provinces?

(2) How do these factors affect housing prices?

(3) Whether these factors affecting housing prices will have different effects in different regions. If so, what are the differences?

In addition, taking into account the current status of the real estate industry in China and the available data, this paper will study the factors that led to price gaps in eastern, central and western China. From the data structure point of view, because this article needs to study the housing prices in different years in the immobile area, the data is bound to be a panel structure. The commonly used estimation methods for panel data have fixed effect estimation and random effect estimation, so next chapter will introduce the principles of these two estimations in detail. In addition, if the lag period house price is added to the interpreted variable, the regression model is a dynamic panel regression model, so the paper will also introduce the estimation of the dynamic panel.

Chapter 3 Methodology

3.1 Overview of Methodology

This paper intends to analyze the dynamic evolution of the residential market in China and the regional differences based on the development status of China's residential market. According to the regional differences in the residential market price in China, through the theoretical analysis of the factors affecting the regional differences of housing prices, the measurement method is used to identify the factors affecting the regional differences of real estate prices in China. With the uneven development of China's residential market and the obvious regional differences in real estate prices, the regional market is defined, and the regional characteristics of regional differences in real estate prices in China are empirically analyzed. In addition, this paper also intends to divide the real estate prices according to the changes in the real estate price operation since the residential market in China, and on this basis, to study the characteristics of the regional differences in real estate prices in China at different stages.

The overview of the methodology will be provided in order to give the readers a general understanding of how the research will proceed and how the research question will be solved. The research question will be solved mainly through data analysis and regression models. The OLS regression will be used here. First of all, the data of each province will be collected and then the provinces will be divided into three groups according to location (Ministry of Civil Affairs of the People's Republic of China, 2018). Through the multiple regression models, the influence of the independent variables towards the dependent variables will be found, and the research question will be solved. Since the data used here is panel data, random effect model and fixed effect model can be used to find the relationship

between the variables. The regression models will be analyzed in detail in later parts. The structure of this chapter will be as follows. After the overview, the source of data and the data collection method will be introduced, following by the discussion of the regression model that will be used here. In the fourth part, the relevant tests related to the model will be introduced as well. In the end, the ethical issues related to this methodology will also be considered.

3.2 Data Source and Collection

Secondary data will be used in this dissertation, and they will come from the public data source that are reliable. In this dissertation, the data is collected from the public data release websites of the Chinese government, which is one of the most authoritative and reliable source since it is directly released by the government. Therefore, the quality of the data can thus be ensured. First of all, it is important to specify the variables that will be used in the model. The dependent variable will be the measurement that can measure the level of the residential market, and in this dissertation, the residential market data will be collected from National Housing Indices, which is an official data published by the National Bureau of Statistical (2018). And there will also be explanatory variables, including the GDP growth rate, the CPI indices, the unemployment rate, the population, and the disposable income of the citizens, and those variables are selected following the previous researches. Those variables are all key economic indicators, showing the level of economic growth, financial development, consumption of the citizens and the investment from other countries (Stock and Watson, 2008). Those data will be from different sources. For instance, the GDP growth rate, the CPI indices, the unemployment rate will be collected from National Bureau of Statistical, which is an authoritative source for government data in China. The disposable income level data can be collected from the People's Bank of

China (2018), which is the central bank in China which has the power of regulating the interest rate levels. Other variables that seem to be appropriate will also be added into the model during the data analysis. Since the complete data of the National Bureau of Statistics only shows from 1999 to 2016, all data will be studied between 1999 and 2016. After the data collection, the data will be arranged into the panel data, with different provinces in different years. With the panel data, it is possible to conduct the regression.

3.3 Regression Model

Regression is the most basic econometric method that can help the researchers find the relationship between different variables. Regression analysis refers to the statistical process for estimating the relationship among variables, and it includes different techniques for modelling and analyzing (Kao, 1999). To be more specific, regression analysis can help the researchers understand how the dependent variable will change if one independent variable changes, holding other variables constant. In this dissertation, the influence of the variables such as GDP growth rate, the CPI indices, the unemployment rate, the population, and the disposable income of the citizens towards the price change in the residential residential market can be found through the regression model (Chamberlain, 1982). There are a variety of techniques and methods that can be used for carrying out the regression analysis. One of the most commonly used one is the linear regression and ordinary least squares regression. Since the intercept term of the panel regression model may have an intercept term that does not change with time or does not vary with the region, the ordinary OLS regression will lead to endogenous problems. Therefore, there are two common ways of estimating and modelling it. One is the fixed effects model and the other is the random effects model. The two models will be used, and they will be introduced below.

- **Fixed Effects Model**

Fixed effects model is a statistical model where the intercept term is a fixed value that varies only with the region and does not change with time. This model is different from the random effects model in that the intercepts are considered fixed. In the fixed effects model, the mean value of the group is fixed, and each group mean is a group specific fixed quantity. To be more specific, when analyzing panel data, the fixed effects model is used to estimate for the coefficients in the regression model including the fixed effects (Baltagi, 2008). When using the fixed effects model, it is necessary to make the fixed effects assumption in advance. The fixed effects assumption states that the individual-specific effects are correlated with the independent variables. The model can be expressed as below.

$$y_{it} = X_{it}\beta + \alpha_i + u_{it}$$

for t = 1, 2, …, T and i = 1, 2, …, N

In this fixed effect model, y_{it} is the dependent variable representing the value for individual i at time t. In this case, it represents the price level of residential market in one province in one certain year. X_{it} is the time-variant matrix for the regressor, and β is the parameter of the coefficient. α_i is the unobserved time-invariant individual effect, which means that it is the same for the same individual in different time, but it is different for different individual (Levin, Lin and Chu, 2002). In this case, α_i will be different from different provinces, but for the same province, it will not change over time. Last but not least, u_{it} is the error term. The model can be estimated using specific method, and in STATA, there are programs for solving and estimating the model. Therefore, the fixed effects model can be estimated here.

$$housing\ price_{it} = \beta_1 GDP_{it} + \beta_2 CPI_{it} + \beta_3 UR_{it} + \beta_4 POP_{it} + \beta_5 IN_{it} + \beta_5 Group_{Others} + \alpha_i + u_{it}$$

Where GDP is the gross domestic production of the city, CPI is the price level of goods, UR is the unemployment rate, POP represents the population and IN represents the income level. Through the regression model, the influences of the independent variables can be easily found through the number of coefficients.

- **Random Effects Model**

Another model is the random effects model, which has many differences with the fixed effects model. In statistics, random effects model refers to the model where it is assumed that there is no fixed effect. It can be regarded as a special form of the fixed effects model (Canay, 2011). To be more specific, in the random effects model, there is a hierarchy of different population whose differences are related to the hierarchy. The assumption under the random effects model is that the individual specific effects are uncorrelated with the dependent variables, and if this assumption holds, the random effects model will be more efficient than the fixed effects model. Therefore, it can be seen that which model is more efficient is depending on which assumption holds for the data. If the assumption of the random effects model does not hold, then the estimations from the random effects model will not be consistent nor efficient. The model for the random effects can be expressed as below.

$$Y_{ij} = \mu + U_i + W_{ij},$$

In this model, μ is the average test score for the entire population, U_i is the individual-specific random effects. That is to say, U_i is different for different individuals, but it will not change over time. Besides, in this model, W_{ij} is the individual-specific random effect. Again, in STATA, there are programs for solving and estimating the model. Therefore, the fixed effects model can be estimated here.

- **GMM estimate**

The fixed effect estimation does not take into account the effect of the lag term of the interpreted variable on the interpreted variable, so this paper introduces dynamic panel regression to solve this problem. The regression model used for dynamic panel analysis is as follows:

$$y_{it} = \alpha y_{i,t-1} + \beta x_{it} + \mu_i + \varepsilon_{it}$$

$$i=1,\ldots,N,\ t=1,\ldots,T$$

Where $y_{i,t-1}$ is the lag term of the dependent variable and μ_i is the fixed effect of the individual i. The lag term of the dependent variable and fixed effects of the dependent variable exist at the same time, which is the key to the particularity of dynamic panel data analysis.

The GMM method, also known as the generalized moment estimation method, is based on the requirements of the measurement model for the data, and a series of moment conditions are obtained. Based on these moment conditions, the coefficients satisfying the conditions

are obtained. The advantage of the moment estimation is that some of the independent variables are allowed to be endogenous, that is, in addition to the fixed effect μ_i, the error term eit may have heteroscedasticity and sequence correlation, but requires an uncorrelated between the error terms ε_{it} and ε_{jt} between different individuals. Therefore, GMM estimation is more suitable for the analysis of macro panel data, because it is difficult to find out the absolute exogenous macro variables, GMM estimation allows some variables to be endogenous to meet the characteristics of macro variables.

3.4 Relevant Tests

Another important test for determining which model is more efficient is the Durbin–Wu–Hausman test, and that test will also be conducted in this paper. Moreover, other tests, including the unit root tests, cointegration tests and Granger causal tests will also be conducted in the data analysis.

First of all, the Durbin–Wu–Hausman test will be conducted in terms to decide whether the random effects model or the fixed effects model can be more efficient. The Durbin–Wu–Hausman test is a statistical hypothesis test named after several economists. It is used to evaluate the consistency of the estimator compared with an alternative, which is a less efficient estimator that is already known (Nakamura and Nakamura, 1981). This test can help the researchers to evaluate whether a statistical model corresponds to the data. In terms of the usage in panel data, the Durbin–Wu–Hausman test can be used to determine and differentiate between fixed effects model and random effects model, and thus it is appropriate to use this test here to find the most suitable model for the data (Holly, 1982). In the Durbin–Wu–Hausman test, the null hypothesis is that the random effects model is

preferred to fixed effects model, due to higher efficiency. And the alternative hypothesis is that the fixed effects model is more efficient.

A common trend may be shown in some non-stationary economic time series, and these results are sometimes not directly related to each other. At this time, the data is regressed, and the result is meaningless despite the high R-square. This situation is the false regression. Therefore, the unit root test needs to be used to test the stationarity of each panel sequence. First, we can first draw a timing diagram on the panel sequence to roughly trace whether the polyline representing the variable contains the trend term or the intercept term from each observation in the time series diagram, so as to make the test mode for the further unit root test. The unit root process means that the lag variable of the random variable has a greater influence on its current value (see Appendix). If a random variable has a unit root process, the random variable is not stable, and it will be returned. Lead to pseudo-regression problems.

After the unit root tests, the cointegration tests will be used in order to see whether there is cointegration relationship between the variables (Johansen, 1988). Finally, the Granger causal test will be adopted to see whether the independent variables are the causes for the changes in residential market prices. The hypothesis in the unit root test is that there is a unit root, and if the statistic in the unit root test is large enough to reject the null hypothesis, the conclusion that there is no unit root can be drawn (Harris, 1995). That is to say, if there is no unit root, the time series will be stationary. The cointegration test is also a commonly used test in statistics and econometrics. Cointegration is the statistical property of a collection of time series variables, and it is an important property in contemporary time series analysis. Since there is often the case that the time series have trends, deterministic

or stochastic trends, it is important to test for cointegration in the data analysis. Besides, another important test is the Granger causal tests, which is used to test whether there is the casual relationship between two variables. Using the Granger causal tests, the researchers will be able to find out whether the relationship between the dependent variable and the independent variable are causal relationship or not. And this test is also widely used in econometrics and statistics.

3.5 Ethical Issues

The data do not relate to individual people but to property transactions and the economy, so there are no ethical issues of harm to individuals.

Chapter 4 Results and Analysis

4.1 Data and Descriptive Statistics Analysis

This paper selects panel data of housing price, unemployment rate, GDP, CPI, per capita income and population in China's provinces from 1999 to 2016 to study the factors affecting housing price in each province. The explanatory variable of this paper is the average selling price of commercial housing. All variables are panel data for 1999-2016 (The latest national data is only shown until 2016), and the data is sourced from the official website of the China National Bureau of Statistical (2018).

This paper selects 31 provinces' data in China from 1999 to 2016. In order to understand the data better and explore the difference between different region, the provinces may need to be divided into groups. According to Ministry of Civil Affairs of the People's Republic of China (2018), the 31 provinces can be divided into three parts: the eastern region, the central region and the western region, the specific classification are as follow in Table 1. The variables include housing prices, unemployment, GDP, CPI, per capita income and population data from 1999 to 2016, which are shown in the appendix. This paper wants to show the difference impact of unemployment, GDP, CPI, per capita income, and population on housing prices in the eastern, central, and western regions. Table 1 also shows the number of each region and their proportion.

Table 1: Provincial grouping and proportion

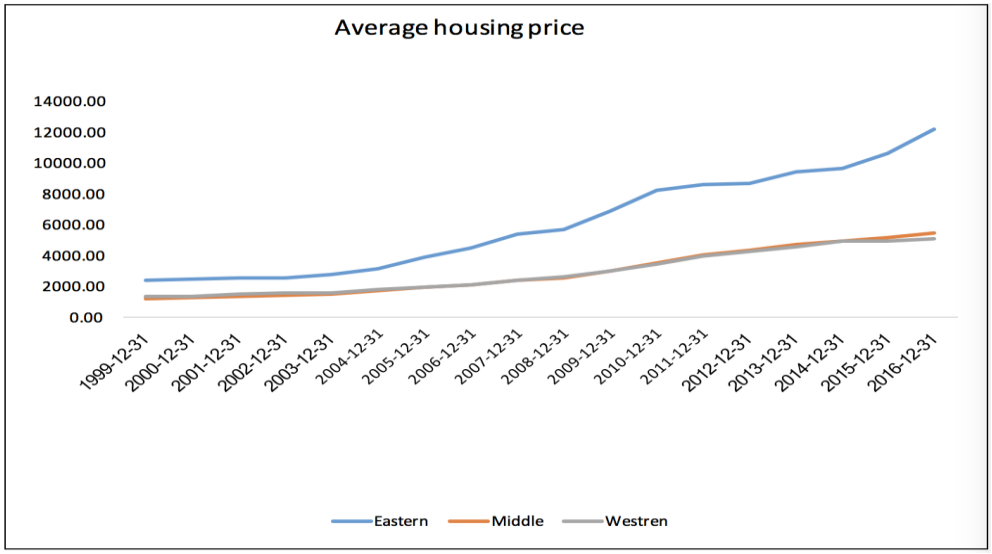
Region	Number of provinces	provinces included	Proportion of provinces by region to total provinces
Eastern	11	Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan.	35.5%
Middle	8	Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei and Hunan.	25.8%
Western	12	Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang.	38.7%
Total	31	—	100%

(Source: Civil Affairs of the People's Republic of China, 2018)

4.1.1 Housing Price

In Figure 1, China's housing prices have been on an upward trend, and for quite a long time, China's housing prices have remained high. From the data, we can also see the changes in China's housing prices in recent years. From the eastern region, the average price of houses in the eastern region increased from about 2404 yuan/square meter in 1999 to about 12142 yuan/square meter in 2016, an increase of 405%. From the central region, the average price of houses in the central region increased from 1188 yuan / square meter in 1999 to about 5451 yuan / square meter in 2016, an increase of 359%. From the perspective of the western region, the average price of houses in the western region increased from 1351 yuan/square meter in 1999 to about 5451 yuan/square meter in 2016, an increase of 274%. With the continuous growth in the average price of housing in the eastern, central and western regions, the difference in the average price of housing has become larger and larger, and there is an increasing gap between house prices in the Eastern region and those in the other two regions.

Figure 1: Average housing price by region



(Source: adapted by author from National Bureau of Statistical, 2018)

In order to better understand the data of housing prices in different regions, and find out whether there are geographical differences in housing prices. Table 2 shows the numerical characteristics of the average selling price of commercial housing in the East, Central and West. It can be seen from Table 2 that the maximum value in the eastern region is almost twice that of the central and western regions, and the maximum value of housing prices in the central and western regions is not much different. The difference in the minimum price of the three regions is not large, but the eastern region is higher than the middle. In the western region; due to the existence of the maximum difference, the eastern region and the central and western regions also showed large differences in the mean and standard deviation. In terms of standard deviation, the western region is the smallest, which means that house prices are relatively stable and fluctuate; the central region is second; the standard deviation in the eastern region is more than twice that in the central and western regions, although the numerical fluctuations are not large, but after comparison, it can be shown that house price fluctuations in the eastern region are greater than those in the central and western regions, and the stability is poor. Analysis of the statistical characteristics of the above data reveals the existence of regional differences in housing prices.

Table 2: Numerical characteristics of housing prices in the three regions

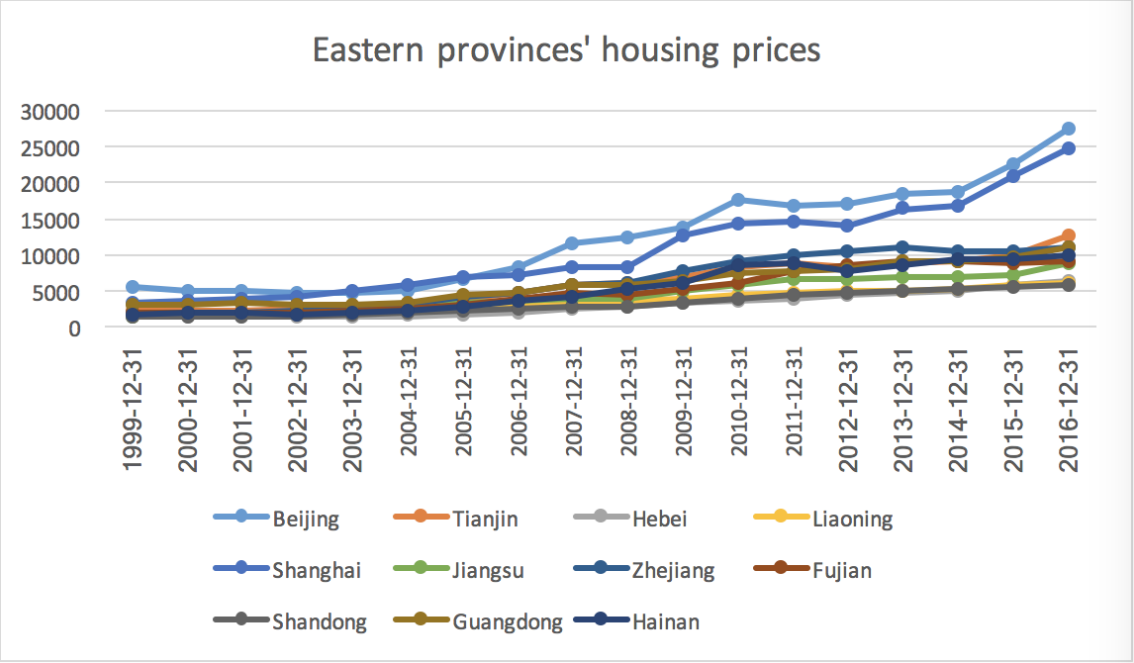
Variable	Obs	Mean	Std. Dev.	Min	Max
Average house price in the eastern region	18	6067.872	3243.536	2404.64	12142.36
Average house price in the eastern region	18	2917.758	1499.604	1188.13	5450.5
Average house price in the eastern region	18	2893.839	1375.995	1327.42	5055.25

(Source: Author's own, 2018)

Figures 2, 3 and 4 below show the trend of housing prices in the eastern, central and western provinces respectively. It is shown that housing prices in the eastern region have been rising since 2004. Figure 2 shows that house prices in Beijing and Shanghai in the trend of housing prices in the eastern region are much higher than those in other provinces and cities. This is one of the typical phenomena in the process of industrialization and urbanization. The housing prices in super-large cities are growing too fast. This phenomenon is related to the concentration of talents, capital and technology in very large cities, and the population growth rate of super-large cities is much higher than that of other cities, which further promotes the rise of housing prices in ultra-large cities, forming a population and the spiral structure in which house prices promote each other.

Housing prices in Beijing and Shanghai are much higher than those in other Eastern provinces, and the average price has exceeded 5,000 yuan per square meter as early as 2002. Price. Since then, housing prices in Beijing and Shanghai have soared, exceeding 10,000 yuan per square meter in 2009 or so, while prices in most other eastern provinces have remained around 10,000 yuan per square meter in 2016. For the eastern region, housing prices in Beijing and Shanghai are much higher than other eastern provinces, which may be one of the reasons for the higher average housing prices in the eastern region than in the central and western regions. In addition, when looking at other eastern provinces, most of their prices are above those in central and western regions. Therefore, this may also be the reason why average housing prices in the eastern region are higher than in the central and western regions.

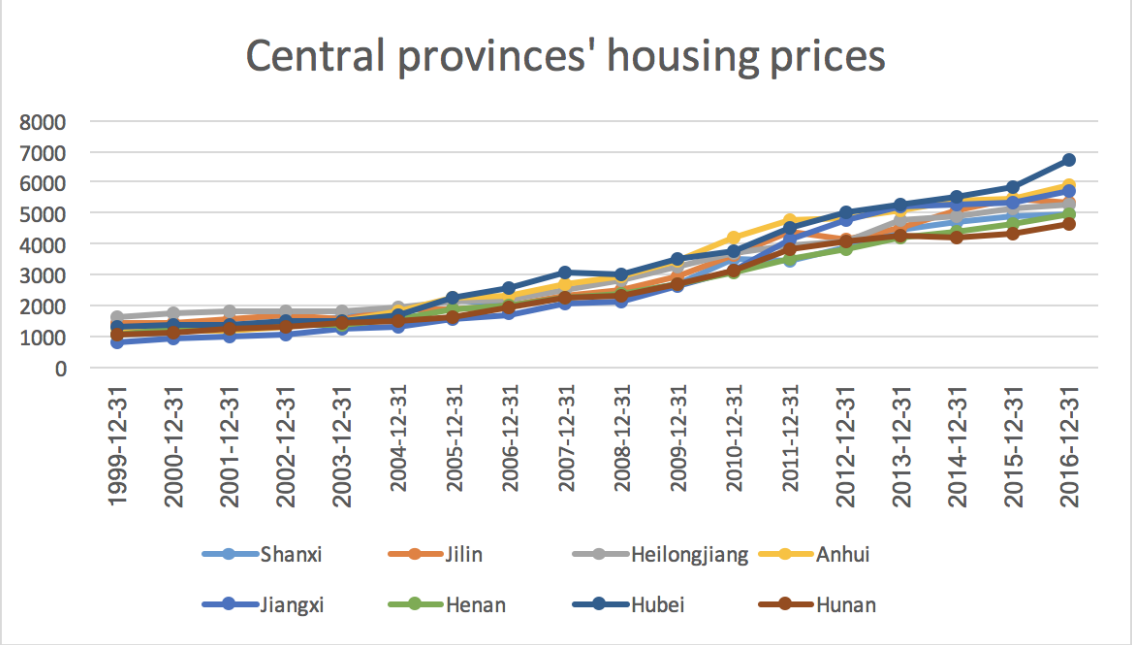
Figure 2: Eastern provinces' housing prices



(Source: adapted by author from National Bureau of Statistical, 2018)

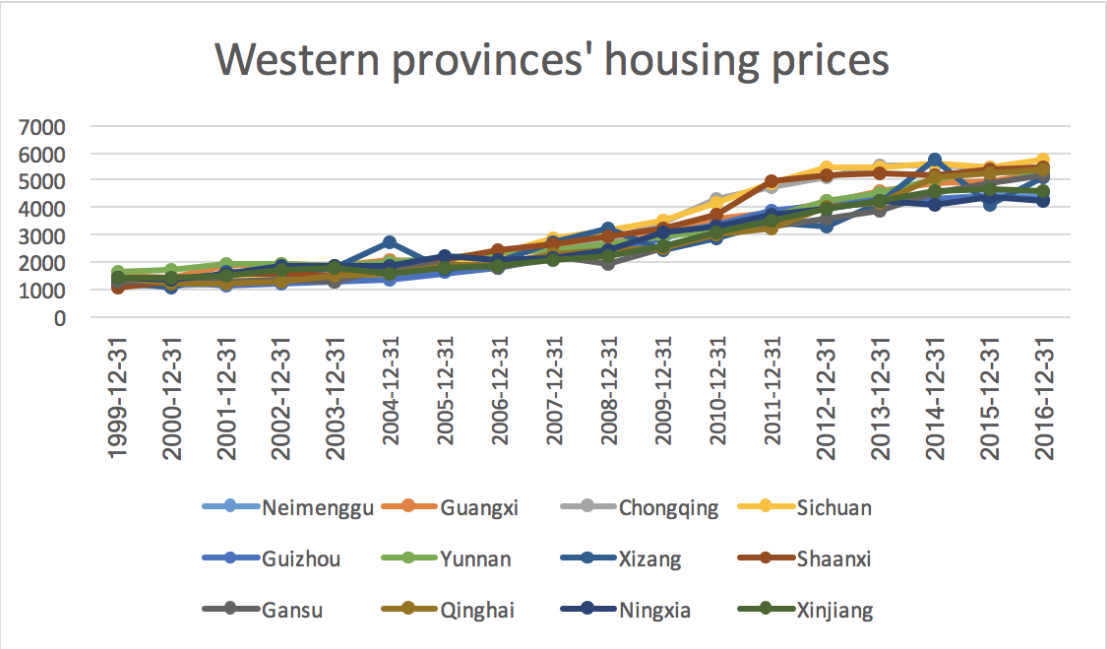
For Figure 3 and 4, overall, there is a lot of consistency in housing prices in the central and western regions. However, after more detailed observation, the growth rate of housing prices in Figure 3 is faster comparing with Figure 4, indicating that the growth rate of housing prices in the central region is greater than that in the western region. This is in contrast to the fact that China's economic development is gradually decreasing from the east to the central and then from the central region to the western region. The situation is related. There is no significant difference in house prices in the central and western regions, which is the biggest difference between them and the eastern region. In contrast, housing prices in the central provinces increased from about 1,000 yuan per square meter in 1999 to about 6,000 yuan per square meter in 2016, and those in the western provinces from about 1,000 yuan per square meter in 1999 to about 5,000 yuan per square meter in 2016.

Figure 3: Central provinces' housing prices



(Source: adapted by author from National Bureau of Statistical, 2018)

Figure 4: Western provinces' housing prices



(Source: adapted by author from National Bureau of Statistical, 2018)

4.2 Discussion of correlations

4.2.1 Scatter plot correlation analysis

Figure 5 to 9 below show the relationship between housing prices in each province and GDP, CPI, income level, population size, and unemployment rate. First, the relationship between house prices and GDP will be analyzed. As can be seen from Figure 5, there is a positive correlation between house prices and GDP in various provinces. In addition, we find that the scatter plots of house prices and GDP in Beijing and Shanghai are the steepest, indicating that the increase in unit GDP has the greatest positive impact on house prices. Second, in Figure 6, it can be found that the unemployment rate in each province has not changed much, so there is no obvious positive and negative relationship in the scatter chart.

In fact, official unemployment rate data in various regions of China have remained at a relatively low level, because employment data for large numbers of migrants has not been counted. Third, after analyzing the data of house prices and CPI, although the CPI has a large change during the sample period, we can see from Figure 7 that there is no obvious positive or negative relationship between house prices and CPI. It is likely that CPI itself is an intermediate variable whose size is affected by many other exogenous macroeconomic variables. Fourth, the relationship between house prices and income levels is showed in Figure 8. Figure 8 tells us that there is a clear positive correlation between house prices and income levels in various provinces and cities, and similar to the relationship between GDP and house prices, and the scatter plots of house prices and income levels in Beijing and Shanghai are particularly steep. Finally, we analyze the relationship between house prices and population in various provinces, as shown in Figure 9. It can be found that apart from Beijing, Guangdong, Hebei, Jiangsu, Shanghai, and Tianjin, there was a significant positive correlation between housing prices and population. The population of other provinces did not change much, resulting in a lack of significant relationship between housing prices and population.

Figure 5: The relationship between house prices and GDP

(Source: adapted by author from National Bureau of Statistical, 2018)

Figure 6: The relationship between house prices and unemployment

Figure 7: The relationship between house prices and CPI

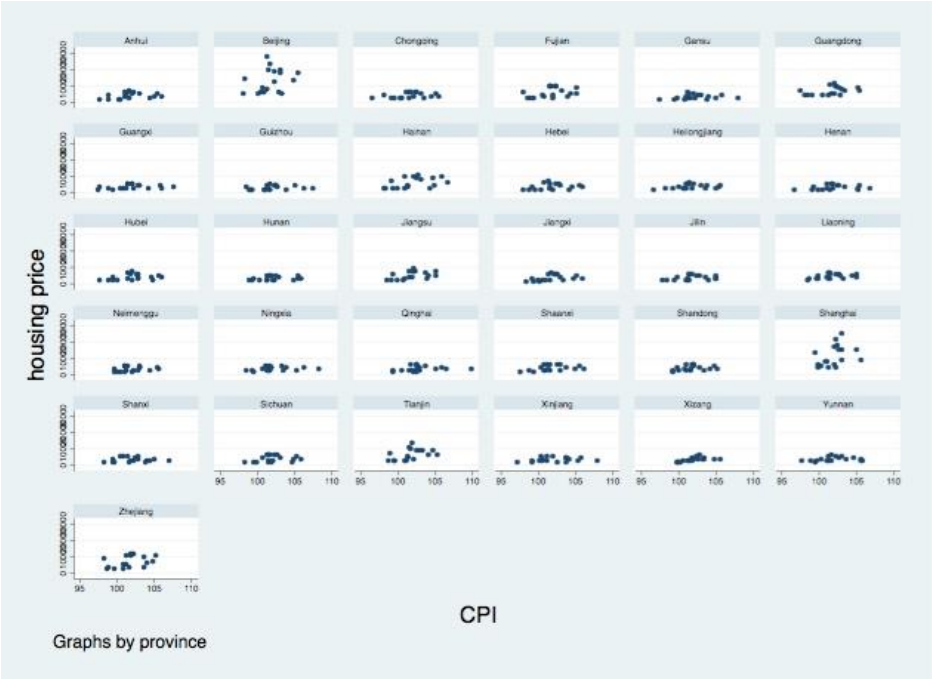


Figure 8: The relationship between house prices and income

Figure 9: The relationship between house prices and population

4.2.2 Correlation coefficient with housing price among provinces

Table 3 shows the correlation between house prices and GDP, CPI, income level, population and unemployment rate in various provinces. Without considering other interference factors, GDP, population and income levels are positively correlated with house prices. There is also a negative correlation, which is that the unemployment rate of half of the provinces and housing prices are basically negatively correlated. These findings are basically consistent with the intuitive judgment.

Table 3: The relationship between house prices and GDP, CPI, income, population and unemployment rate (|k|≈1*)**

Province	Area	Unemployment	GDP	CPI	Income	Population
Anhui	Central	-0.488**	0.984***	0.29	0.958***	-0.455*
Heilongjiang	Central	0.233	0.989***	0.307	0.973***	0.368
Henan	Central	0.104	0.998***	0.259	0.962***	-0.294
Hubei	Central	-0.637***	0.991***	0.293	0.975***	0.589**
Hunan	Central	0.398	0.988***	0.174	0.94***	0.499**
Jiangxi	Central	-0.099	0.994***	0.337	0.948***	0.951***
Jilin	Central	-0.333	0.991***	0.335	0.975***	0.811***
Shanxi	Central	0.633***	0.978***	0.06	0.961***	0.985***
Beijing	Eastern	0.068	0.978***	0.262	0.964***	0.956***
Fujian	Eastern	0.081	0.977***	0.309	0.952***	0.948***
Guangdong	Eastern	-0.657***	0.994***	0.402*	0.97***	0.917***
Hainan	Eastern	-0.771***	0.952***	0.457*	0.935***	0.951***
Hebei	Eastern	0.243	0.984***	0.198	0.972***	0.96***
Jiangsu	Eastern	-0.643***	0.986***	0.415*	0.978***	0.959***
Liaoning	Eastern	-0.534**	0.963***	0.402*	0.98***	0.962***
Shandong	Eastern	-0.063	0.997***	0.303	0.972***	0.99***
Shanghai	Eastern	-0.176	0.954***	0.383	0.981***	0.912***
Tianjin	Eastern	0.015	0.967***	0.457*	0.985***	0.974***
Zhejiang	Eastern	-0.829***	0.974***	0.375	0.943***	0.974***
Chongqing	Western	-0.607***	0.965***	0.34	0.98***	0.577**
Gansu	Western	-0.717***	0.984***	0.154	0.955***	0.97***
Guangxi	Western	-0.585**	0.995***	0.223	0.951***	-0.113
Guizhou	Western	-0.928***	0.944***	0.235	0.898***	-0.888***
Neimenggu	Western	-0.283	0.997***	0.242	0.956***	0.992***
Ningxia	Western	-0.834***	0.982***	0.216	0.938***	0.963***
Qinghai	Western	-0.19	0.991***	0.173	0.968***	0.946***
Shaanxi	Western	0.057	0.983***	0.385	0.936***	0.957***
Sichuan	Western	-0.294	0.982***	0.249	0.932***	-0.334
Xinjiang	Western	-0.819***	0.994***	0.225	0.937***	0.935***
Xizang	Western	-0.739***	0.927***	0.608***	0.836***	0.916***
Yunnan	Western	0.231	0.997***	0.226	0.94***	0.924***

(Source: adapted by author from National Bureau of Statistical, 2018)

4.2.3 Correlation coefficient with housing price among three regions

Next, the correlation coefficient between each variable will be shown in this part (Table 4). It can be found that house prices are negatively correlated with unemployment rate (significant), population (not significant), and house prices are positively correlated with GDP, CPI and income levels.

Table 4: Correlation coefficient among variables

	Housing price	Unemployment	GDP	CPI	Income	Population
Housing price	**1**					
Unemployment	**-0.369*** **	**1**				
GDP	**0.448*** **	**-0.216*** **	**1**			
CPI	**0.159*** **	**0.070***	**0.124*** **	**1**		
Income	**0.868*** **	**-0.271*** **	**0.634*** **	**0.206*** **	**1**	
Population	**-0.0600**	**-0.0380**	**0.624*** **	**-0.0190**	**0.0590**	**1**

(Source: adapted by author from National Bureau of Statistical, 2018)

In addition, we also studied the correlation coefficient between variables and house prices in the eastern, central and western regions, which is shown in Table 5. It can be found that

the variables in each region have the same positive or negative relationship with housing prices, except for the population. The population in the eastern region (significant) and the western region is positively correlated with house prices, while the central region is negatively correlated. Moreover, the income, GDP, CPI of the three regions are significantly positively correlated with house prices. However, the unemployment and house prices in the three regions are negatively correlated and only significant in the Eastern and Western regions.

Table 5: Correlation coefficient with housing price among three area

	Eastern	Central	Western
Housing price	1	1	1
Unemployment	-0.361***	-0.0320	-0.285***
GDP	0.245***	0.792***	0.729***
CPI	0.248***	0.250***	0.243***
Income	0.889***	0.934***	0.917***
Population	-0.253***	-0.0250	0.121*

(Source: adapted by author from National Bureau of Statistical, 2018)

4.3 Regression Analysis

4.3.1 OLS vs Fixed effect for 31 provinces

First, this paper establishes a simple multiple regression model which is a basic method to empirically analyze panel data. Additionally, it can be used to compare with fixed or random effects model. The equation is as follows:

$$y_{it} = a_{it} + x1_{it} + x2_{it} + x3_{it} + x4_{it} + x5_{it} + \varepsilon_{it}$$

Among them, a_{it} is the intercept term, y_{it} represents the average selling price of commodity housing; x1-x5 is the explanatory variable, corresponding to: unemployment rate, GDP, CPI, income level, population. The time variable t takes values from 1 to 18, and the cross-sectional variable *i* represents a different province and city, with values ranging from 1 to 31. All variables are provincial panel data for 1999-2016.

In order to carry out a more accurate analysis of the factors affecting housing prices, this paper firstly uses the housing prices of various provinces and cities as the explanatory variables, and uses the housing price, GDP, population, unemployment rate, CPI and income as the explanatory variables to perform panel regression.

First, the whole sample is analyzed. Table 6 compares the results of OLS regression and fixed effect estimation and random effect estimation. The unemployment rate and GDP have significant negative effects on house prices under the three regression results. The income level is in three kinds of regression, as a result, there is a significant positive impact on house prices. Under the premise of controlling the other four variables, the impact of

CPI on house prices is not significant. For the OLS regression, the relationship between unemployment and housing prices is the same as Miller's and Peng's previous research (2006). In addition, the result of CPI disagrees with Liya's (2008) existing research.

In selecting the panel regression model, in order to compare the fixed effect estimation with the random effect estimation, the Hausman test is carried out in this paper. The test results are shown in Figure 10. Since the figure shows Prob＞chi2 = 0.0000, it means that the Hausman test rejects the null hypothesis, indicating that fixed effect estimation should be used rather than random effect model. The results of the fixed effect estimation are also shown in Table 6 below. According to the results of the Hausman test, each region was analyzed using a fixed effect model later.

From the results of the overall fixed effect estimation (Table 6), the unemployment rate and inflation CPI have no significant impact on housing prices, and these results disagree to existing literature of Liya (2008), Miller and Peng (2006). GDP is significantly negatively correlated with house prices, and income and population are significantly positively correlated with house prices. For the result of population, it agrees with the previous literature for Downs (1993).

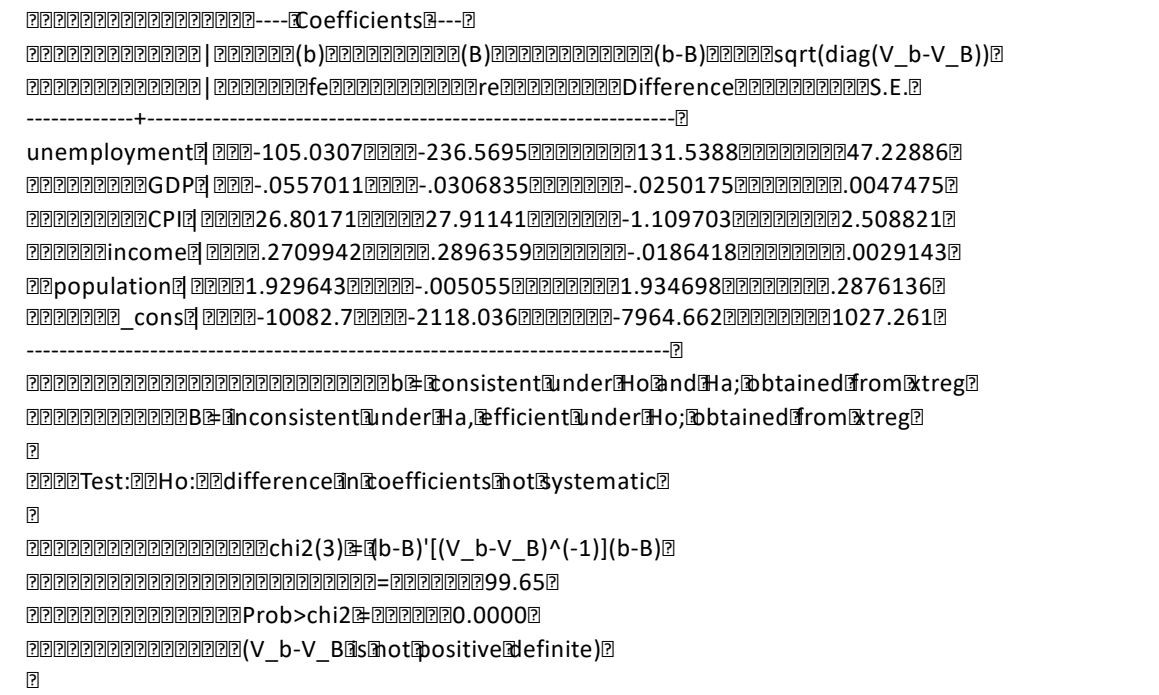
Table 6: OLS Vs Fixed Effect Vs Random Effect

	OLS	**FE**	**RE**
VARIABLES	Housing price	Housing price	Housing price

	-670.1***	-106.0	-236.4**
Unemployment	(142.8)	(96.70)	(97.78)
	-0.0422***	-0.0557***	-0.0307***
GDP	(0.0153)	(0.00905)	(0.00898)
	-4.868	26.07	27.32
CPI	(25.96)	(21.73)	(24.27)
	0.330***	0.271***	0.290***
Income	(0.0251)	(0.00899)	(0.00966)
	-0.0221	1.930***	-0.00428
Population	(0.0329)	(0.261)	(0.0544)
	2,350	-10,019***	-2,063
Constant	(2,424)	(2,362)	(2,444)
Observations	556	556	556
R-squared	0.793	0.825	-
Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1			

(Source: adapted by author from National Bureau of Statistical, 2018)

Figure 10: Hausman Test



(Source: adapted by author from National Bureau of Statistical, 2018)

4.3.2 Differences in housing prices in the eastern, central and western regions

In this part, by comparing three regions' results of OLS and fixed effects model, the difference in housing price changes in the eastern, central and western regions of China can be found. First, we divided the sample into three subsamples of the eastern region, the central region, and the western region, and then compared the regression results of the three, as shown in Table 7. From the regression results, the unemployment rate has a significant negative impact on housing prices in the three regions, but the negative impact on housing prices in the eastern and western regions is particularly significant. It is likely

that the unemployment rate in the central and western regions is the indicator of China's macroeconomic situation, once the economy is in recession, the employment rate in the eastern and western regions has dropped significantly, and people's income levels have dropped significantly, leading to a sharp drop in house prices. In the eastern region, there are relatively few outsiders, and their housing prices are less affected by economic fluctuations. Therefore, in the process of regulating housing prices, relevant government departments in China should pay attention to the differential treatment of housing prices in the central and eastern regions. Overall, housing prices in the eastern and western regions are more affected by the market and their volatility is more severe.

Table 7: OLS in the eastern, central and western regions

	Eastern area	**Central area**	**Western area**
VARIABLES	**housingprice**	**housingprice**	**housingprice**
unemployment	**-867.9*** **	**-13.28**	**-209.3*** **
	(173.9)	**(77.98)**	**(61.04)**
gdp	**-0.0940*** **	**0.0542*** **	**0.0656*** **
	(0.0148)	**(0.0156)**	**(0.0162)**
cpi	**66.06**	**14.23**	**43.11*** **
	(46.74)	**(18.30)**	**(13.84)**

income	**0.413*** **	**0.141*** **	**0.133*** **
	(0.0213)	**(0.0140)**	**(0.0112)**
population	**0.0215**	**-0.148*** **	**-0.0433* **
	(0.0438)	**(0.0275)**	**(0.0224)**
Constant	**-4,277**	**-189.4**	**-2,761** **
	(4,594)	**(1,696)**	**(1,284)**
Observations	**198**	**144**	**214**
R-squared	**0.897**	**0.894**	**0.874**
Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1			

(Source: adapted by author from National Bureau of Statistical, 2018)

Secondly, the difference in the impact of GDP on housing prices in the three major regions should be explored. GDP in the eastern region has a negative impact on house prices, while GDP in the central and western regions has a positive impact on house prices. It is possible that this is first and foremost a policy-oriented conclusion that output growth does not necessarily lead to an increase in house prices, especially in the eastern region, where the increase in output leads to a decline in house prices, followed by the fixed effect of Table 8.

The estimate further confirms the result. This result shows that there is a bubble in housing prices in the eastern region. When the real economy is in good condition, investors' enthusiasm for investing in real estate declines, causing house prices to fall. On the contrary, when the real economy is in poor condition, investors invest. In the real economy, the return on investment will fall, and funds will flow from the real economy into the residential market, thus pushing up house prices.

Table 8: Fixed Effect Estimate in the eastern, middle and western regions

	Eastern area	**Central area**	**Western area**
VARIABLES	**housingprice**	**housingprice**	**housingprice**
unemployment	**-73.81**	**-190.5***	**-314.7*****
	(183.4)	**(97.86)**	**(64.29)**
gdp	**-0.110*****	**0.0487*****	**0.0929*****
	(0.0134)	**(0.0120)**	**(0.0113)**
cpi	**35.92**	**31.36***	**45.48*****
	(47.55)	**(17.66)**	**(13.93)**
income	**0.380*****	**0.142*****	**0.117*****

	(0.0144)	**(0.0132)**	**(0.00847)**
population	**1.745*** **	**0.467**	**-0.0497**
	(0.421)	**(0.388)**	**(0.334)**
Constant	**-11,153****	**-4,488**	**-2,530**
	(4,802)	**(2,729)**	**(1,696)**
Observations	**198**	**144**	**214**
R-squared	**0.892**	**0.924**	**0.903**
Number of province	**11**	**8**	**12**
Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1			

(Source: adapted by author from National Bureau of Statistical, 2018)

Third, we found that CPI has a positive impact on housing prices in the three major regions, but only the positive impact of CPI on housing prices in the western region is significant at the 1% confidence level, that is, housing prices in the western region are affected by regional inflation levels. More significant. In general, the direct impact of rising CPI on housing prices has four points:

i) The rising inflation has led to an increase in the cost of housing construction, which has

led to a rise in housing prices;

ii) The rise in inflation levels led to an increase in wage levels, and rising housing construction costs, leading to rising house prices;

iii) An increase in inflation levels will drive up housing rents, leading to rising house prices;

iv) The rise in inflation levels will lead to a fall in real interest rates. According to the principle that asset prices are negatively correlated with real interest rates, the fall in real interest rates means that house prices are rising.

In addition, the rise in CPI will indirectly lead to rising house prices through the credit crunch. In China's economic development over the past 20 years, investing in real estate is a very effective way to resist inflation and carry out asset preservation. The regression results in Tables 7 and 8 all show that there is a significant positive correlation between China's housing prices and inflation income levels. This is because although inflation has brought many uncertainties to the residential market, in China, real estate can largely hedge the risk of inflation, especially during periods of high inflation. And only if there is a higher inflation expectation, the funds will gather to real estate assets such as real estate, which further pushes up housing prices.

In general, the reasonable range of housing prices is 3 to 6 times the per capita income.

Fourth, we find that the income level has a significant positive impact on the housing prices of the three major regions. The increase in the unit income level leads to the increase in housing prices in the eastern region, that is, the increase in housing prices caused by the

increase in the income level of one unit in the eastern region. The magnitude is about three times that of the central and western regions. This aspect shows that housing prices in the eastern region are more affected by income levels. On the other hand, housing prices in the eastern region are more affected by market macro factors. Therefore, the price fluctuations in the eastern region are significantly higher than those in the middle and western regions.

Fifth, the population is an important factor in determining the long-term trend of housing prices. This is because cities with population inflows will have rigid demand for housing. At this time, housing prices will be supported and the market will be able to support them. If population growth slows down and even the population declines, the housing demand for housing will continue to decrease, and housing prices will lack strong support for growth. From Table 4, the overall correlation between house prices and population is not strong, but if we study the relationship between house prices and population in the eastern, central and western regions, it can be found that there is a significant negative correlation between house prices and population in the eastern region, while the population of the west is positively correlated with housing prices (Table 5). This shows that the effect of population on housing prices is related to other economic characteristics and cannot be generalized.

As can be seen from above, the regression results in the eastern region are roughly the same as the overall regression results, only the coefficient size is slightly different. Among them, GDP, income and population have a significant impact on housing prices. For every unit increase in GDP, the unit price will be reduced by 0.11 units. If the income increases by 1 unit, the unit price will increase by 0.38 units. If the population increases by 1 unit, it will lead to the unit house price increased by 1.745 units.

The results in Table 8 show that the GDP and income levels in the middle region have a significant impact on housing prices. For every 1-unit increase in GDP, the unit price will increase by 0.0487 units. If the income increases by 1 unit, the unit price will increase by 0.142 units.

The third column in Table 8 shows that the unemployment rate in the western region is significantly negatively correlated with house prices. GDP, CPI and income are significantly positively correlated with house prices, while the population in the western region has no significant impact on house prices.

4.3.3 Dynamic panel estimation

The fixed effect estimation does not take into account the effect of the lag term of the interpreted variable on the interpreted variable, so dynamic panel estimation can solve this problem. According to the results of the dynamic panel estimation, the first-order lag item of the house price has a significant impact on the house price. As for Table 9, in the eastern region, the house price in the previous period increases by 1 unit. When other conditions remain unchanged, the house price in the current period increases by 0.956 units; in the central region, In the previous period, the house price increased by 1 unit. When other conditions were unchanged, the current house price increased by 0.951 units; in the western region, the previous period house price increased by 1 unit. When other conditions remain unchanged, the current house price increased by 0.768 units. These regression results not only reveal the inertia of housing price changes, but also provide the policy implications of the trend of housing price growth, that is, the housing prices in the regions with higher base prices are growing faster, which is also the result of increasing housing

price gaps in eastern and central-western China.

Furthermore, we compare the results of dynamic panel regression with the results of fixed effect estimation. It is found that the positive and negative effects of explanatory variables on housing prices remain basically the same, indicating that the results obtained by using fixed effects estimation are robust. However, after adding the first-order lag term of the interpreted variable, we find that the absolute value of the estimated coefficient of the explanatory variable of the other explanatory variable has dropped significantly. The reason for this is very complicated. This explains the explanatory variable. There is a correlation between the first-order lag term and the explanatory variable.

Table 9: Correlation coefficient with housing price among three area after dynamic panel estimation

	all sample	**Eastern**	**Central**	**Western**
VARIABLES	**housingprice**	**housingprice**	**housingprice**	**housingprice**
housingprice	**1.100*** **	**0.956*** **	**0.951*** **	**0.768*** **
	(0.0217)	**(0.0443)**	**(0.0422)**	**(0.0541)**
unemployment	**418.7*** **	**401.5*** **	**55.83**	**-87.77**
	(69.00)	**(110.1)**	**(50.86)**	**(66.96)**

gdp	**-0.0145****	**-0.0182****	**0.0196*****	**0.0325*****
	(0.00631)	**(0.00822)**	**(0.00629)**	**(0.0110)**
cpi	**9.704**	**-10.54**	**19.72*****	**34.48*****
	(10.36)	**(25.53)**	**(6.954)**	**(8.992)**
income	**0.0160****	**0.0718*****	**-0.000121**	**0.0266*****
	(0.00789)	**(0.0177)**	**(0.00743)**	**(0.00770)**
population	**0.0581**	**-0.149****	**-0.0731***	**-0.0224**
	(0.0529)	**(0.0721)**	**(0.0441)**	**(0.0462)**
Constant	**-2,858*****	**165.3**	**-1,672****	**-2,839*****
	(1,095)	**(2,691)**	**(700.6)**	**(912.2)**
Observations	**525**	**187**	**136**	**202**
Number of province	**31**	**11**	**8**	**12**
Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1				

(Source: adapted by author from National Bureau of Statistical, 2018)

Chapter 5 Conclusion

5.1 Summary of key findings

First, the main effective variables affecting the national housing price level are: GDP, income level and population quantity. Based on the analysis of the development status of China's residential market and the regional characteristics of residential market price evolution, it is found that China's residential market has achieved rapid development in terms of investment and demand, but residential prices show obvious regional differences. Real estate prices in the eastern region are significantly higher than those in the central and western regions. In particular, real estate prices in Beijing and Shanghai are significantly higher than in other provinces in the country. There are also regional differences in real estate prices in the eastern, central and western regions.

Second, in order to deeply analyze the root causes of regional differences in real estate prices, the factors affecting the regional differences in real estate prices in China are carefully identified. The results of empirical tests show that income levels, population size, unemployment rate, and inflation rate are the main reasons for the regional differences in real estate prices in China. Therefore, the relevant departments can consider these four aspects when formulating regional real estate price control policies. The income level is for house prices. China’s population growth over the past 30 years is an important reason for its rapid rise in housing prices. With the decline in China’s birth rate and the aging of the population in recent years, China has no dividend for population growth, and housing prices will also increase in the future. And the market will be in an embarrassing situation, blindly pushing up housing prices, and even some cities through the purchase restrictions and other measures for the property market to prevent the decline, although in violation of

the law of economic development, but to a certain extent has been stable. The property market has played a certain role.

Third, China has a vast territory, and there are huge differences in the natural conditions and economic development of various regions. In addition, the housing prices in China have obvious regional differences. According to the geographical location and the degree of economic development, the residential market in China is divided into the eastern, central and western regions. The statistical characteristics show that the regional characteristics of real estate prices are obvious. The residential market development level and the low level of economic development are affected by the income level. The higher the level of real estate development, the greater the degree of economic fluctuations, and the lower the level of real estate development, the opposite. It may mainly due to the single financing channel in the region. Therefore, local governments at all levels and relevant departments may consider carefully formulating policies for the regulation of the residential market in accordance with the principle of adapting to local conditions.

The main findings of this paper are as follows:

Firstly, factors affecting housing prices have unobserved or omitted fixed effects at the provincial level, so the panel data with provinces as cross-section should be estimated by fixed effects rather than random effects.

Secondly, housing prices in the eastern region are growing much faster than those in the central and Western regions, mainly because the GDP and income levels in the eastern region are much higher than those in the central and Western regions.

Third, factors affecting housing prices in different regions are not always complete, but GDP and income levels have a significant impact on housing prices in all regions.

5.2 Discussion and recommendation

After the above analysis of the factors affecting housing prices in China, it can be known that the factors affecting housing prices exist in regional differences. Therefore, under the condition that the cost of policy-making permits, the government should implement different policies according to local conditions in different regions to effectively control housing prices in different regions.

As far as the whole country and the eastern region are concerned, the rise of GDP and income is the main reason for the rise of housing prices. Therefore, restraining the overheated economy is an effective method to control the overall housing prices in the eastern region and the whole country.

GDP and income are also effective factors affecting house prices in the central and western regions. In order to keep house prices at a reasonable level in the central and western regions, the local economic development level must maintain a relatively stable growth rate. In addition, CPI is also an important factor affecting house prices in the central and western regions, which shows that local house prices are greatly affected by short-term price fluctuations. In order to stabilize house prices, the government should closely monitor the local price level, to prevent sharp price fluctuations, causing losses to the local economy.

5.3 Limitations & Future research

According to the regression results of this paper, the main effective variables affecting the national housing price level are: GDP, income level and population quantity. However, the accuracy of the regression results obtained in this paper remains to be discussed because the independent variables considered in this paper are few and most of them are holistic factors. In addition, in practice, some micro-factors, such as the area of urban green space, real estate developers operating profits, infant birth rate, the average level of education in the province, etc. also have an impact on housing prices. If these micro-variables are added to the model, it may have an impact on the results of the model. However, this paper can still find that the development of macro-economy and the rise of income stimulate consumption demand to a certain extent, thus promoting the rise of the overall house price in China.

In order to further test the robustness of the model, it is possible to add the square and cross terms of independent variables into the model. In addition, in order to minimize the endogenous problems caused by missing variables, this paper can also add some other factors that may affect housing prices.

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Appendix

A. Data collected

Table 1: Housing price in eastern area

housing price	Beijing	Tianjin	Hebei	Liaoning	Shanghai	Jiangsu	Zhejiang	Fujian	Shandong	Guangdong	Hainan
1999-12-31	5647.0	2251.0	1352.0	1919.0	3422.0	1584.0	1908.0	2064.0	1344.0	3161.0	1799.0
2000-12-31	4919.0	2328.0	1448.0	2076.0	3565.0	1643.0	1947.0	2084.0	1427.0	3228.0	1980.0
2001-12-31	5062.0	2375.0	1463.0	2126.0	3866.0	1801.0	2050.0	2015.0	1457.0	3305.0	1910.0
2002-12-31	4764.0	2487.0	1503.0	2139.0	4134.0	1925.0	2387.0	2152.0	1605.0	3241.0	1789.0
2003-12-31	4737.0	2518.0	1463.0	2291.0	5118.0	2197.0	2737.0	2297.0	1698.0	3195.0	2105.0
2004-12-31	5052.9	3114.6	1605.4	2412.0	5855.0	2651.4	3108.2	2559.7	2045.3	3482.0	2404.9
2005-12-31	6788.1	4054.7	1862.0	2797.6	6842.0	3358.8	4280.0	3161.7	2425.2	4442.8	2924.5
2006-12-31	8279.5	4773.5	2111.4	3073.4	7196.0	3592.2	4774.4	3994.0	2540.5	4852.7	3787.5
2007-12-31	11553.3	5811.1	2585.8	3490.2	8361.0	4024.4	5786.0	4684.3	2904.1	5914.3	4161.6
2008-12-31	12418.0	6015.0	2779.0	3758.0	8195.0	4049.0	6262.0	4384.0	2970.0	5953.0	5443.0
2009-12-31	13799.0	6886.0	3263.0	4034.0	12840.0	4983.0	7826.0	5427.0	3505.0	6513.0	6261.0
2010-12-31	17782.0	8230.0	3539.0	4505.0	14464.0	5841.0	9258.0	6256.0	3944.0	7486.0	8735.0
2011-12-31	16852.0	8744.8	3982.8	4732.7	14603.2	6554.4	9838.1	7764.3	4447.7	7879.2	8943.5
2012-12-31	17021.6	8217.7	4478.0	4942.0	14061.4	6726.8	10642.6	8646.1	4763.0	8112.2	7893.8
2013-12-31	18553.0	8746.0	4897.0	5122.0	16420.0	6909.0	11042.0	9050.0	5049.0	9090.0	8669.0
2014-12-31	18833.0	9219.0	5131.0	5373.0	16787.0	7006.0	10526.0	9136.0	5315.0	9083.0	9315.0
2015-12-31	22633.0	10107.0	5759.0	5758.0	20949.0	7356.0	10525.0	8881.0	5560.0	9796.0	9339.0
2016-12-31	27497.0	12830.0	6438.0	6080.0	24747.0	8805.0	11121.0	9218.0	5855.0	11097.0	9878.0

Table 2: Housing price in central area

housing price	Shanxi	Jilin	Heilongjiang	Anhui	Jiangxi	Henan	Hubei	Hunan
1999-12-31	1027.0	1436.0	1609.0	1232.0	820.0	1022.0	1296.0	1063.0
2000-12-31	1118.0	1408.0	1739.0	1173.0	949.0	1260.0	1368.0	1079.0
2001-12-31	1349.0	1552.0	1784.0	1163.0	972.0	1236.0	1363.0	1248.0
2002-12-31	1435.0	1665.0	1803.0	1290.0	1062.0	1380.0	1456.0	1326.0
2003-12-31	1611.0	1574.0	1799.0	1513.0	1210.0	1388.0	1506.0	1413.0
2004-12-31	1803.2	1880.0	1939.0	1782.1	1325.0	1572.9	1671.7	1510.5
2005-12-31	2209.9	1888.2	2099.1	2220.2	1528.7	1867.0	2263.3	1624.8
2006-12-31	1988.2	2009.6	2195.6	2321.9	1708.0	2011.8	2555.7	1928.4
2007-12-31	2249.6	2302.5	2471.3	2664.4	2071.9	2253.4	3053.1	2233.2
2008-12-31	2355.0	2507.0	2832.0	2949.0	2136.0	2339.0	3001.0	2302.0
2009-12-31	2707.0	2917.0	3241.0	3420.0	2643.0	2666.0	3532.0	2680.0
2010-12-31	3487.0	3647.0	3719.0	4205.0	3144.0	3042.0	3743.0	3146.0
2011-12-31	3432.7	4363.9	3966.4	4776.1	4147.7	3500.8	4486.4	3790.3
2012-12-31	3871.4	4146.7	4067.2	4825.0	4744.7	3831.2	5042.8	4048.6
2013-12-31	4433.0	4483.0	4738.0	5080.0	5203.0	4205.0	5266.0	4243.0
2014-12-31	4734.0	5112.0	4882.0	5394.0	5288.0	4366.0	5513.0	4227.0
2015-12-31	4870.0	5476.0	5144.0	5457.0	5358.0	4611.0	5863.0	4304.0
2016-12-31	4984.0	5364.0	5295.0	5924.0	5709.0	4964.0	6724.0	4640.0

Table 3: Housing price in western area

housing price	Neimenggu	Guangxi	Chongqing	Sichuan	Guizhou	Yunnan	Xizang	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang
1999-12-31	1147.0	1517.0	1377.0	1350.0	1283.0	1651.0	1313.0	1042.0	1274.0	1462.0	1404.0	1394.0
2000-12-31	1136.0	1450.0	1351.0	1340.0	1269.0	1739.0	1075.0	1253.0	1302.0	1238.0	1352.0	1424.0
2001-12-31	1235.0	1836.0	1443.0	1368.0	1164.0	1940.0	1674.0	1570.0	1259.0	1208.0	1596.0	1533.0
2002-12-31	1256.0	1926.0	1556.0	1381.0	1238.0	1913.0	1569.0	1554.0	1326.0	1292.0	1865.0	1735.0
2003-12-31	1270.0	1883.0	1596.0	1421.0	1313.0	1882.0	1753.0	1534.0	1275.0	1465.0	1868.0	1817.0
2004-12-31	1400.6	2082.6	1766.2	1572.2	1385.0	1977.5	2747.6	1731.0	1753.7	1582.9	1880.4	1585.2
2005-12-31	1653.2	2013.6	2135.0	1945.5	1606.6	2165.0	1700.1	2059.6	1936.2	1832.2	2235.4	1797.7
2006-12-31	1811.4	2195.4	2269.2	2270.9	1779.8	2380.2	1976.5	2461.3	1779.8	1920.6	2063.1	1858.1
2007-12-31	2246.5	2538.6	2722.6	2840.5	2136.7	2455.0	2704.1	2622.0	2190.5	2311.0	2136.2	2081.1
2008-12-31	2483.0	2826.0	2785.0	3157.0	2339.0	2680.0	3202.0	2952.0	1958.0	2460.0	2435.0	2240.0
2009-12-31	2972.0	3260.0	3442.0	3509.0	2874.0	2931.0	2452.0	3223.0	2483.0	2517.0	3090.0	2604.0
2010-12-31	3521.0	3562.0	4281.0	4138.0	3357.0	3158.0	2896.0	3759.0	3042.0	3005.0	3304.0	3087.0
2011-12-31	3782.9	3772.5	4733.8	4917.9	3888.8	3635.4	3474.5	4949.2	3318.2	3248.1	3732.2	3548.8
2012-12-31	4053.1	4203.4	5079.9	5448.8	4115.7	4209.2	3268.6	5155.9	3570.2	4048.5	3947.9	3918.4
2013-12-31	4301.0	4593.0	5569.0	5498.0	4295.0	4494.0	4174.0	5280.0	3886.0	4163.0	4232.0	4268.0
2014-12-31	4333.0	4854.0	5519.0	5597.0	4312.0	4998.0	5774.0	5166.0	4544.0	5081.0	4117.0	4628.0
2015-12-31	4441.0	4960.0	5486.0	5475.0	4415.0	5300.0	4111.0	5362.0	4913.0	5242.0	4413.0	4653.0
2016-12-31	4546.0	5237.0	5485.0	5762.0	4307.0	5269.0	5112.0	5471.0	5201.0	5400.0	4241.0	4632.0

Table 4: Unemployment in eastern area

unemployment	Beijing	Tianjin	Hebei	Liaoning	Shanghai	Jiangsu	Zhejiang	Fujian	Shandong	Guangdong	Hainan
1999-12-31	0.6	2.9	2.5	3.5	3.1	2.9	3.4	2.3	3.2	2.5	3.2
2000-12-31	0.8	3.2	2.8	3.7	3.5	3.4	3.4	2.6	3.2	2.5	3.3
2001-12-31	1.2	3.6	3.2	3.2	4.3	3.6	3.7	3.8	3.3	2.9	3.4
2002-12-31	1.4	3.9	3.6	6.5	4.8	4.2	4.2	4.2	3.6	3.1	3.1
2003-12-31	1.4	3.8	3.9	6.5	4.9	4.1	4.2	4.1	3.6	2.9	3.4
2004-12-31	1.3	3.8	4.0	6.5	4.5	3.8	4.1	4.0	3.4	2.7	3.4
2005-12-31	2.1	3.7	3.9	5.6	4.4	3.6	3.7	4.0	3.3	2.6	3.6
2006-12-31	2.0	3.6	3.8	5.1	4.4	3.4	3.5	3.9	3.3	2.6	3.6
2007-12-31	1.8	3.6	3.8	4.3	4.2	3.2	3.3	3.9	3.2	2.5	3.5
2008-12-31	1.8	3.6	4.0	3.9	4.2	3.3	3.5	3.9	3.7	2.6	3.7
2009-12-31	1.4	3.6	3.9	3.9	4.3	3.2	3.3	3.9	3.4	2.6	3.5
2010-12-31	1.4	3.6	3.9	3.6	4.4	3.2	3.2	3.8	3.4	2.5	3.0
2011-12-31	1.4	3.6	3.8	3.7	3.5	3.2	3.1	3.7	3.4	2.5	1.7
2012-12-31	1.3	3.6	3.7	3.6	3.1	3.1	3.0	3.6	3.3	2.5	2.0
2013-12-31	1.2	3.6	3.7	3.4	4.0	3.0	3.0	3.6	3.2	2.4	2.2
2014-12-31	1.3	3.5	3.6	3.4	4.1	3.0	3.0	3.5	3.3	2.4	2.3
2015-12-31	1.4	3.5	3.6	3.4	4.0	3.0	2.9	3.7	3.4	2.5	2.3
2016-12-31	1.4	3.5	3.7	3.8	4.1	3.0	2.9	3.9	3.5	2.5	2.4

Table 5: Unemployment in central area

unemployment	Shanxi	Jilin	Heilongjiang	Anhui	Jiangxi	Henan	Hubei	Hunan
1999-12-31	2.1	3.3	2.5	3.2	2.6	2.6	3.3	3.9
2000-12-31	2.2	3.7	3.3	3.3	2.9	2.6	3.5	3.7
2001-12-31	2.6	3.1	4.7	3.7	3.3	2.8	4.0	4.0
2002-12-31	3.4	3.6	4.9	4.0	3.4	2.9	4.3	4.0
2003-12-31	3.0	4.3	4.2	4.1	3.6	3.1	4.3	3.8
2004-12-31	3.1	4.2	4.5	4.2	3.6	3.4	4.2	4.4
2005-12-31	3.0	4.2	4.4	4.4	3.5	3.5	4.3	4.3
2006-12-31	3.2	4.2	4.4	4.3	3.6	3.5	4.2	4.3
2007-12-31	3.2	3.9	4.3	4.1	3.4	3.4	4.2	4.3
2008-12-31	3.3	4.0	4.2	3.9	3.4	3.4	4.2	4.2
2009-12-31	3.9	4.0	4.3	3.9	3.4	3.5	4.2	4.1
2010-12-31	3.6	3.8	4.3	3.7	3.3	3.4	4.2	4.2
2011-12-31	3.5	3.7	4.1	3.7	3.0	3.4	4.1	4.2
2012-12-31	3.3	3.7	4.2	3.7	3.0	3.1	3.8	4.2
2013-12-31	3.1	3.7	4.4	3.4	3.2	3.1	3.5	4.2
2014-12-31	3.4	3.4	4.5	3.2	3.3	3.0	3.1	4.1
2015-12-31	3.5	3.5	4.5	3.1	3.4	3.0	2.6	4.1
2016-12-31	3.5	3.5	4.2	3.2	3.4	3.0	2.4	4.2

Table 6: Unemployment in western area

unemployment	Neimenggu	Guangxi	Chongqing	Sichuan	Guizhou	Yunnan	Xizang	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang
1999-12-31	3.1	3.3	3.5	3.7	4.0	2.5	3.3	2.6	2.7	2.6	4.5	3.7
2000-12-31	3.3	3.2	3.5	4.0	3.8	2.6	6.8	2.7	2.7	2.4	4.6	3.8
2001-12-31	3.7	3.5	3.9	4.3	4.0	3.3	7.1	3.2	2.8	3.5	4.4	3.7
2002-12-31	4.1	3.7	4.1	4.5	4.1	4.0	4.9	3.3	3.2	3.6	4.4	3.7
2003-12-31	4.5	3.6	4.1	4.4	4.0	4.1	4.2	3.5	3.4	3.8	4.4	3.5
2004-12-31	4.6	4.1	4.1	4.4	4.1	4.3	4.0	3.8	3.4	3.9	4.5	3.5
2005-12-31	4.3	4.2	4.1	4.6	4.2	4.2	4.3	4.2	3.3	3.9	4.5	3.9
2006-12-31	4.1	4.2	4.0	4.5	4.1	4.3	4.3	4.0	3.6	3.9	4.3	3.9
2007-12-31	4.0	3.8	4.0	4.2	4.0	4.2	4.3	4.0	3.3	3.8	4.3	3.9
2008-12-31	4.1	3.8	4.0	4.6	4.0	4.2	3.9	3.9	3.2	3.8	4.4	3.7
2009-12-31	4.0	3.7	4.0	4.3	3.8	4.3	3.8	3.9	3.3	3.8	4.4	3.8
2010-12-31	3.9	3.7	3.9	4.1	3.6	4.2	4.0	3.9	3.2	3.8	4.4	3.2
2011-12-31	3.8	3.5	3.5	4.2	3.6	4.1	3.2	3.6	3.1	3.8	4.4	3.2
2012-12-31	3.7	3.4	3.3	4.0	3.3	4.0	2.6	3.2	2.7	3.4	4.2	3.4
2013-12-31	3.7	3.3	3.4	4.1	3.3	4.0	2.5	3.3	2.3	3.3	4.1	3.4
2014-12-31	3.6	3.2	3.5	4.2	3.3	4.0	2.5	3.3	2.2	3.2	4.0	3.2
2015-12-31	3.7	2.9	3.6	4.1	3.3	4.0	2.5	3.4	2.1	3.2	4.0	2.9
2016-12-31	3.7	2.9	3.7	4.2	3.2	3.6	2.6	3.3	2.2	3.1	3.9	2.5

Table 7: GDP in eastern area

GDP	Beijing	Tianjin	Hebei	Liaoning	Shanghai	Jiangsu	Zhejiang	Fujian	Shandong	Guangdong	Hainan
1999-12-31	2678.8	1501.0	4514.2	4171.7	2866.3	7697.8	5443.9	3414.2	7493.8	9250.7	476.7
2000-12-31	3161.7	1701.9	5044.0	4669.1	3151.4	8553.7	6141.0	3764.5	8337.5	10741.3	526.8
2001-12-31	3708.0	1919.1	5516.8	5033.1	3390.1	9456.8	6898.3	4072.9	9195.0	12039.3	579.2
2002-12-31	4315.0	2150.8	6018.3	5458.2	3637.2	10606.9	8003.7	4467.6	10275.5	13502.4	642.7
2003-12-31	5007.2	2578.0	6921.3	6002.5	4057.4	12442.9	9705.0	4983.7	12078.2	15844.6	714.0
2004-12-31	6033.2	3111.0	8477.6	6672.0	4750.6	15003.6	11648.7	5763.4	15021.8	18864.6	819.7
2005-12-31	6969.5	3905.6	10012.1	8047.3	5513.7	18598.7	13417.7	6554.7	18366.9	22557.4	918.8
2006-12-31	8117.8	4462.7	11467.6	9304.5	6211.8	21742.1	15718.5	7583.9	21900.2	26587.8	1065.7
2007-12-31	9846.8	5252.8	13607.3	11164.3	7104.0	26018.5	18753.7	9248.5	25776.9	31777.0	1254.2
2008-12-31	11115.0	6719.0	16012.0	13668.6	8314.4	30982.0	21462.7	10823.0	30933.3	36796.7	1503.1
2009-12-31	12153.0	7521.9	17235.5	15212.5	8587.0	34457.3	22990.4	12236.5	33896.7	39482.6	1654.2
2010-12-31	14113.6	9224.5	20394.3	18457.3	10368.6	41425.5	27722.3	14737.1	39169.9	46013.1	2064.5
2011-12-31	16251.9	11307.3	24515.8	22226.7	12582.0	49110.3	32318.9	17560.2	45361.9	53210.3	2522.7
2012-12-31	17879.4	12893.9	26575.0	24846.4	13691.6	54058.2	34665.3	19701.8	50013.2	57067.9	2855.5
2013-12-31	19800.8	14442.0	28443.0	27213.2	14454.9	59753.4	37756.6	21868.5	55230.3	62474.8	3177.6
2014-12-31	21330.8	15726.9	29421.2	28626.6	15039.4	65088.3	40173.0	24055.8	59426.6	67809.9	3500.7
2015-12-31	23014.6	16538.2	29806.1	28669.0	15083.7	70116.4	42886.5	25979.8	63002.3	72812.6	3702.8
2016-12-31	25669.1	17885.4	32070.5	22246.9	15386.1	77388.3	47251.4	28810.6	68024.5	80854.9	4053.2

Table 8: GDP in central area

GDP	Shanxi	Jilin	Heilongjiang	Anhui	Jiangxi	Henan	Hubei	Hunan
36525.0	1667.1	1682.1	2866.3	2712.3	1853.7	4517.9	3229.3	3214.5
2000-12-31	1845.7	1951.5	3151.4	2902.1	2003.1	5053.0	3545.4	3551.5
2001-12-31	2029.5	2120.4	3390.1	3246.7	2175.7	5533.0	3880.5	3831.9
2002-12-31	2324.8	2348.5	3637.2	3519.7	2450.5	6035.5	4212.8	4151.5
2003-12-31	2855.2	2662.1	4057.4	3923.1	2807.4	6867.7	4757.5	4660.0
2004-12-31	3571.4	3122.0	4750.6	4759.3	3456.7	8553.8	5633.2	5641.9
2005-12-31	4230.5	3620.3	5513.7	5350.2	4056.8	10587.4	6590.2	6596.1
2006-12-31	4878.6	4275.1	6211.8	6112.5	4820.5	12362.8	7617.5	7688.7
2007-12-31	6024.5	5284.7	7104.0	7360.9	5800.3	15012.5	9333.4	9439.6
2008-12-31	7315.4	6426.1	8314.4	8851.7	6971.1	18018.5	11328.9	11555.0
2009-12-31	7358.3	7278.8	8587.0	10062.8	7655.2	19480.5	12961.1	13059.7
2010-12-31	9200.9	8667.6	10368.6	12359.3	9451.3	23092.4	15967.6	16038.0
2011-12-31	11237.6	10568.8	12582.0	15300.7	11702.8	26931.0	19632.3	19669.6
2012-12-31	12112.8	11939.2	13691.6	17212.1	12948.9	29599.3	22250.5	22154.2
2013-12-31	12665.3	13046.4	14454.9	19229.3	14410.2	32191.3	24791.8	24621.7
2014-12-31	12761.5	13803.1	15039.4	20848.8	15714.6	34938.2	27379.2	27037.3
2015-12-31	12766.5	14063.1	15083.7	22005.6	16723.8	37002.2	29550.2	28902.2
2016-12-31	13050.4	14776.8	15386.1	24407.6	18499.0	40471.8	32665.4	31551.4

Table 9: GDP in western area

GDP	Neimenggu	Guangxi	Chongqing	Sichuan	Guizhou	Yunnan	Xizang	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang
36525.0	1379.3	1971.4	1663.2	3649.1	937.5	1899.8	106.0	1592.6	956.3	239.4	264.6	1163.2
2000-12-31	1539.1	2080.0	1791.0	3928.2	1029.9	2011.2	117.8	1804.0	1052.9	263.7	295.0	1363.6
2001-12-31	1713.8	2279.3	1976.9	4293.5	1133.3	2138.3	139.2	2010.6	1125.4	300.1	337.4	1491.6
2002-12-31	1940.9	2523.7	2232.9	4725.0	1243.4	2312.8	162.0	2253.4	1232.0	340.7	377.2	1612.7
2003-12-31	2388.4	2821.1	2555.7	5333.1	1426.3	2556.0	185.1	2587.7	1399.8	390.2	445.4	1886.4
2004-12-31	3041.1	3433.5	3034.6	6379.6	1677.8	3081.9	220.3	3175.6	1688.5	466.1	537.1	2209.1
2005-12-31	3905.0	3984.1	3467.7	7385.1	2005.4	3461.7	248.8	3933.7	1934.0	543.3	612.6	2604.1
2006-12-31	4944.3	4746.2	3907.2	8690.2	2339.0	3988.1	290.8	4743.6	2277.4	648.5	725.9	3045.3
2007-12-31	6423.2	5823.4	4676.1	10562.4	2884.1	4772.5	341.4	5757.3	2704.0	797.4	919.1	3523.2
2008-12-31	8496.2	7021.0	5793.7	12601.2	3561.6	5692.1	394.9	7314.6	3166.8	1018.6	1203.9	4183.2
2009-12-31	9740.3	7759.2	6530.0	14151.3	3912.7	6169.8	441.4	8169.8	3387.6	1081.3	1353.3	4277.1
2010-12-31	11672.0	9569.9	7925.6	17185.5	4602.2	7224.2	507.5	10123.5	4120.8	1350.4	1689.7	5437.5
2011-12-31	14359.9	11720.9	10011.4	21026.7	5701.8	8893.1	605.8	12512.3	5020.4	1670.4	2102.2	6610.1
2012-12-31	15880.6	13035.1	11409.6	23872.8	6852.2	10309.5	701.0	14453.7	5650.2	1893.5	2341.3	7505.3
2013-12-31	16916.5	14449.9	12783.3	26392.1	8086.9	11832.3	815.7	16205.5	6330.7	2122.1	2577.6	8443.8
2014-12-31	17770.2	15672.9	14262.6	28536.7	9266.4	12814.6	920.8	17689.9	6836.8	2303.3	2752.1	9273.5
2015-12-31	17831.5	16803.1	15717.3	30053.1	10502.6	13619.2	1026.4	18021.9	6790.3	2417.1	2911.8	9324.8
2016-12-31	18128.1	18317.6	17740.6	32934.5	11776.7	14788.4	1151.4	19399.6	7200.4	2572.5	3168.6	9649.7

Table 10: CPI in eastern area

CPI	Beijing	Tianjin	Hebei	Liaoning	Shanghai	Jiangsu	Zhejiang	Fujian	Shandong	Guangdong	Hainan
1999-12-31	100.6	98.9	98.1	98.6	101.5	98.7	98.8	99.1	99.3	98.2	98.3
2000-12-31	103.5	99.6	99.7	99.9	102.5	100.1	101.0	102.1	100.2	101.4	101.1
2001-12-31	103.1	101.2	100.5	100.0	100.0	100.8	99.8	98.7	101.8	99.3	98.5
2002-12-31	98.2	99.6	99.0	98.9	100.5	99.2	99.1	99.5	99.3	98.6	99.5
2003-12-31	100.2	101.0	102.2	101.7	100.1	101.0	101.9	100.9	101.1	100.6	100.1
2004-12-31	101.0	102.3	104.3	103.5	102.2	104.1	103.9	104.1	103.6	103.0	104.4
2005-12-31	101.5	101.5	101.8	101.4	101.0	102.1	101.3	102.2	101.7	102.3	101.5
2006-12-31	100.9	101.5	101.7	101.2	101.2	101.6	101.1	100.8	101.0	101.8	101.5
2007-12-31	102.4	104.2	104.7	105.1	103.2	104.3	104.2	105.2	104.4	103.7	105.1
2008-12-31	105.1	105.4	106.2	104.6	105.8	105.4	105.0	104.6	105.3	105.6	106.9
2009-12-31	98.5	99.0	99.3	100.1	99.6	99.6	98.5	98.2	100.0	97.7	99.3
2010-12-31	102.4	103.5	103.1	103.0	103.1	103.8	103.8	103.2	102.9	103.1	104.8
2011-12-31	105.6	104.9	105.7	105.2	105.2	105.3	105.4	105.3	105.0	105.3	106.1
2012-12-31	103.3	102.7	102.6	102.8	102.8	102.6	102.2	102.4	102.1	102.8	103.2
2013-12-31	103.3	103.1	103.0	102.4	102.3	102.4	102.3	102.5	102.2	102.5	102.8
2014-12-31	101.6	101.9	101.7	101.7	102.7	102.2	102.1	102.0	101.9	102.3	102.4
2015-12-31	101.8	101.7	100.9	101.4	102.4	101.7	101.4	101.7	101.2	101.6	101.0
2016-12-31	101.4	102.1	101.5	101.6	103.2	102.3	101.9	101.7	102.1	102.3	102.8

Table 11: CPI in central area

CPI	Shanxi	Jilin	Heilongjiang	Anhui	Jiangxi	Henan	Hubei	Hunan
1999-12-31	99.6	98.0	96.8	97.8	98.6	96.9	97.8	100.5
2000-12-31	103.9	98.6	98.3	100.7	100.3	99.2	99.0	101.4
2001-12-31	99.8	101.3	100.8	100.5	99.5	100.7	100.3	99.1
2002-12-31	98.4	99.5	99.3	99.0	100.1	100.1	99.6	99.5
2003-12-31	101.8	101.2	100.9	101.7	100.8	101.6	102.2	102.5
2004-12-31	104.1	104.1	103.8	104.5	103.5	105.4	104.9	105.1
2005-12-31	102.3	101.5	101.2	101.4	101.7	102.1	102.9	102.3
2006-12-31	102.0	101.4	101.9	101.2	101.2	101.3	101.6	101.4
2007-12-31	104.6	105.3	105.2	105.3	104.8	105.4	104.8	105.6
2008-12-31	107.2	105.1	105.6	106.2	106.1	107.0	106.3	106.0
2009-12-31	99.6	100.1	100.2	99.1	99.3	99.4	99.6	99.6
2010-12-31	103.0	103.7	103.9	103.1	103.0	103.5	102.9	103.1
2011-12-31	105.2	105.3	105.8	105.6	105.3	105.6	105.8	105.5
2012-12-31	102.5	102.5	103.2	102.3	102.8	102.5	102.9	102.0
2013-12-31	103.1	102.9	102.2	102.4	102.5	102.9	102.8	102.5
2014-12-31	101.7	102.0	101.5	101.6	102.4	101.9	102.0	101.9
2015-12-31	100.6	101.7	101.1	101.3	101.5	101.3	101.5	101.4
2016-12-31	101.1	101.6	101.5	101.8	102.0	101.9	102.2	101.9

Table 12: CPI in western area

CPI	Neimenggu	Guangxi	Chongqing	Sichuan	Guizhou	Yunnan	Xizang	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang
1999-12-31	99.8	97.7	99.3	98.5	99.2	99.7	100.0	97.8	97.6	99.5	98.7	97.4
2000-12-31	101.3	99.7	96.7	100.1	99.5	97.9	99.9	99.5	99.5	99.5	99.6	99.4
2001-12-31	100.6	100.6	101.7	102.1	101.8	99.1	100.1	101.0	104.0	102.6	101.6	104.0
2002-12-31	100.2	99.1	99.6	99.7	99.0	99.8	100.4	98.9	100.0	102.3	99.4	99.4
2003-12-31	102.2	101.1	100.6	101.7	101.2	101.2	100.9	101.7	101.1	102.0	101.7	100.4
2004-12-31	102.9	104.4	103.7	104.9	104.0	106.0	102.7	103.1	102.3	103.2	103.7	102.7
2005-12-31	102.4	102.4	100.8	101.7	101.0	101.4	101.5	101.2	101.8	100.8	101.5	100.7
2006-12-31	101.5	101.3	102.4	102.3	101.7	101.9	102.0	101.5	101.3	101.6	101.9	101.3
2007-12-31	104.6	106.1	104.7	105.9	106.4	105.9	103.4	105.2	105.2	106.7	105.5	105.5
2008-12-31	105.7	107.8	105.6	105.1	107.6	105.7	105.7	106.4	108.2	110.1	108.5	108.1
2009-12-31	99.7	97.9	98.4	100.8	98.7	100.4	101.4	100.5	101.3	102.7	100.8	100.7
2010-12-31	103.2	103.0	103.3	103.2	102.9	103.7	102.2	104.0	104.1	105.4	104.1	104.3
2011-12-31	105.6	105.9	105.3	105.3	105.2	104.9	105.0	105.7	105.9	106.1	106.3	106.0
2012-12-31	103.1	103.2	102.6	102.5	102.7	102.7	103.5	102.8	102.7	103.1	102.0	103.8
2013-12-31	103.2	102.2	102.7	102.8	102.5	103.1	103.6	103.1	103.2	104.0	103.4	104.0
2014-12-31	101.6	102.1	101.8	101.6	102.4	102.4	102.9	101.6	102.1	102.8	101.9	102.1
2015-12-31	101.1	101.5	101.3	101.5	101.8	101.9	102.0	101.0	101.6	102.6	101.2	100.6
2016-12-31	101.2	101.6	101.8	101.9	101.4	101.5	102.5	101.3	101.3	101.8	101.5	101.4

Table 13: Income in eastern area

Income	Beijing	Tianjin	Hebei	Liaoning	Shanghai	Jiangsu	Zhejiang	Fujian	Shandong	Guangdong	Hainan
1999-12-31	9182.8	7649.8	5365.0	4898.6	10931.6	6538.2	8428.0	6859.8	5809.0	9125.9	5338.3
2000-12-31	10349.7	8140.5	5661.2	5357.8	11718.0	6800.2	9279.2	7432.3	6490.0	9761.6	5358.3
2001-12-31	11577.8	8958.7	5984.8	5797.0	12883.5	7375.1	10464.7	8313.1	7101.1	10415.2	5838.8
2002-12-31	12463.9	9337.6	6679.7	6524.5	13249.8	8177.6	11715.6	9189.4	7614.4	11137.2	6822.7
2003-12-31	13882.6	10312.9	7239.1	7240.6	14867.5	9262.5	13179.5	9999.5	8399.9	12380.4	7259.3
2004-12-31	15637.8	11467.2	7951.3	8007.6	16682.8	10481.9	14546.4	11175.4	9437.8	13627.7	7735.8
2005-12-31	17653.0	12638.6	9107.1	9107.6	18645.0	12318.6	16293.8	12321.3	10744.8	14769.9	8123.9
2006-12-31	19977.5	14283.1	10304.6	10369.6	20667.9	14084.3	18265.1	13753.3	12192.2	16015.6	9395.1
2007-12-31	21988.7	16357.4	11690.5	12300.4	23622.7	16378.0	20573.8	15506.1	14264.7	17699.3	10996.9
2008-12-31	24724.9	19422.5	13441.1	14392.7	26674.9	18679.5	22726.7	17961.5	16305.4	19732.9	12607.8
2009-12-31	26738.5	21402.0	14718.3	15761.4	28837.8	20551.7	24610.8	19576.8	17811.0	21574.7	13750.9
2010-12-31	29072.9	24292.6	16263.4	17712.6	31838.1	22944.3	27359.0	21781.3	19945.8	23897.8	15581.1
2011-12-31	32903.0	26920.9	18292.2	20466.8	36230.5	26340.7	30970.7	24907.4	22791.8	26897.5	18369.0
2012-12-31	36468.8	29626.4	20543.4	23222.7	40188.3	29677.0	34550.3	28055.2	25755.2	30226.7	20917.7
2013-12-31	44563.9	28979.8	15189.6	20817.8	44878.3	24775.5	29775.0	21217.9	19008.3	23420.7	15733.3
2014-12-31	48531.8	31506.0	24141.3	29081.8	48841.4	34346.3	40392.7	30722.4	29221.9	32148.1	24486.5
2015-12-31	52859.2	34101.3	26152.2	31125.7	52961.9	37173.5	43714.5	33275.3	31545.3	34757.2	26356.4
2016-12-31	57275.3	37109.6	28249.4	32876.1	57691.7	40151.6	47237.2	36014.3	34012.1	37684.3	28453.5

Table 14: Income in central area

Income	Shanxi	Jilin	eilongjiang	Anhui	Jiangxi	Henan	Hubei	Hunan
1999-12-31	4342.6	4480.0	4595.1	5064.6	4720.6	4532.4	5212.8	5815.4
2000-12-31	4724.1	4810.0	4912.9	5293.6	5103.6	4766.3	5524.5	6218.7
2001-12-31	5391.1	5340.5	5425.9	5668.8	5506.0	5267.4	5856.0	6780.6
2002-12-31	6234.4	6260.2	6100.6	6032.4	6335.6	6245.4	6788.5	6958.6
2003-12-31	7005.0	7005.2	6678.9	6778.0	6901.4	6926.1	7322.0	7674.2
2004-12-31	7902.9	7840.6	7470.7	7511.4	7559.6	7704.9	8022.8	8617.5
2005-12-31	8913.9	8690.6	8272.5	8470.7	8619.7	8668.0	8785.9	9524.0
2006-12-31	10027.7	9775.1	9182.3	9771.1	9551.1	9810.3	9802.7	10504.7
2007-12-31	11565.0	11285.5	10245.3	11473.6	11451.7	11477.1	11485.8	12293.5
2008-12-31	13119.1	12829.5	11581.3	12990.4	12866.4	13231.1	13152.9	13821.2
2009-12-31	13996.6	14006.3	12566.0	14085.7	14021.5	14371.6	14367.5	15084.3
2010-12-31	15647.7	15411.5	13856.5	15788.2	15481.1	15930.3	16058.4	16565.7
2011-12-31	18123.9	17796.6	15696.2	18606.1	17494.9	18194.8	18373.9	18844.1
2012-12-31	20411.7	20208.0	17759.8	21024.2	19860.4	20442.6	20839.6	21318.8
2013-12-31	15119.7	15998.1	15903.4	15154.3	15099.7	14203.7	16472.5	16004.9
2014-12-31	24069.4	23217.8	22609.0	24838.5	24309.2	23672.1	24852.3	26570.2
2015-12-31	25827.7	24900.9	24202.6	26935.8	26500.1	25575.6	27051.5	28838.1
2016-12-31	27352.3	26530.4	25736.4	29156.0	28673.3	27232.9	29385.8	31283.9

Table 15: Income in western area

Income	Neimenggu	Guangxi	Chongqing	Sichuan	Guizhou	Yunnan	Xizang	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang
1999-12-31	4770.5	5619.5	5896.0	5477.9	4934.0	6178.7	6908.6	4654.0	4475.2	4703.5	4472.9	5319.8
2000-12-31	5129.1	5834.4	6276.0	5894.3	5122.2	6324.6	7426.3	5124.2	4916.3	5170.0	4912.4	5644.9
2001-12-31	5535.9	6665.7	6721.1	6360.5	5451.9	6797.7	7869.2	5483.7	5382.9	5853.7	5544.2	6395.0
2002-12-31	6051.0	7315.3	7238.0	6610.8	5944.1	7240.6	8079.1	6330.8	6151.4	6170.5	6067.4	6899.6
2003-12-31	7012.9	7785.0	8093.7	7041.9	6569.2	7643.6	8765.5	6806.4	6657.2	6745.3	6530.5	7173.5
2004-12-31	8123.0	8690.0	9221.0	7709.9	7322.1	8870.9	9106.1	7492.5	7376.7	7319.7	7217.9	7503.4
2005-12-31	9136.8	9286.7	10243.5	8386.0	8151.1	9265.9	9431.2	8272.0	8086.8	8057.9	8093.6	7990.2
2006-12-31	10358.0	9898.8	11569.7	9350.1	9116.6	10069.9	8941.1	9267.7	8920.6	9000.4	9177.3	8871.3
2007-12-31	12377.8	12200.4	12590.8	11098.3	10678.4	11496.1	11130.9	10763.3	10012.3	10276.1	10859.3	10313.4
2008-12-31	14432.6	14146.0	14367.6	12633.4	11758.8	13250.2	12481.5	12857.9	10969.4	11640.4	12931.5	11432.1
2009-12-31	15849.2	15451.5	15748.7	13839.4	12862.5	14423.9	13544.4	14128.8	11929.8	12691.9	14024.7	12257.5
2010-12-31	17698.2	17063.9	17532.4	15461.2	14142.7	16064.5	14980.5	15695.2	13188.6	13855.0	15344.5	13643.8
2011-12-31	20407.6	18854.1	20249.7	17899.1	16495.0	18575.6	16195.6	18245.2	14988.7	15603.3	17578.9	15513.6
2012-12-31	23150.3	21242.8	22968.1	20307.0	18700.5	21074.5	18028.3	20733.9	17156.9	17566.3	19831.4	17920.7
2013-12-31	18692.9	14082.3	23058.2	14231.0	11083.1	12577.9	9746.8	14371.5	10954.4	12947.8	14565.8	13669.6
2014-12-31	28349.6	24669.0	25147.2	24234.4	22548.2	24299.0	22015.8	24365.8	21803.9	22306.6	23284.6	23214.0
2015-12-31	30594.1	26415.9	27238.8	26205.3	24579.6	26373.2	25456.6	26420.2	23767.1	24542.4	25186.0	26274.7
2016-12-31	32975.0	28324.4	29610.0	28335.3	26742.6	28610.6	27802.4	28440.1	25693.5	26757.4	27153.0	28463.4

Table 16: Population in eastern area

population	Beijing	Tianjin	Hebei	Liaoning	Shanghai	Jiangsu	Zhejiang	Fujian	Shandong	Guangdong	Hainan
1999-12-31	1257.0	907.0	6275.0	4171.0	1474.0	7213.0	4475.0	3316.0	8883.0	7270.0	762.0
2000-12-31	1364.0	1001.0	6334.0	4184.0	1608.6	7327.0	4679.9	3410.0	8998.0	8650.0	789.0
2001-12-31	1385.0	1004.1	6388.0	4194.0	1668.3	7359.0	4728.8	3445.4	9041.0	8733.2	795.6
2002-12-31	1423.0	1007.0	6437.0	4203.0	1713.0	7406.0	4776.4	3476.0	9082.0	8842.1	803.0
2003-12-31	1456.0	1011.0	6484.0	4210.0	1765.8	7458.0	4856.8	3502.0	9125.0	8962.7	811.0
2004-12-31	1493,0	1024,0	6525,0	4217,0	1835,0	7523,0	4925,2	3529,1	9180,0	9110,7	818,0
2005-12-31	1538,0	1042,5	6569,0	4221,0	1890,3	7588,2	4990,9	3557,0	9248,2	9194,0	828,0
2006-12-31	1601,0	1075,0	6614,0	4271,0	1964,1	7655,7	5071,8	3585,0	9308,9	9442,1	835,9
2007-12-31	1676,0	1115,0	6674,0	4298,0	2063,6	7723,1	5154,9	3612,0	9367,0	9659,5	845,0
2008-12-31	1771,0	1176,0	6988,8	4315,0	2140,6	7762,5	5212,4	3639,0	9417,2	9893,5	854,2
2009-12-31	1860,0	1228,2	7034,4	4341,0	2210,3	7810,3	5275,5	3666,0	9470,3	10130,2	864,1
2010-12-31	1961,9	1299,3	7193,6	4375,0	2302,7	7869,3	5446,5	3693,0	9587,9	10440,9	868,6
2011-12-31	2018,6	1354,6	7240,5	4383,0	2347,5	7898,8	5463,0	3720,0	9637,3	10505,0	877,4
2012-12-31	2069,3	1413,2	7287,5	4389,0	2380,4	7920,0	5477,0	3748,0	9684,9	10594,0	886,6
2013-12-31	2114,8	1472,2	7332,6	4390,0	2415,2	7939,5	5498,0	3774,0	9733,4	10644,0	895,3
2014-12-31	2151,6	1516,8	7383,8	4391,0	2425,7	7960,1	5508,0	3806,0	9789,4	10724,0	903,5
2015-12-31	2171,0	1547,0	7424,9	4382,4	2415,0	7976,3	5539,0	3839,0	9847,2	10849,0	910,8
2016-12-31	2189,0	1672,0	7470,0	4378,0	2420,0	7999,0	5590,0	3874,0	9947,0	10999,0	917,0

Table 17: Population in central area

population	Shanxi	Jilin	eilongjiang	Anhui	Jiangxi	Henan	Hubei	Hunan
1999-12-31	3204.0	2658.0	3792.0	6237.0	4231.0	9387.0	5938.0	6532.0
2000-12-31	3247.0	2682.0	3807.0	6093.0	4149.0	9488.0	5646.0	6562.0
2001-12-31	3271.6	2690.8	3811.0	6128.0	4185.8	9555.0	5658.0	6595.9
2002-12-31	3294.0	2699.0	3813.0	6144.0	4222.0	9613.0	5672.0	6629.0
2003-12-31	3314.0	2704.0	3815.0	6163.0	4254.0	9667.0	5685.0	6663.0
2004-12-31	3335.0	2709.0	3817.0	6228.0	4284.0	9717.0	5698.0	6698.0
2005-12-31	3355.2	2716.0	3820.0	6120.1	4311.2	9380.0	5710.0	6326.0
2006-12-31	3374.6	2723.0	3823.0	6110.0	4339.1	9392.0	5693.0	6342.0
2007-12-31	3392.6	2729.8	3824.0	6118.0	4368.4	9360.0	5699.0	6355.0
2008-12-31	3410.6	2734.2	3825.0	6135.0	4400.1	9429.0	5711.0	6380.0
2009-12-31	3427.4	2739.6	3826.0	6131.0	4432.2	9487.1	5720.0	6406.0
2010-12-31	3574.1	2746.6	3833.4	5956.7	4462.3	9405.5	5727.9	6570.1
2011-12-31	3593.3	2749.4	3834.0	5968.0	4488.4	9388.2	5758.0	6595.6
2012-12-31	3610.8	2750.4	3834.0	5988.0	4503.9	9406.2	5779.0	6638.9
2013-12-31	3629.8	2751.3	3835.0	6029.8	4522.2	9413.4	5799.0	6690.6
2014-12-31	3648.0	2752.4	3833.0	6082.9	4542.2	9436.0	5816.0	6737.2
2015-12-31	3664.1	2753.3	3811.7	6143.6	4565.6	9480.0	5851.5	6783.0
2016-12-31	3682.0	2733.0	3799.0	6196.0	4592.0	9532.0	5885.0	6822.0

Table 18: Population in western area

population	eimenggu	Guangxi	hongqing	Sichuan	Guizhou	Yunnan	Xizang	Shaanxi	Gansu	Qinghai	Ningxia	Xinjiang
1999-12-31	2362.0	4713.0	3075.0	8550.0	3710.0	4192.0	256.0	3618.0	2543.0	510.0	543.0	1774.0
2000-12-31	2372.0	4751.0	2848.8	8329.0	3756.0	4241.0	258.0	3644.0	2515.3	517.0	554.0	1849.0
2001-12-31	2381.5	4788.0	2829.2	8143.0	3798.5	4287.4	263.6	3653.1	2523.4	523.1	563.0	1876.2
2002-12-31	2384.1	4822.0	2814.4	8110.0	3837.0	4333.0	268.2	3662.2	2530.8	529.0	572.0	1905.0
2003-12-31	2385.8	4857.0	2803.2	8176.0	3870.0	4376.0	272.2	3671.7	2537.2	534.0	580.0	1934.0
2004-12-31	2392.7	4889.0	2793.3	8090.0	3904.0	4415.0	276.4	3681.2	2541.5	539.0	588.0	1963.0
2005-12-31	2403.1	4660.0	2798.0	8212.0	3730.0	4450.4	280.3	3690.0	2545.1	543.2	596.2	2010.4
2006-12-31	2415.1	4719.0	2808.0	8169.0	3690.0	4483.0	285.1	3699.0	2546.8	547.7	603.7	2050.0
2007-12-31	2428.8	4768.0	2816.0	8127.0	3632.0	4514.0	288.8	3708.0	2548.2	551.6	610.3	2095.2
2008-12-31	2444.3	4816.0	2839.0	8138.0	3596.0	4543.0	292.3	3718.0	2550.9	554.3	617.7	2130.8
2009-12-31	2458.2	4856.0	2859.0	8185.0	3537.0	4571.0	295.8	3727.0	2554.9	557.3	625.2	2158.6
2010-12-31	2472.2	4610.0	2884.6	8044.9	3479.0	4601.6	300.2	3735.0	2560.0	563.5	633.0	2185.0
2011-12-31	2481.7	4645.0	2919.0	8050.0	3469.0	4631.0	303.3	3743.0	2564.2	568.2	639.5	2208.7
2012-12-31	2489.9	4682.0	2945.0	8076.2	3484.1	4659.0	307.6	3753.0	2577.6	573.2	647.2	2232.8
2013-12-31	2497.6	4719.0	2970.0	8107.0	3502.2	4686.6	312.0	3764.0	2582.2	577.8	654.2	2264.3
2014-12-31	2504.8	4754.0	2991.4	8140.2	3508.0	4713.9	317.6	3775.1	2590.8	583.4	661.5	2298.5
2015-12-31	2511.0	4796.0	3017.0	8204.0	3529.5	4741.8	324.0	3793.0	2599.6	588.4	667.9	2359.7
2016-12-31	2520.0	4838.0	3220.0	8262.0	3555.0	4771.0	331.0	3813.0	2610.0	593.0	675.0	2398.0

B. Unit root process：

If the random variable y_t satisfies the following expression, the random variable y_t obeys the unit root process

$$y_t = y_{t-1} + \varepsilon_t \text{ , } \varepsilon_t \textit{ is a Stationary process}$$