9-2019

The interplay between real estate prices in Shenzhen, Dongguan and Huizhou

Zhituan SU
Singapore Management University, zhituan.su.2016@ckdba.smu.edu.sg

THE INTERPLAY BETWEEN REAL ESTATE PRICES IN SHENZHEN, DONGGUAN AND HUIZHOU

SU ZHITUAN

SINGAPORE MANAGEMENT UNIVERSITY

2019

The Interplay between Real Estate Prices in Shenzhen, Dongguan and Huizhou

SU Zhituan

Submitted to Lee Kong Chian School of Business in partial fulfillment of the requirements for the Degree of Doctor of Business Administration

Dissertation Committee:

YU Jun (Supervisor/Chairman)
Professor of Economics and Finance
Singapore Management University

ZHOU Chunsheng (Co-supervisor)
Professor of Finance
Cheung Kong Graduate School of Business

LI Jing (Member)
Professor of Economics
Singapore Management University

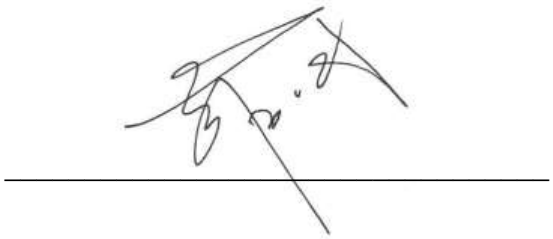
Singapore Management University

2019

Declaration

I hereby declare that this doctorate dissertation is my original work
and it has been written by me in its entirety.
I have duly acknowledged all the sources of information
which have been used in this dissertation.

This doctorate dissertation has also not been submitted for any degree
in any university previously.



SU Zhituan

31 October 2019

The Interplay between Real Estate Prices in Shenzhen, Dongguan and Huizhou

Su Zhituan

Abstract

In recent years, the Chinese government has proposed a national development strategy for the construction of Guangdong-Hong Kong-Macao Greater Bay Area, which has been beefing up the trend of integrated development of Shenzhen, Dongguan and Huizhou, frontiers of the reform and opening up. Among many other topics, the evolution of the real estate prices in Shenzhen, Dongguan and Huizhou has become a front-burner topic.

In this dissertation focusing on the real estate price in Shenzhen, Dongguan and Huizhou, we have conducted in-depth analysis of the interplay between the real estate price in Shenzhen, Dongguan and Huizhou from such perspectives as empirical relationship, causes and strategy suggestion. The research mainly consists of the following content:

The first is background analysis and literature review, with the purpose of exploring the real estate price in urban agglomerations along the urbanization process, specifically the overall background of the interplay between real estate prices in Shenzhen, Dongguan and Huizhou, and probing into the role of real estate prices as signals in market economy conditions.

The second is an in-depth analysis of the interplay between real estate prices in Shenzhen, Dongguan and Huizhou based on statistical data, and build a Granger

causality test and a VAR model, leading to the analysis of and discussion on the empirical relationship of the interplay.

The third is an analysis of the reasons for the interplay between real estate prices in Shenzhen, Dongguan and Huizhou, including the economic, psychosocial and political reasons, and an exploration and explanation of the mechanism of the interplay between real estate prices in Shenzhen, Dongguan and Huizhou.

The fourth is proposal of countermeasures and suggestions specifically for industry, government and resident sectors based on the interplay between real estate prices in Shenzhen, Dongguan and Huizhou, so as to enhance the availability of this research as theoretical reference and practical guidance.

Through analysis of empirical relationship and causes, we have drawn several conclusions that, for example, the real estate price in Shenzhen Granger-causes those in Dongguan and Huizhou, and the real estate prices in Dongguan and Huizhou Granger-cause each other, which provide theoretical and practical references for industry development, government intervention and residents' property investment and buying.

Keywords: Real estate price; Interplay; Shenzhen; Dongguan; Huizhou

Table of Contents

Table of Contents.....i

Acknowledgement.....v

Chapter 1 Introduction.....1

1.1 Background, purposes and significance.....1

1.1.1 Research background.....1

1.1.2 Research purposes.....4

1.1.3 Research significance.....5

1.2 Content and methodology.....7

1.2.1 Main research content.....7

1.2.1 Main methodology.....8

1.3 Technical routes and innovations.....9

1.3.1 Technical routes.....9

1.3.2 Possible innovations.....10

Chapter 2 Basic theories and literature review.....12

2.1 Urbanization and urban agglomeration.....12

2.1.1 About urbanization.....12

2.1.2 About urban agglomerations.....14

2.2 Real estate and real estate prices.....16

2.2.1 About real estate.....16

2.2.2 About real estate prices.....19

2.3 Research on the factors affecting real estate prices.....23

2.3.1 Macro factors.....23

2.3.2 Regional factors.....27

2.3.3 Internal factors.....31

2.3.4 Other factors.....32

2.4 The signal effect of real estate prices.....34

2.4.1 Connection between real estate prices and economic growth.....34

2.4.2 Macro-control of real estate prices.....35

2.5 Evaluation of relevant literatures and researches.....38

Chapter 3 Problem introduction and research+ design.....40
3.1 Problem introduction.....40
3.1.1 The emergence of the Shenzhen-Dongguan-Huizhou urban agglomeration 40
3.1.2 Development of the real estate industry in Shenzhen, Dongguan and Huizhou 49
3.1.3 Raising of problems in this dissertation.....59
3.2 Methodology reference and data sources 62
3.2.1 Methodology reference 62
3.2.2 Data sources.....64
3.3 Research design.....66
3.3.1 Empirical analysis: Clarifying the interplay 66
3.3.2 Qualitative and comparative analysis: Cause analysis and strategy recommendations 67
Chapter 4 Empirical analysis of interplay between real estate prices in Shenzhen, Dongguan and Huizhou 68
4.1 Data processing, unit root test and Granger causality test 68
4.1.1 Data processing.....69
4.1.2 Unit root test 70
4.1.3 Granger causality test.....75
4.2 VAR model analysis of interplay between real estate prices in Shenzhen, Dongguan and Huizhou 77
4.2.1 Building VAR model 77
4.2.2 Exogenous test 82
4.2.3 Stability test 84
4.2.4 Impulse response analysis.....85
4.2.5 Variance decomposition.....89
4.3 Conclusion of empirical analysis of interplay between real estate prices in Shenzhen, Dongguan and Huizhou.....92
4.3.1 Causal association.....92
4.3.2 Degree of direction of interplay.....94
4.3.3 Lag period.....96

4.3.4 Predication role of VAR model 98

Chapter 5 Cause analysis of interplay between real estate prices in Shenzhen, Dongguan and Huizhou 101

5.1 Economic causes of interplay between real estate prices in Shenzhen, Dongguan and Huizhou 101

5.1.1 Macro causes.....101

5.1.2 Regional causes.....107

5.1.3 Internal causes.....113

5.2 Socio-psychological causes of interplay between real estate prices in Shenzhen, Dongguan and Huizhou 118

5.2.1 Psychological expectations 118

5.2.2 Market noise.....123

5.2.3 Behavioral biases 127

5.3 Real estate-related policy causes.....130

5.3.1 Land policy 131

5.3.2 Financial policy.....131

5.3.3 Tax policy 132

5.3.4 Purchase quota policy 133

5.3.5 Policy factors of interplay between real estate prices in Shenzhen, Dongguan and Huizhou from 2003-2017.....134

Chapter 6 Strategy suggestions for interplay between real estate prices in Shenzhen, Dongguan and Huizhou 136

6.1 Industry development strategy 136

6.1.1 Establish crisis awareness and face up to periodic fluctuations in economy.....137

6.1.2 Establish risk awareness and prevent reoccurrence of overheating in real estate investment.....140

6.1.3 Establish sense of competition and seize high point during industry reshuffle 142

6.2 Government intervention strategy 145

6.2.1 Identify government intervention objectives 145

6.2.2 Measures of government intervention in real estate markets in Shenzhen, Dongguan and Huizhou.....150

6.3 Suggestions for investment and housing purchase by residents....153

6.3.1 Suggestions for investment 153
6.3.2 Suggestions for housing purchase 157
Chapter 7 Research summary and prospects 159
7.1 Major works and conclusions 159
7.1.1 Review of major works 159
7.1.2 Major conclusions and discussion 160
7.2 Problems and future research direction 163
7.2.1 Problems 163
7.2.2 Future research direction 164
References 166
Appendix 1 Statistical Data of Real Estate Prices and Relevant Indexes in Shenzhen, Dongguan and Huizhou 183

Acknowledgement

First of all, I would like to extend my sincere gratitude to Professor Yu Jun, Zhou Chunsheng and Li Jing, three supervisors of my dissertation, for their utmost guidance which greatly contribute to the completion of this dissertation. I am looking forward to more edification and guidance in the future from my supervisors.

Secondly, I would like to thank the faculties of Singapore Management University and Cheung Kong Graduate School of Business for their delivery of the most advanced management knowledge and support for my completion of the DBA program.

Finally, I want to thank my family members for giving me a lot of encouragement and help.

I am immensely grateful and hereby extend my sincere thanks again to all those who cared about me and helped me!

Su Zhituan

In Shenzhen, October 2019

Chapter 1 Introduction

As continuously promoting the reform and opening up, the Chinese government proposed a national development strategy for the construction of Guangdong-Hong Kong-Macao Greater Bay Area in recent years, so that Shenzhen, Dongguan and Huizhou, three of the frontiers of the reform and opening up, has shown an increasingly strengthened trend of integrated development, and the Shenzhen-Dongguan-Huizhou urban agglomeration has repeatedly become a focus that attracts worldwide attention. In terms of the real estate sector, a basic industry in the Shenzhen-Dongguan-Huizhou urban agglomeration, the real estate prices in Shenzhen, Dongguan and Huizhou interacted profoundly with each other based on practical observation, which is worthy of further study and exploration.

1.1 Background, purposes and significance

1.1.1 Research background

Urbanization is a historical process where a traditional rural society dominated by agriculture gradually shifts into a modern urban society dominated by industry and service. In recent years, China witnessed continuously increasing rate and progress of urbanization, and has made remarkable achievements. According to the National Bureau of Statistics, China's urbanization rate reached 59.58% in 2018. (National Bureau of Statistics of China, 2019)

Urbanization is often accompanied by urban expansion and the rise of urban agglomerations. In China, it has been established as a national strategy to promote the integrated development of neighboring cities as a whole. The famous megalopolises in China include Beijing-Tianjin-Hebei, the Yangtze River Delta, the Pearl River Delta, Chengdu-Chongqing and Changsha-

Zhuzhou-Xiangtan megalopolises. Along the long-term development process of the Pearl River Delta megalopolis, covering Hong Kong and Macao, an in tegrated development has been established among Hong Kong and Macao; Shenzhen, Dongguan and Huizhou; Guangzhou, Foshan and Zhaoqing; and Zhuhai, Jiangmen and Zhongshan.

On February 27, 2009, a joint conference was held by Shenzhen, Huizhou and Dongguan for the first time to enter into such agreements as the Framework Agreement on Promoting Close Regional Cooperation in the East Coast of the Pearl River Estuary (2009) and the Agreement on the Plan of Integrated Development for Shenzhen, Dongguan and Huizhou(2009), which marked the official recognition of the integrated development of Shenzhen, Dongguan and Huizhou as a part of a national policy. Since then, the three cities have carried out in-depth cooperation from many aspects, such as infrastructure, industrial differentiation, talent mobility and urban management, which have accelerated the integration process of the three cities.

In March 2017, Premier Li Keqiang stated in the Fifth Session of the 12th National People's Congress that we should deepen the cooperation between Hong Kong, Macao and the Chinese Mainland, formulate a development plan for the urban agglomeration of the Guangdong-Hong Kong-Macao Greater Bay Area, and take the unique advantages of Hong Kong and Macao to enhance the bay area’s status and role in the national economic development and opening up. On July 1, 2017, the Framework Agreement on Deepening Guangdong-Hong Kong-Macao Cooperation in the Development of the Greater Bay Area (2017) was signed in Hong Kong. President Xi Jinping attended the signing ceremony. In March 2018, during the deliberation of the Guangdong delegation,

President Xi Jinping pointed out and stressed that we should seize the major opportunities of constructing the Guangdong-Hong Kong-Macao Greater Bay Area, and work together with Hong Kong and Macao to accelerate the related work and build a world-class bay area and a world-class urban agglomeration. In February 2019, the Development Plan for Guangdong-Hong Kong-Macao Greater Bay Area was officially launched, marking that the construction of the Guangdong-Hong Kong-Macao Greater Bay Area has been elevated as a national strategy.

As a hot issue in the urbanization process, how the real estate prices of cities and urban agglomerations will evolve has received much attention. Generally speaking, the real estate prices of cities and urban agglomerations will be affected by the country's macroeconomic policies and economic conditions, which may be subdivided into such factors as money supply, GDP growth, urbanization rate, interest rate, exchange rate, etc. The real estate prices will also be affected by internal factors of cities or urban agglomerations, such as urban population growth in the city, GDP per capita of the city, investment completion of real estate development enterprises, urban built-up area, construction land area, etc. More specially, the real estate price in one of the cities of an urban agglomeration may be affected by the deepening of the integration of the urban agglomeration. For example, the housing price in Shenzhen may be assimilated by the high housing price in Hong Kong, which may further assimilate the housing prices in Dongguan and Huizhou. Thus, the housing price in a city may be increasingly boosted.

Obviously, the real estate prices of cities and urban agglomerations are a complicated result of interplay and interaction between various factors. By

establishing a suitable mathematical model based relevant statistical data to quantify those influencing factors, plus necessary qualitative analysis, the influencing factors and forming mechanism of the real estate prices in cities or urban agglomerations may be clarified, which is conducive for real estate industry, government administrations and ordinary residents to improve their ability of predicting the real estate price trend.

On the one hand, Shenzhen, Dongguan and Huizhou are independent cities, and on the other hand, they constitute an urban agglomeration with integrated development, showing a notable trend of mutual integration. The real estate prices in Shenzhen, Dongguan and Huizhou interplay with each other following certain time period. By establishing relevant mathematical models with public statistical data to analyze the relationship and causes of the real estate prices between Shenzhen, Dongguan and Huizhou, the changes in the real estate prices in Shenzhen, Dongguan and Huizhou will be better predicted, and the future evolution of the real estate industry will be further analyzed, so as to reach correct choices for the real estate industry, the government's intervention and the residents' property buying.

1.1.2 Research purposes

On the whole, this dissertation focuses on the interplay between real estate prices in Shenzhen, Dongguan and Huizhou for the following major purposes:

The first is to explore the real estate price of urban agglomerations in the urbanization process by carrying out literature review and tracing theoretical sources, and to specifically analyze the background and conditions of interplay between real estate prices in Shenzhen, Dongguan and Huizhou, and analyze the role of real estate prices as signals in market economy conditions.

The second is to put forward research hypotheses, conduct an in-depth analysis of interplay between real estate prices in Shenzhen, Dongguan and Huizhou based on statistical data, build a VAR model that presents interplay between real estate prices in Shenzhen, Dongguan and Huizhou and conduct relevant analysis and verification accordingly.

The third is to conduct a comprehensive analysis of the reasons for the interplay between real estate prices in Shenzhen, Dongguan and Huizhou and probe into the economic, psychosocial and political factors for interplay between real estate prices in Shenzhen, Dongguan and Huizhou, in order to further clarify the in-depth connection between real estate prices in Shenzhen, Dongguan and Huizhou.

The fourth is to propose strategic recommendations for industry, government and resident sectors based on the interplay between real estate prices in Shenzhen, Dongguan and Huizhou, to enhance the availability of this research as theoretical reference and practical guidance.

1.1.3 Research significance

This research will focus on the interplay between real estate prices in such three cities as Shenzhen, Dongguan and Huizhou and comprehensively analyze the reasons for the evolution of the real estate prices in the Shenzhen-Dongguan-Huizhou urban agglomeration as a whole. The significance of this research lies in the following three aspects:

(1) Clarifying the interplay between real estate prices in the much-talked-about region in China - the Shenzhen-Dongguan-Huizhou urban agglomeration, and constructing a quantitative model, plus qualitative analysis, to help real estate enterprises in Shenzhen, Dongguan and Huizhou strengthen their understanding

about real estate price trends and industrial development, and to promote a fast, soundly and sustainable development of real estate industry, including my own business.

(2) Whereas the real estate prices in Shenzhen, Dongguan and Huizhou interplay with each other, in the case of extreme conditions such as overheating of the real estate industry and large fluctuations in real estate prices, the government may implement certain regulation with its "visible hands" to iron out the violent fluctuations in the real estate industry and economic development. But the premise is that we must first clarify the interplay between and the reasons for the real estate prices in Shenzhen, Dongguan and Huizhou, and carry out moderate intervention accordingly. This research provides a result of government intervention in the real estate industry in Shenzhen, Dongguan and Huizhou, which may be adopted as reference for decision making.

(3) The analysis of the interplay between real estate prices in Shenzhen, Dongguan and Huizhou, combined with relevant qualitative analysis, helps the resident sector correctly judge the future changes in the housing prices in Shenzhen, Dongguan and Huizhou, and make decisions of real estate trading accordingly. This research can provide certain reference for the common residents in property investment and buying.

(4) The research on the interplay between real estate prices in Shenzhen, Dongguan and Huizhou can not only serve to guide the practices of the industry, government and resident sectors, but also boast positive academic value and can describe the formation process and mechanism of real estate prices, which can also provide reference for the formation mechanism of the real estate prices in other cities and urban agglomerations.

1.2 Content and methodology

1.2.1 Main research content

In this dissertation focusing on the real estate prices in Shenzhen, Dongguan and Huizhou, we have analyzed the interplay between real estate prices in Shenzhen, Dongguan and Huizhou from an empirical perspective, and comprehensively analyzed Shenzhen, Dongguan and Huizhou as a whole, so as to probe into relevant strategies for industry development, government intervention and residents' property investment and buying. The main content of this dissertation consists of 7 chapters.

Chapter 1 is an introduction, which mainly includes background, purposes, significance, content and methodology of the research as well as technical routes and possible innovations.

Chapter 2 is literature review and basic theories, which involves previous research findings and relevant basic theories, such as urbanization, urban agglomeration, real estate and real estate prices, influencing factors and signal effect of real estate prices.

Chapter 3 is problem introduction and research design, which mainly includes the methodology of the influencing factors of real estate prices, the problems raised in this dissertation and the design of research approaches.

Chapter 4 is an empirical analysis of the interplay between real estate prices in Shenzhen, Dongguan and Huizhou, which mainly include Granger causality tests and VAR models in time series for building a mathematical model of the interplay.

Chapter 5 is an analysis of the reasons for the interplay between real estate prices in Shenzhen, Dongguan and Huizhou, which mainly consists of

economic, psychosocial and political reasons, in order to further clarify the internal relationship of the real estate prices in Shenzhen, Dongguan and Huizhou.

Chapter 6 is strategic recommendations based on the interplay between real estate prices in Shenzhen, Dongguan and Huizhou, where relevant countermeasures are proposed from three major aspects, i.e. industry development, government intervention, and residents' property investment and buying.

Chapter 7 is the research summary and outlook, including the main work, related conclusions, existing problems and future research directions.

1.2.1 Main methodology

(1) Empirical analysis. We build relevant mathematical models with such measuring tools as Granger causality test and vector auto-regression (VAR) model based on acquired statistical data, to analyze the interplay between real estate prices in Shenzhen, Dongguan and Huizhou and their mathematical connections, which forms an empirical research on the interplay between real estate prices in Shenzhen, Dongguan and Huizhou.

(2) Statistical analysis. We describe the interplay between real estate prices in Shenzhen, Dongguan and Huizhou in a quantitative way based on statistical data, so as to conduct statistical analysis such as time series and trend prediction.

(3) Literature review, summary and analysis. Referring to the previous research findings, we analyze the basic theories of urbanization, urban agglomeration, real estate and its prices by means of literature review, summary and analysis, and summarize and analyze non-quantitative factors of the interplay between

real estate prices in Shenzhen, Dongguan and Huizhou from such perspectives as expectation, behavior, policy regulation, and equilibrium theory.

(4) Qualitative and comparative analysis. On the basis of combining quantitative analysis, we have qualitative analysis of the reasons for the interplay between real estate prices in Shenzhen, Dongguan and Huizhou, to develop general predictions and judgments. We conduct comparative analysis of the strategies for the industry, government and resident sectors proposed based on the interplay between real estate prices, to make logical reasoning and normative research.

1.3 Technical routes and innovations

1.3.1 Technical routes

Based on the methodology and approaches, the technical routes of the dissertation can be illustrated as follows (Fig. 1):

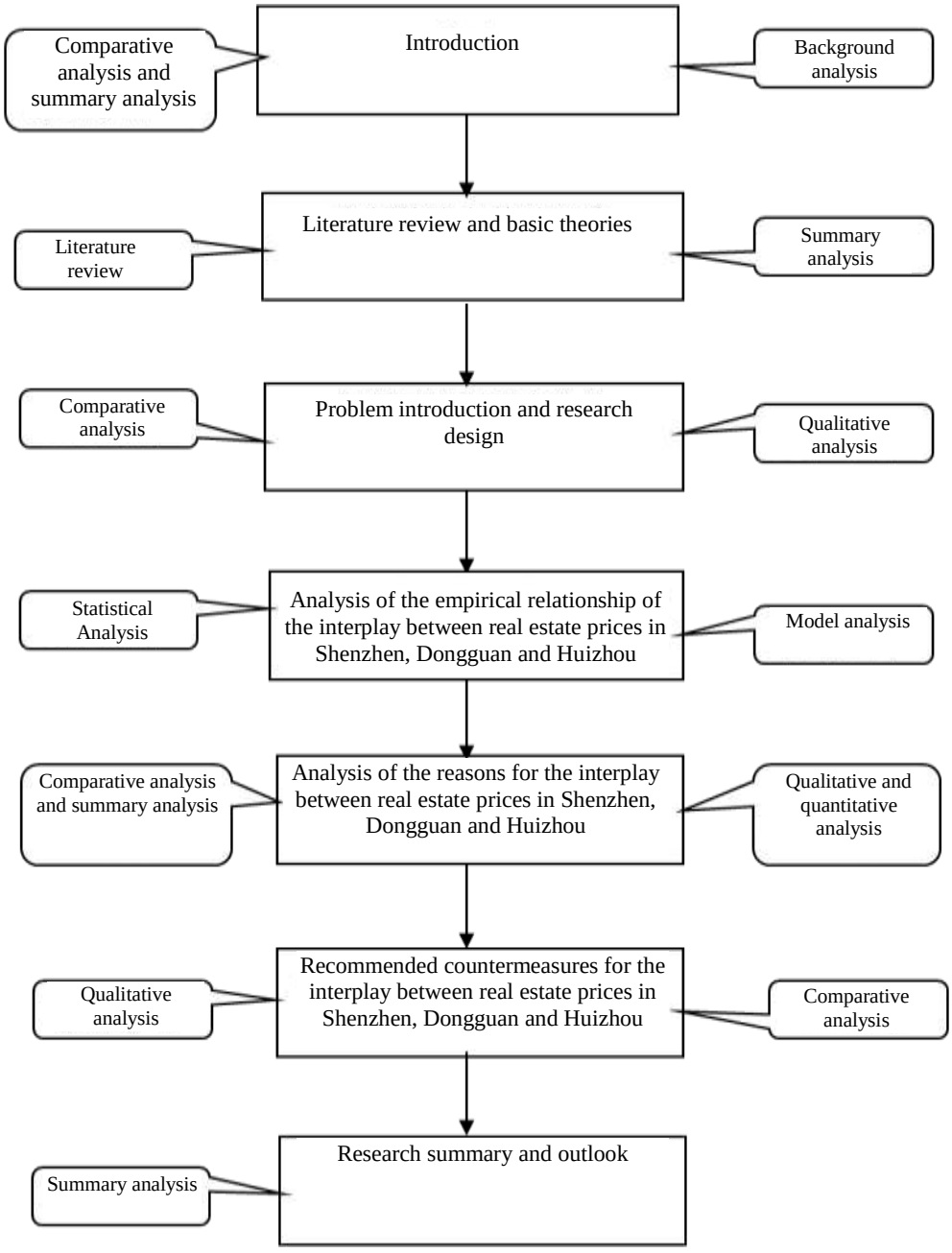


Fig. 1-1 Technical routes of the research

1.3.2 Possible innovations

Along the process of the research, possible innovations may be found from the following aspects:

The first is possible innovation in the content of the research. At present, there are few researches on the real estate prices in Shenzhen, Dongguan and Huizhou, especially regarding their interplay or a comprehensive discussion by

combining those cities as an urban agglomeration. This dissertation mainly deals with the real estate prices in the Shenzhen-Dongguan-Huizhou urban agglomeration, and fully takes the relationship of and the reasons for the interplay into account, thus presenting certain innovation in the content.

The second is possible innovation in the perspective of the research. The interplay between real estate prices in an urban agglomeration is a complex issue, involving different fields of statistics, economics, sociology and psychology. In this dissertation, we have comprehensively considered the multiple aspects of the interplay between real estate prices in Shenzhen, Dongguan and Huizhou, thus boasting certain innovation in the perspective.

The third is possible innovation in research value. Innovation in research value is what we strive for in this dissertation. Since the real estate prices in Shenzhen, Dongguan and Huizhou keep soaring in recent years, it will help provide reference and basis for industry development, government intervention and residents' property investment and buying to strengthen researches on the interplay between real estate prices in Shenzhen, Dongguan and Huizhou, so as to bring about possible innovation in research value.

Chapter 2 Basic theories and literature review

It is the urbanization in China that drives its real estate market, which was basically a blank prior to the reform and opening-up, to keep developing into what it is now. Driven by the rapid economic and social development, China's urban agglomerations are gradually emerging, and the real estate prices in the cities keep rising as a whole, so that there are more and more researches on the influencing factors of the real estate prices in cities and urban agglomerations. By means of literature review, this chapter presents previous research findings of the relevant theories of urbanization and urban agglomerations and influencing factors of real estate prices.

2.1 Urbanization and urban agglomeration

2.1.1 About urbanization

Urbanization is a long dynamic evolution. With the continuous development of urbanization in the world, the relevant theories and research findings of urbanization are also emerging. A comprehensive theory has been developed by interaction and innovation, and is being updated and improved.

According to the urban location theory, cities and towns stand for a social production mode characterized by the spatial accumulation of various material elements and material processes produced by the society. The location theory analyzes the root causes of urban benefits and determines the distribution conditions and patterns of cities (Du, 1988).

The structural theory is the basic theory accounting for urban employment structure and economic structure in the urbanization process. The dual economic structure theory originally described the coexistence of different systems, techniques and mechanisms in the early stages of development of

backward countries. Lewis (1954) believed that in a society with the characteristics of dual economic structure, the great number of low-income labor forces in the traditional agricultural sector make the labor supply fully flexible, so that the industrial sector may gain unlimited labor supply by paying wages only meeting the survival need of peasants in the traditional agricultural sector. That promotes the agricultural labor force to keep flowing into cities from rural areas, which will continue until the rural surplus labor is completely absorbed by cities, the rural wages become equal to the urban wages, the urban-rural differences gradually disappear, and the national economy is modernized. The migration theory mainly explains the basic principles of population mobility between urban and rural areas from the perspective of factors affecting urban and rural population mobility. E.G. Raven Stein (1885) suggests that the migration behavior is due to the interaction of push factors of the emigration place and pull factors of the immigration place. “Push” factors are the social, economic and natural pressures that force residents to move out; “pull” factors are the social, economic and natural gravitations that attract residents to move in(Zhang & Song, 2003) Petty-Clark Law believes that with the development of the economy, that is, with the increase in the per capita national income, the labor force is first transferred from the primary industry to the secondary industry. When the per capita national income is further increased, the labor force is transferred to the tertiary industry(Wang, 2002).

The theory of non-equilibrium growth regards the process of economic development as a structural evolution process in which different sectors grow up successively, connect with each other and exert pressure and thrust on each other. The theory expounds the non-equilibrium characteristics of regional

economic development. French economist Francois Perroux stated in 1955 that a “growth pole” was the center of economic activity formed by the collective development of leading sectors and innovative enterprises in certain regions or large cities, just like a “pole in a magnetic field”, which have gravitation or radiation, to promote itself and also drive economic growth in other sectors and regions (Cheng, 2005). G. Myrdal proposed the theory of “geographical dual economy” structure in 1957. He argued that the reason for dual economy in geography lay in the gap in economic development between various regions, and the existence of that gap was due to the existence of “spread effect” and “polarization effect”. That gap would in turn trigger a “circular cumulative causation”, where regions under rapid development develop faster with quicker urbanization, while regions under sluggish development develop slower with tardier urbanization, so that the regional economic gap would be gradually enlarged to form a regional dual economy structure as well as significant difference in the degree of urbanization (Zhao, 2015).

2.1.2 About urban agglomerations

An urban agglomeration is the highest form of spatial organization of cities that have developed to maturity. It refers to a cluster of cities within a specific geographical area, which is compactly located and closely related in economy to be highly urbanized and integrated, based on the infrastructure network, such as developed transportation and communication, and generally consists of one or more megacities as the core (compared with a small number of urban agglomerations that have multiple cores) and 3 or more metropolises as components. An urban agglomeration is a huge, multi-core and multi-level

urban group and an agglomeration of metropolitan areas that are composed of several megacities and metropolises located intensively.

From the current situation in countries in the world, the spatial structure of urban agglomerations has three main forms: The first is a group with megacities as the core, surrounded by a number of small and medium-sized cities; the second is a belt or an area with multiple cores consisting of several similarly-sized cities as centers; and the third is a metropolitan region consisting of several connected metropolitan areas and urban agglomerations, where cities are closely related to each other in terms of population and economic activities, forming a large multi-core whole.

The gradient transfer theory believed that the development of regional economy depends on the state of its industrial structure, which further depends on the regional economic sectors, especially the stage of the industrial life cycle where its leading industry is located (Yan & Yang, 2015). The flying geese paradigm proposed by a Japanese scholar is similar to the gradient transfer theory, and has been extended and applied by some scholars to explain the international division of labor, industrial structure changes, and the successive economic take-off of Asian countries centered on East Asia (Hu, 2003). The gradient transfer theory and the flying geese paradigm can well account for the relationship of industrial structure complementation and urban function coordination between central cities and flanking cities in an urban agglomeration.

Regional integrated development is an important reason for the formation of an urban agglomeration. An urban agglomeration is composed of cities at different levels. In the urban system, cities in different sizes and at different levels have

different dominant functions, and play various roles. The neighboring cities have close relationship and exchanges in such terms as personnel, capital, materials, commodities, technology and information. The functions and positioning of each city are coordinating and complementary to each other to a certain degree, to contribute to an integrated development. The integrated development of cities features connections in administration, transportation, industrial cooperation, commodity circulation, technology, information, finance, etc., and also form support in terms of infrastructure sharing, hinterland overlapping, resource complementing, and industry linkage.

An urban agglomeration is a city-region system formed in a certain geographical space with a high level of urbanization along the urbanization process, which consists of several densely distributed cities at different levels and their hinterlands through spatial interaction, with regional networked organizations as links. The emergence of an urban agglomeration is the product of the interaction between development of productivity and the gradual optimization of production factors. The development of an urban agglomeration may help achieve optimal allocation of resources in a wider scope, enhance the role of leadership and radiation, and promote the development of cities within the urban agglomeration.

2.2 Real estate and real estate prices

With the development of cities and the rapid growth of China's real estate market, theories and research findings related to real estate and real estate prices have also been increasingly enriched.

2.2.1 About real estate

As an objective form of material, real estate is the general term of house property and landed property, including land and permanent buildings on the land and the derivative rights. The house property mainly includes those for dwelling and commercial uses. The landed property mainly includes land and land capital. Land has the characteristics of usefulness, scarcity and effective social demand. Land capital is the development investment for the land to reach a certain standard of use. This kind of investment requires a certain amount of materialized labor and living labor, so it has commodity attributes.

Real estate is also called immovable property in economics because of the characteristics of its fixed and immovable position. Real estate has three forms of existence, that is, land, constructions, and house-land integration. In real estate auctions, the auction targets may also be in three forms of existence, namely, land (or land use rights), constructions and physical entities under house-land integration and its rights.

The real estate industry refers to the industry engaged in the development, operation, management and service of land and real estate. The real estate industry mainly involves: firstly, the transfer of state-owned land use rights, real estate development and redevelopment, such as land acquisition, demolition, resettlement, entrusted planning and design, organization of development and construction, redevelopment of old urban land, etc.; secondly, the real estate operation, including transfer, leasing and mortgage of land use rights and purchasing, leasing and mortgage of houses; thirdly, the real estate intermediary services, including real estate consultation, valuation, brokerage, property management, second-hand housing transactions, etc.

The regulation and management of real estate refers to the establishment of a capital market, a technology market, a labor market, and an information market for real estate, the formulation of reasonable real estate prices, and the establishment and improvement of real estate laws and regulations, in order to achieve the country's macro-control of the real estate market. China's real estate industry has been significantly affected by macroeconomic adjustments by governments at various levels.

Real estate demand refers to the number of real estate goods that real estate consumers (including production and operation consumers and individual consumers) are willing to and can buy in a certain period of time at a certain price level. The demand mentioned herein is different from the need of the common meaning, but refers to the demand with the payment ability, that is, the effective demand. From a macroeconomic point of view, real estate demand refers to the total demand of the society for the real estate market. The total amount of real estate demand in the whole society or a certain region in a certain period includes the total number of physical objects and the total amount of value.

The real estate market is a place or field for trading activities, such as sale, leasing, buying and mortgage of houses and land. The real estate includes houses, that is, residents' personal consumption materials, and also factories and office buildings that are used as production materials. Therefore, the residential property market is part of the market of livelihood means, and the non-residential property market is part of the market of production factors. Real estate is a natural commodity, so establishing and developing a market for real estate transactions is a requirement for economic operation.

The real estate market is the basic condition for the real estate industry to carry out social reproduction, and can drive the development of many industries such as construction industry and building materials industry. Through the market mechanism, the real estate market can realize the value and use value of real estate in a timely manner, improve the economic effectiveness of the real estate industry, promote the effective allocation of real estate resources and the virtuous circle of real estate construction funds. The real estate market can guide the rationalization of residents' consumption structure, which is conducive to improving living conditions and improving residents' living standards.

2.2.2 About real estate prices

The real estate price refers to the price of the constructions together with its occupied land, and is the most important adjustment mechanism for real estate economic operation and resource allocation. The real estate value is the unity of the construction value and the value of the natural resources of the land and the value of the labor invested in the land. The real estate price is the monetary presentation of that comprehensive special value.

The material composition of real estate includes the land. The original land itself is a non-labor product, with its price as the capitalization of land rent. Only the labor processed on the land can be measured by the socially necessary labor time. Therefore, real estate is not completely a labor product. Since land is scarce and cannot be regenerated, land prices are particularly affected by supply-demand relationship and geographical locations, which also affects the performance of real estate prices in different cities and regions.

Real estate prices are greatly affected by changes in real estate demand. On the one hand, the individuality of real estate makes every plot of real estate unique. It is impossible to produce the same real estate goods in large quantities because of the rising price of a certain plot of real estate. Therefore, the supply of any plot of real estate is inelastic; on the other hand, the long-term and regional characteristics of real estate construction also make the supply obviously lagging. Within a certain period, the relationship between supply and demand cannot be adjusted at any time. Any oversupply or undersupply should take a long time to adjust. Due to the limited elasticity of the supply of real estate goods, the real estate equilibrium prices are mainly determined by changes in demand. At the same time, despite the individual characteristics of real estate, alternative features, such as product, investment and speculation demands in neighboring areas, have further complicated the formation of real estate prices (Zhou, 2015).

Based on a summary of relevant economic, management and previous research findings, it is generally held that the factors affecting the formation of real estate prices mainly include the following ones:

(1) Inherent factors. The inherent factors of real estate are the most direct causes of its price. The main inherent factors include, among others, the location, geological conditions, terrain and topography, surrounding environment, planning and design, plane pattern, function, quality, appearance image, land price, cost of construction and installation.

(2) The factor of supply-demand relationship. Various factors that affect real estate prices are achieved by affecting the relationship between supply and demand of real estate. When those factors act on the real estate market and

cause oversupply, real estate prices will fall. In the case of undersupply, real estate prices will show an upward trend.

(3) Economic factors. The economic factors mainly include economic development status, residents' income level, investment level, industrial structure, employment situation, fiscal revenue and expenditure, and financial status. In the regions featuring high level of economic development, rapid economic growth, reasonable industrial structures, a high employment rate, high income levels and investment levels, more fiscal revenues and outstanding financial situation, there will be a greater demand for real estate, so that real estate prices will be higher.

(4) Social factors. The social factors include population, family, history of urban formation, urbanization and social security. On the one hand, the influence of social factors on real estate prices is quite complicated, and requires a long process, for it is penetrative. On the other hand, the influence of some social factors on real estate prices is not the same at different stages. For example, when the population transfers to a certain city, the demand for real estate will increase substantially at the beginning, which will promote the rise of real estate prices. As time goes on, too many people will accelerate the deterioration of the living environment, resulting in a decrease in real estate demand, thus decrease in real estate prices.

(5) Administrative and political factors. Administrative factors refer to systems, regulations, policies, and administrative measures. Political factors refer to the degree of political stability, political relations between countries and so on. Those two kinds of factors have more prominent effect on real estate prices, and the effect is at a relatively fast speed. For example, strengthening

government macro-control will reduce real estate demand in a short period of time, resulting in a rapid decline in real estate prices.

(6) The factor of psychological expectation. The main psychological factors that can cause changes in real estate prices include: the mindset, brand effect, personal preference and crowd psychology of buyers and sellers. Firstly, in terms of the mindset of buyers and sellers, the eagerness of the buyer in buying a house will inevitably raise the real estate price. Secondly, as for the brand effect, everyone has their own preferred developer brand, and the price of each property launched by each developer is not the same, therefore, the choice of different brands will also affect the level of real estate prices. Thirdly, in terms of personal preferences, different consumer preferences for numbers is another reason that affects real estate prices. In reality, real estate developers will differentiate prices of apartments on different floors of different buildings. For example, those with popular numbers may be priced higher. Considering the pricing strategy, many consumers still choose to buy such apartments at higher prices, though they are of the same quality. That is the effect of different personal preferences on real estate prices. Fourthly, as for the crowd psychology, because people cannot obtain real information on real estate prices, and can only judge the conditions of the real estate market by observing other people's behaviors, when they find many people buying houses, they may infer that real estate prices will rise. Such crowd psychology may greatly enhance the demand for real estate, thus pushing up the real estate price.

(7) Other factors. Supply-side indirect factors, such as real estate investment amount and interest rates of real estate loans, and demand-side indirect factors, such as total urban population and per capita disposable income, as well as

shadow prices of real estate comprehensively based on historical prices, inflation and trading behaviors, will also have a profound influence on real estate prices.

Generally speaking, those influencing factors of real estate prices can be divided into two types: quantitative and non-quantitative ones. The quantitative factors are mainly related to the economic aspect, and are the dominating factors, while the non-quantitative factors are mainly related to social, political and psychological aspects, and are in a secondary position.

The quantitative economic factors may be further subdivided into macro factors, regional factors and internal factors. The macro factors mainly include money supply in the broad sense (M2), GDP growth, urbanization rate, interest rate, exchange rate, etc. The regional factors mainly include the mutual transmission and interaction of real estate prices between adjacent cities, which is conducive to the research on the real estate price changes of urban agglomerations. The internal factors mainly include urban population growth, per capita GDP growth, construction land prices, built-up area growth, real estate investment amount, etc.

2.3 Research on the factors affecting real estate prices

The formation of real estate prices is extremely complicated, due to many influencing factors. There are also plenty relevant researches by Chinese scholars, which mainly focus on economic factors.

2.3.1 Macro factors

The macro factors that form real estate prices are mainly related to economic fundamentals. Indexes such as money supply in the broad sense (M2), GDP

growth, urbanization rate, interest rate, and exchange rate are inextricably linked with real estate prices.

Long and Wu (2003) analyzed the significant impact of population on real estate investment with a multiple linear regression model based on the statistical data of 13 large and medium-sized cities in China at the end of 2000, and proposed a macro analysis method for the evaluation of the relationship between urban real estate investment and urban agglomeration effect in China. Shang (2004) probed into the influence of macro factors on the price of construction products, and proposed that the price of construction products was closely related to the price of macroeconomic variables. If the fluctuation of macroeconomic variables occurs before the price fluctuation of construction products, the former fluctuation may be considered as a predictor for the latter fluctuation. Those macroeconomic variables include unemployment rate, investment in the construction industry, per capita national income, interest rates of bank loans, and industrial output (Shang, 2004).

Chen and Zong (2004) studied the relationship between real estate tax and residential asset prices, to find that the factors affecting residential prices include expectations of future fluctuations in residential prices. If residents expect future housing prices to rise, the housing price will rise in the current period. If there is speculation in residential transfers, coupled with uncertainty and tax factors, the asset prices will suffer from shocks. The impact of taxation on the price of residential assets has a dual mechanism, for it affects the expected appreciation of capital and the net present value of assets by changing the expectations of investors on prices, and by affecting the income flow of residential assets.

Zhao (2004) explored the relationship between exchange rates and real estate prices from the perspective of exchange rates. He believed that the reasons for the rise in China's housing prices included the fact of exchange rates. The expected appreciation of Renminbi leads to the inflow of hot money. When international floating money floods into the real estate market, foreign exchange reserves rapidly increase, meanwhile causing soaring Renminbi supply, which not only leads to inflationary pressures, but also causes rising housing prices.

Nie and Liu (2005) have adopted a variety of methods to study the relationship between housing price and monetary policy, and concluded that the effect of monetary policy changes is greater than interest rates on housing prices.

Liang and Gao (2006) adopted the time series from Q1 1999 to Q4 2005 to analyze the causes of fluctuations in China's commercial housing sales prices, and build three measuring models for indexes of commercial housing sales prices from such perspectives as supply, demand and capital, to find that the land price, the psychological expectation of housing prices, and the five-year loan interest rates have the greatest impact on housing prices in the three models. In the supply model, there is a weak negative correlation between residential investment and completed floor space and housing prices. In the demand model, there is a weak positive impact of the sales income of the residents in the towns and cities on housing prices. In the capital model, there is non-significant impact of changes in the money supply on the housing prices. At the same time, there is a weak negative correlation between loans of construction industry and real estate development funds in the current year and the housing prices. The MTV model, which comprehensively considers the influencing factors from

various aspects, shows that capital availability and demand have a strong influence on housing prices, while the supply factors exert weak influence.

Wang and Shen(2007) applied the time series data from 1994 to 2004 to study the correlation between China's RMB exchange rates and real estate prices. From a theoretical point of view, he explained that undervalued exchange rates and exchange rate adjustment will both lead to the rise of real estate prices. The empirical Granger causality test also demonstrated that land price increase caused by undervalued exchange rates would further raise housing prices.

Shi and Chen (2008) adopted the time series data from January 2001 to December 2006 to probe into determinants of real estate prices under uncertain conditions. They built a co-integration equation and a VAR model with actual commercial housing sales prices as explained variables. The empirical findings show that the impact of the real 5-year mortgage interest rate on real estate prices is statistically significant, but it is small in value, so it lacks economic significance. The shock from changes in real estate prices standing for adaptive expectations is the main factor of the rising of real estate prices. The residents' income has a small effect on the rising of real estate prices. Therefore, it can be considered to a certain extent that the current soaring of housing price in China may be due to the "adaptive expectations" of the residents, while the fundamental factors, such as residents' income and interest rates of mortgage loans, actually exert only a small influence.

Ma and Yuan (2008) established a VAR model based on 38 quarters of data from 1999 to 2008 in China. After empirical tests, they found that land prices, money supply and economic growth are all positively correlated with real estate prices.

Liu, Chen and Cheng (2009) studied the relationship between money illusion and China's urban housing valuation, and argued that Chinese investors were affected by money illusion. The long-term low nominal interest rates made investors lower their expectations for rental yields, that is, the valuation multiples were improved to make the housing market overvalued and the housing price inflate. In recent years, China's nominal interest rates have been falling, the domestic rent-to-value ratio has been decreasing, and housing prices have been inflating, so there may be money illusions in the housing market.

Luo et al. (2012) built a VAR model based on the data from 2001 to 2010, and studied the time lag of each factor with pulse diagrams and variance decomposition. They found that the previous housing prices and money supply had a greater impact on housing prices, and there is a two-way Granger causal relationship between housing prices and GDP and money supply.

Li and Li (2014) selected 83 months of data to build a VAR model of real estate prices and short-term exchange rates of international capital flows. The results show that raised housing prices will push up exchange rates, but changes in exchange rates have little effect on housing prices.

Gai (2017) established a VAR model for housing prices, exchange rates, inflation and GDP, and concluded by empirical analysis that RMB exchange rates had a long-term impact on real estate prices, and there is a transfer effect from exchange rates to real estate prices, which, however, seems lagging to a certain degree.

2.3.2 Regional factors

From the perspective of a single city or an urban agglomeration, real estate prices are more affected by regional factors. The effect of regional factors on

the real estate prices of cities and urban agglomerations is also often discussed in extant researches. There are plenty international and domestic researches related to that aspect.

Holly et al. (2011) provided a spatial and temporal diffusion analysis method for real estate price shocks in dynamic systems, and demonstrated the use of the method by using the changes in real estate prices in the UK economy. They found that the real estate prices in London were affected by the international development by connecting with New York and other financial centers, so that the housing prices in New York had a direct impact on the housing prices in London.

Gong et al. (2016) studied the spatial relationship between the 10 housing markets in the Pan-Pearl River Delta. A Granger causality test initially revealed the one-way causal effect on housing prices from the central and eastern regions to western regions in China, that is, the impact of a specific city gradually spreads to the rest cities.

Teye and Ahelegbey (2017) employed Bayesian Global Vector Autoregressive (BG-VAR) model to study the spatial and temporal relationship between housing prices in 12 provinces in the Netherlands. The results showed the evidence of time dependence and housing price diffusion model of different provincial housing markets in the Netherlands in different periods.

Ferreira et al. (2012) investigated whether transmission is an important part of the previous housing cycle, based on proprietary micro-data of the entire housing transactions in 99 metropolitan areas between 1993 and 2009. They found strong evidence for that during the booming period of real estate, but none during the recession.

Shen and Liu (2004), by means of the mixed sample regression of urban housing prices and economic fundamentals in 14 cities from 1995 to 2002, concluded that the economic fundamentals of 14 cities (including per capita disposable income of urban households, total population, unemployment rate, vacancy rate and commercial construction cost) may partly account for the price level or change rate of houses, and the model, if added with the historical housing prices, would explain the housing prices much better. Different cities have different impact characteristics, and since 1998, the economic fundamentals have played a significantly weaker role of accounting for the housing prices.

Liang and Gao (2007) used the panel data model to analyze the regional differences in real estate prices in China, and concluded that there were certain differences in credit expansion in the eastern, central and western regions, which exerts a greater impact on the real estate prices in the eastern and western regions; the interest rates had a small impact on housing prices, nearly without any regional difference; and the per capita GDP was the biggest factor affecting real estate prices, with limited regional differences.

Xu (2009) analyzed the real estate data of 35 cities in China and found that the main reason for the rising housing prices in China was the accelerating urbanization process and the growing disposable income per capita.

Yan et al. (2009) employed the time series data of Beijing from Q1 2001 to Q4 2007 to establish a co-integration equation and a vector error correction model for the average sales price of commercial housing, and studied the housing price fluctuations in Beijing. An analysis of the impact of fluctuations in fundamental factors on the short-term fluctuations in housing prices showed that the

continuous decline in housing ownership costs and the rapid increase in total income since 2005 were important reasons for the continuous increase in housing prices and the continued deviation from equilibrium.

Yu (2010) adopted the panel data of 35 major cities from 1998 to 2008 to study the main factors affecting China's housing prices, and examined the differences in the impact of economic fundamentals and real estate policies on China's housing prices, by building a panel regression model with the housing sale prices as the explained variable, and concluded that the economic fundamental variables, such as non-agricultural population, per capita disposable income, real interest rates, per capita actual use of foreign capital, and per capita housing ownership area, were basically insignificant. The model, if added with the historical housing prices, would explain the housing prices much better. Different cities have different impact characteristics, and since 1998, the economic fundamentals have played a significantly weaker role of accounting for the housing prices.

Chen and Huang (2010) analyzed the housing price interactions between the typical cities of Guangzhou, Shenzhen and Dongguan in the Pearl River Delta region by means of the VAR method, based on the realistic background of housing price linkage in different cities in the Pearl River Delta region, and found that housing prices in the three cities shared a common trend, and the interaction between the housing prices among the three cities is different in degree.

Geng (2014) empirically analyzed the relationship between real estate prices and the economic fundamentals in Beijing, and concluded that gross domestic

product and residents' disposable income Granger-caused the housing prices in Beijing.

Song and Liu (2018) focusing on 135 districts and counties in the Yangtze River Delta, found by dissimilarity index measurement that commercial housing prices increasingly differed between the districts and counties in 2014-2016, and then by a quantitative analysis based on stepwise regression and geographic weighted regression with average commercial housing prices per unit area as the dependent variable and 16 extracted influencing factors of housing prices as the independent variables, they further discovered that 7 indexes had the most significant influence on the dissimilarity of housing prices, that is, university resources, economic density, real estate policy, economic strength, public service investment, high-end practitioners and industrial structures, and that the extent of the influence from those factors on housing prices in the region had significant spatial instability.

2.3.3 Internal factors

The internal factors that form the real estate prices are mainly related to the economic and social development of a city, including such indicators as per capita GDP growth, permanent resident population, construction land area, and per capita income of residents.

Yao (2003) studied the relationship between land reserves and real estate prices. He argued that the short-term impact of land reserves on housing prices was from two aspects: Firstly, land supply prices would have an impact on housing development cost; secondly, the land supply mechanism affected the amount of real estate development, which would change the housing supply and ultimately affect the real estate price.

Kuang (2005) adopted the data from Q1 1999 to Q1 2005 in China to analyze the relationship between housing prices and land prices, and believed that China's land market was in an undersupply, in the short term, housing prices and land prices would Granger-cause each other, and in the long term, land prices would Granger-cause housing prices.

Zhang et al.(2011) probed into the impact of expected income and return on the fluctuations in housing prices, based on the panel data in 35 large and medium cities in 1999-2008, and concluded that such factors as expected income growth, expected real estate return growth and interest rates had different effects on real estate prices. Expected income growth has led to a rise in housing prices, while the expected decline in per capita real income has led to the emergence of an inflection point of housing prices. Expected real estate return growth has led to a rapid increase in housing prices. The impact of interest rates on housing prices is not very significant, due to the regulation of China's financial markets and high expected real estate returns.

Song (2015) analyzed the real estate market data of Dalian from the macro and micro aspects by establishing a VAR model and a Hedonic model, before reaching the final conclusion that the tourism development in the macro term had not notably promoted the rise of housing prices in Dalian, and that micro factors, such as greening rate, number of rooms and traffic conditions, had positive stimulating effects on real estate prices, while the floor number and healthcare status were negatively correlated with real estate prices.

2.3.4 Other factors

Chinese scholars have also carried out many researches on other factors affecting real estate prices, and the conclusions reached are of very positive significance.

Xie (2008) explored the behavioral psychological causes from the perspective of behavioral economics by means of a comparative analysis of the herd effect in China's real estate market and stock market, and argued that public expectations were the fundamental factor of herd behaviors in those two markets. At the same time, by virtue of a differential equation model, he conducted an equilibrium analysis of those two markets and provided the conditions of stability. According to the current situation of China's real estate market and stock market, he proposed that policies should be made by wisely utilizing expectations for stabilizing the market.

Kuang (2010) studied the relationship between expectations, speculation and housing price fluctuations in China. The empirical analysis of China's 35 large and medium-sized cities showed that the expectation and speculation factors could outstandingly explain the housing price fluctuations. The effect of rational expectations is less than the effect of adaptive expectations on housing prices. The speculative motives of speculators are mainly due to the level of housing prices in the previous period, so the government should mainly adjust the residents' adaptive expectations. At the same time, the impact of economic fundamentals is more important, for housing price fluctuations are more importantly influenced by economic fundamentals. Among the fundamental factors, interest rates have the greatest impact on real estate prices, and development costs are not the main factor in housing price fluctuations. What's

more, in cities with faster urbanization, housing prices also grow faster, so the government should put the degree of urbanization under control.

Zhang and Li (2016) analyzed the impact of real estate developers' price expectations on their land acquisition behavior in the market by building a land equilibrium price model, and found that the impact of housing prices on land prices was not obvious; compared with current housing prices, housing price expectations had a bit more significant impact on land prices.

2.4 The signal effect of real estate prices

Price is the most important signal of the market economy. The real estate market and the macro economy are closely connected and presented by real estate prices as signals. Chinese scholars have made abundant researches on the relationship between real estate prices and economic growth, and macro-control of real estate.

2.4.1 Connection between real estate prices and economic growth

It is generally believed that the prosperity of the real estate market can drive the demand for products in the upstream and downstream industries, and the wealth effect caused by the rise in real estate prices will also drive domestic consumption, thereby promoting economic growth. However, the excessive prosperity of the real estate market may accumulate great real estate bubbles, which will pose a great risk to the country's economy, and the bank's real estate credit will confront default risk. Once the real estate bubbles burst, the risk will be transmitted from the real estate market to the financial market, and even lead to a financial crisis, which will cause slumps in the country's consumption and investment, resulting in nationwide economic recession.

Huo (2015) conducted an empirical study on the relationship between real estate prices and economic development in China, and thought over the impact of housing price fluctuations on the Chinese economy mainly from the perspective of consumption and investment. His conclusions are as follows: The means of impact from housing price fluctuations on consumption mainly include the realized wealth effect or potential wealth effect, budget constraint effect, liquidity constraint effect, substitution effect, etc. The mechanism of transmission from housing price fluctuations to investment mainly includes "promotion effect" and "extrusion effect". Rising housing prices may lead to booming investment by residents and enterprises, increased mortgage loans, bank credit expansion, etc. But there are also phenomena of "extrusion", where funds are pouring into the real estate sector, so that the proportion of investment in other sectors is forced to shrink.

Zhao (2016) conducted an empirical study on the relationship between M2 incremental changes and real estate price volatility, and found that The M2 growth rate and the real estate price growth rate have a long-term stable positive equilibrium relationship. In the long run, the M2 growth rate plays a significant role in promoting the real estate price growth rate. In the short run, the housing price growth rate has a positive impact on the M2 growth rate. In response, the M2 growth rate is more sensitive to the impact from housing price growth rate, but there is only weak positive response.

2.4.2 Macro-control of real estate prices

Real estate regulation refers to the state intervening in the supply and demand of the real estate market by economic policies (monetary policy, credit policy, fiscal and taxation policy), laws and regulations, administrative planning and

other means, to reach the balance of the total supply and demand of real estate, rational and stable supply and demand structures, so as to promote the sound development and smooth operation of the real estate market, and realize the coordinated development of the national economy and the real estate market.

Gu and Zhang (2014) by virtue of the two major tools of monetary policy - interest rates and reserve requirement ratios, analyzed the relevance of monetary policy and real estate prices, and further analyzed the regulatory mechanism of monetary policy on real estate prices. On that basis, they conducted an empirical analysis of the control of monetary policy over real estate prices with the monthly data from 2003 to 2013 as samples. They found that interest rates Granger-caused real estate prices, but with an insignificant control effect on real estate prices, and that reserve requirement ratios also Granger-caused real estate prices, with a long-term stable positive equilibrium relationship in between, and significant control effect on real estate prices.

Zhou et al. (2017) studied the time-varying correlation between real estate price fluctuations and macro economy, and concluded that the relationship between real estate prices and macro economy had significant time-varying characteristics. Among the macroeconomic variables, the one with the greatest impact on real estate prices is the short-term interest rate, while real estate price shocks have the greatest impact on output growth in the macro economy. With the development of the real estate market, the time-point impulse response between real estate prices and macro economy gradually transforms to be of convergence and stability from the initial strong heterogeneity and volatility.

Wang (2018) conducted an empirical test on the implementation effect of real estate macro-control policies by using a VAR model and impulse response

functions, which showed that the adjustment of interest rates works for regulating housing prices, but the effect is rather limited; the land policy is effective for the regulation of housing prices, but such effect is slightly lagging; the purchase restriction policy does not play a role in reducing housing prices, but could restrain the growth rate of housing prices.

Sun (2018) probed into the relationship between banks' real estate loans and real estate prices and found that there is a long-term positive interaction between banks' credit quota and real estate prices, with a positive feedback effect. In the short term, real estate prices have a negative impact on banks' credit quota, and then the overall impact turns positive, with the turning point around the third month. In the short term, bank credit has a positive effect on housing prices. In recent years, the interaction between banks' credit quota and real estate prices in China's real estate market basically conforms to the overall situation, without any fundamental changes. In order to promote the sound development of China's real estate market, the government should adopt more prudent monetary and credit policies. At the same time, it should focus on regulating the supply and demand structure of the real estate market in policy regulation, and may curb the demand for speculative or investment house purchases by improving the real estate taxation policy.

Liu (2018) classified the differentiated credit policy into four indexes of down payment ratios, that is, no house or mortgage, mortgage without a house, a house without mortgage, and a house with outstanding mortgage, which correspond to purchasers in the real estate market with rigid demand, demand for improvement, demand for investment and demand for speculation. In addition, by combining with down payment ratios, interest rates, purchase

restrictions and other policy measures, she verified the impact of differentiated credit policies on the real estate market, and concluded that the differentiated credit policy had a significant effect on the regulation of the real estate market, and could achieve the goal of "guaranteeing rigid demand and combating speculative demand", but the impact features some regional heterogeneity.

2.5 Evaluation of relevant literatures and researches

Literature searching and analysis reveal that the interplay between real estate prices in Shenzhen, Dongguan and Huizhou has been seldom discussed in the extant researches, and it is worthwhile to further conduct non-quantitative researches on the factors affecting the real estate prices of the urban agglomeration.

(1) There is very limited researches on the interplay between real estate prices in Shenzhen, Dongguan and Huizhou. The real estate prices in the Shenzhen-Dongguan-Huizhou region, as one of the most vibrant regions in China's economic growth, also attract great attentions of the Chinese people. However, there are few researches on the real estate prices in Shenzhen, Dongguan and Huizhou, especially regarding their interplay. The main reasons are as the follows: The first reason is the hysteretic nature of researches. The real estate prices in Shenzhen witnessed soaring growth in the past two years, driving the development of real estate in Dongguan and Huizhou. Then, the academia started to adopt the interplay between real estate prices in Shenzhen, Dongguan and Huizhou as a topic of researches, but no relevant researches have been published by now. The second season is the initiative for researches. Most academic institutions and scholars lack the initiative to focus on the interplay between the real estate industries in Shenzhen, Dongguan and Huizhou.

However, I, as the author of this dissertation, wants to confirm the future development strategy of my own enterprise through this research.

(2) Relevant researches on the interplay between real estate prices in an urban agglomeration should be further probed into. Among the relevant researches on the factors affecting real estate prices, some researches, focusing on the micro level, analyzed the real estate prices of an individual property in terms of geographical location, direction, floor number, land cost, construction cost, and psychological expectations, while some researches, focusing on the macro level, analyzed the overall impact of money supply, GDP, interest rates, exchange rates, and macro-control policies on real estate prices. There are also some researches with analysis of per capita GDP, land supply and real estate investment of specific cities. Those researches are of positive reference value for revealing the influencing factors of real estate prices, but relatively speaking, there are very limited mesoscopic researches on the interplay between real estate prices in an urban agglomeration, especially for the much-talked-about region of the Shenzhen-Dongguan-Huizhou urban agglomeration. Since relevant property investment and buying must be based on price linkage, the interplay between real estate prices is worth in-depth discussion.

Based on the problems of the extant literatures and researches, this dissertation will make full use of the previous research findings under the guidance of relevant theories, comprehensively analyze the interplay of the real estate prices in Shenzhen, Dongguan and Huizhou, and provide countermeasures and suggestions for industry development, government intervention and residents' property investment and buying in Shenzhen, Dongguan and Huizhou, so as to make up for the shortcomings of the extant researches.

Chapter 3 Problem introduction and research design

In the Shenzhen-Dongguan-Huizhou urban agglomeration, an important urban agglomeration in the Pearl River Delta, the interplay between real estate prices in the three cities is highly profound with very complicated influencing mechanisms. At the same time of raising the problems, by referring to relevant methodology and analyzing the characteristics of relevant statistical data, we may establish a path for the research on the interplay between real estate prices in Shenzhen, Dongguan and Huizhou.

3.1 Problem introduction

3.1.1 The emergence of the Shenzhen-Dongguan-Huizhou urban agglomeration

(1) Overview of Shenzhen City

Shenzhen is located in the southern part of Guangdong Province, on the east bank of the Pearl River Estuary, separated from Hong Kong by water. On the east of Daya Bay and Dapeng Bay, and the west of the Pearl River Estuary and Lingdingyang Estuary, Shenzhen connects with Hong Kong across the Shenzhen River and borders Dongguan and Huizhou in the north. The city has jurisdiction over 9 administrative districts and 1 new district with a total area of 1,997.47 square kilometers. As of the end of 2017, the permanent resident population of Shenzhen recorded 12.528 million, of which the registered population was 4,347,200, the actual population under management was over 20 million, and the urbanization rate reached 100%.

Shenzhen, or “Shen” for short, also known as “Pengcheng”, is one of the four first-tier cities in China, a provincially administered municipality in Guangdong Province, a city specifically designated in the state plan, a sub-provincial city, a national regional center and a mega-city. It is designated by the State Council

to be a national economic center, an international city, a national innovative city, an international center of technology industry innovations, a global ocean center, an international integrated transportation hub, and one of China's three national financial centers.

As the first special economic zone established in China, Shenzhen is the bridgehead of China's reform and opening up and an emerging immigrant city. It has developed into a highly influential international and modern metropolis, creating the world-renowned “Shenzhen speed” and won such titles as “the city of design”, “the city of fashion”, “the city of entrepreneurs” and “the city of volunteers”.

Located at the forefront of the Pearl River Delta, Shenzhen is a link and bridge connecting Hong Kong and the Chinese Mainland. It plays an important role in multiple sectors of China, including high-tech industries, financial services, foreign trades, marine transportation, and creative culture, and shoulders the important mission of experimentation and demonstration of institutional innovation and further opening up in China. With a full range of water, land and air ports, Shenzhen is the port city boasting the largest number of ports, the largest number of entry and exit people, and the largest traffic volume in China. In 2017, the GDP of Shenzhen recorded RMB 2,243.84 billion yuan, an increase of 8.8% over the previous year. The per capita GDP reached RMB 183,127 yuan, an increase of 4.0%, converted to US $27,123 according to the average exchange rate in 2017. As one of the economic centers in China, Shenzhen has a total economic aggregate ranking fourth among cities in the Chines Mainland for a long time and is one of the most economically effective

cities in the Chinese Mainland. The World's Most Economically Powerful Cities in 2012 by The Economist inscribed Shenzhen in the second place.

(2) Overview of Dongguan City

Dongguan is a prefecture-level city in Guangdong Province, also known as "Guancheng". It is one of the five prefecture-level cities in the country that do not have districts. It is located in the southeast of Guangzhou, on the east bank of the Pearl River Estuary, and adjacent to Shenzhen in the south. It has such honorary titles as the land of Cantonese opera, a music city, a city of science and technology, a city of museums, a national forest city, an international garden city, a national civilized city and a national basketball city. It is an important transportation hub and foreign trade port in Guangdong.

With more than 1,700 years of history as an ancient county, Dongguan is the important birthplace of Lingnan (south of the Five Ridges) civilization, a place where the modern Chinese history was unfolded and the reform and opening up was first implemented. As an important transportation hub and foreign trade port in Guangdong, Shenzhen is recognized as the leading city of the "Four Tigers in Guangdong", and is known as the "world factory". It is listed as one of the first national comprehensive pilot areas of new-type urbanization and a famous historical and cultural city in Guangdong. Dongguan has about 1.2 million compatriots from Hong Kong and Macao, and is a famous hometown of overseas Chinese, for it has about 300,000 overseas Chinese.

Dongguan, a city known for its manufacturing, is meanwhile vigorously implementing five projects of "clear water, blue sky, green land, livability and green GDP", to achieve a forest coverage rate of 36.7% and a greening rate of 98.7%. It is striving for win-win achievements in both economic development

and environmental protection. In 2018, Dongguan won the 24th place in “China's Best Cities for Business in 2018”, the 5th place in “Best Prefecture-level Cities in Chinese Mainland in 2018” and the 7th place in “30 Most Innovative Cities”.

In 2017, Dongguan's gross domestic product (GDP) recorded RMB 758.21 billion yuan, an increase of 8.1% over the previous year; the per capita GDP was RMB 91,329 yuan, up by 7.5%, which can be converted to US $13,527 at the average exchange rate. It ranked the 24th in the “Top 100 Cities in China 2017”.

(3) Overview of Huizhou City

Located in front of Luofu Mountain, south to Daya Bay, with more than 100 kilometers of the Dongjiang River, Huizhou belongs to the east bank of the Pearl River Delta and the Guangdong-Hong Kong-Macao Greater Bay Area. It is adjacent to Shenzhen and Hong Kong, connecting with Heyuan City in the north and Shanwei City in the east, and neighboring Dongguan City and Guangzhou City in the west. It is one of the central cities in the Pearl River Delta. Huizhou has jurisdiction over Huicheng District, Huiyang District, Huidong County, Boluo County and Longmen County. It has two state-level development zones: Zhongkai High-tech Industrial Development Zone and Daya Bay Economic and Technological Development Zone.

As a key development area in Guangdong Province, Huizhou witnessed rapid economic growth, and has become an emerging industrialized city in the east of the Pearl River Delta. Huizhou is the world’s largest production base for telephones, color TV and laser heads, and Asia’s largest audio system production base, and one of China’s largest production bases for car audio,

DVD and mobile phones. It has cultivated many well-known companies, such as TCL, Desay, Adayo, Cosun and Virtue.

In 2017, Huizhou City's GDP was initially accounted for RMB 383.06 billion yuan, ranking fifth in Guangdong Province, up 7.6% year-on-year. The per capita GDP is RMB 80,205 yuan, which is converted to US $11,879 at the average exchange rate.

(4) Integrated development of Shenzhen, Dongguan and Huizhou and the formation of the urban agglomeration

Shenzhen, Dongguan and Huizhou share a deep connection in their origin, for they all belonged to Huiyang before 1979. After being demarcated as one of the first special economic zones in China in 1979, Shenzhen was separated from Huizhou, and in 1988, Dongguan was also separated from Huizhou to become an independent city. With the economic and social development of the three cities, the re-integrated development of Shenzhen, Dongguan and Huizhou has gradually been put on the agenda.

In December 2008, the Outlines for Reform and Development Planning of Pearl River Delta Region (the Sate Council, 2008) was officially approved, to demarcate several economic circles, and first propose the concept of integrated development of Shenzhen, Dongguan and Huizhou.

On February 27, 2009, a joint conference was held by the three cities in Shenzhen to sign the Framework Agreement on Promoting Close Regional Cooperation in the East Coast of the Pearl River Estuary (People's Government of Guangdong Province,2009). The agreement stipulated the principles, content and objectives of future cooperation among the three cities. The conference also established a joint conference system for the main leaders of party and

government administration of the three cities. The three parties also agreed to hold at least one joint conference every six months to discuss about major issues in the cooperation.

On May 16, 2009, the second joint conference of Shenzhen, Dongguan and Huizhou was held in Dongguan. In the conference, the mayors of the three cities signed a package agreements and plans, about recent key work for promoting close cooperation on the east bank of the Pearl River Estuary, comprehensive management of border and cross-border rivers, border road construction and connection, cooperation on cross-border passenger transport bus operation. The integration process of Shenzhen, Dongguan and Huizhou has gained breakthroughs.

On September 24, 2009, the third joint conference of the integration of Shenzhen, Dongguan and Huizhou was held in Huizhou. The mayors of the three cities signed a package documents, including the agreement on integrated cooperation planning, the framework agreement of integrated social public services, the supplemental agreement on transportation integration, and the regulations for special groups of comprehensive management of border and cross-border rivers. The integration of Shenzhen, Dongguan and Huizhou has been deepening along pragmatic cooperation.

In March 2011, the second joint conference for transportation integration of Shenzhen, Dongguan and Huizhou was held in Dongguan, where the transportation departments of the three cities again finalized the transportation cooperation projects for next few years, which covers planning, establishment, road network connection, inter-city buses, annual ticket connection and joint law enforcement.

In April 2011, the fifth joint conference of Shenzhen, Dongguan and Huizhou was held, where such documents were signed as the Framework Agreement of Cooperation Planning for Pingdi-Xinwei-Qingxi Region on the Border of Shenzhen, Dongguan and Huizhou(2011), the Agreement on the Industrial Development Cooperation(2011), the Framework Agreement on Information Cooperation(2011), and the Supplemental Agreement III for Promoting Transportation Integration(2011). The Memorandum for Strengthening the Cooperation between Shenzhen and Huizhou (2011) was also entered into by Shenzhen and Huizhou. It is stated in the conference that the integrated development of the east bank of the Pearl River Estuary has ushered a new prospect and laid a good foundation.

In May 2012, the sixth joint conference of Shenzhen, Dongguan and Huizhou was held in Huizhou City. The main party and government leaders of the three cities jointly reviewed and identified nine key issues to be jointly promoted in the near future, and signed four cooperation agreements to further promote the integration of Shenzhen, Dongguan and Huizhou. The conference has reviewed and determined the priorities for the near future that should be jointly promoted by Shenzhen, Dongguan and Huizhou, involving 9 aspects including flood control of cross-border rivers, joint pollution control and prevention mechanism, cooperation between Dongguan and Huizhou to build a subdivided park for industrial transfer, construction of the Daya Bay coastal tourism economic zone, joint promotion of the new energy vehicles, and joint construction of cooperation mechanisms for labor supervision and law enforcement in Shenzhen, Dongguan and Huizhou.

In August 2013, the seventh joint conference held by the main leaders of the party and government of Shenzhen, Dongguan and Huizhou reviewed and approved the Master Plan of Regional Coordinated Development in Shenzhen, Dongguan and Huizhou (2012-2020) and 13 key tasks recently promoted by the three cities, and signed four cooperation agreements, including the construction of the auto part industry, marking that the cooperation between the three cities has embraced a new stage of further expanding and comprehensively deepening. In October 2014, the economic circle of Shenzhen, Dongguan and Huizhou was expanded, to engage Shanwei City and Heyuan in the construction in the "3+2" mode (Shenzhen, Dongguan and Huizhou + Shanwei and Heyuan), which not only doubled the area of the economic circle of Shenzhen, Dongguan and Huizhou, but also expanded the economic circle to account for nearly 40% of the economic aggregate of the whole province.

(5) Establishment of the national strategy of the Guangdong-Hong Kong-Macao Greater Bay Area

In 2009, the Research on the Coordinated Development Planning of Urban Agglomerations of the Greater Pearl River Delta (People's Government of GuangDong Province et al. 2009) was completed, which listed the *Bay Area Development Plan* as part of the overall layout and coordination plan, and proposed four follow-up projects, namely cross-border transportation cooperation, cross-border regional cooperation, cooperation on ecological and environmental protection and coordination mechanism construction.

In 2010, the governments of Guangdong, Hong Kong and Macao jointly formulated the Key Action Plan for the Livable Bay Area around the Pearl

River Delta (People's Government of GuangDong Province et al. 2009) to implement the above-mentioned cross-border regional cooperation.

In 2016, Guangdong Provincial Government proposed in Report on the Work of the Government Delivered at the fourth Session of the 12th Guangdong Provincial People's Congress on January 25, 2016 that "to carry out the urban upgrading of the Pearl River Delta, and join hands with Hong Kong and Macao to build the Guangdong-Hong Kong-Macao Greater Bay Area" (People's Government of Guangdong Province, 2016, n.p.).

In the Fifth Session of the 12th National People's Congress held on March 5, 2017, Premier Li Keqiang said in the government work report that we should further promote the cooperation between Hong Kong and Macao and the Chinese Mainland, formulate a development plan for the urban agglomeration of the Guangdong-Hong Kong-Macao Greater Bay Area, and take the unique advantages of Hong Kong and Macao to enhance the bay area's status and role in the national economic development and opening up.

On July 1, 2017, the Framework Agreement on Deepening Guangdong-Hong Kong-Macao Cooperation in the Development of the Greater Bay Area was signed in Hong Kong. President Xi Jinping attended the signing ceremony.

On January 19, 2018, Guangdong Provincial Development and Reform Commission initiated the preparation of the intercity railway construction plan for the Guangdong-Hong Kong-Macao Greater Bay Area, to promote the construction of "loop + radiation lines" of the Pearl River Delta intercity railway network and improve the intercity railway network around the Bay Area. In the future, the Guangdong-Hong Kong-Macao Greater Bay Area will be benefited from a "one-hour urban railway circle".

On October 24, 2018, Hong Kong-Zhuhai-Macao Bridge was officially opened to traffic.

On February 18, 2019, the Chinese government formally issued the Development Plan for Guangdong-Hong Kong-Macao Greater Bay Area. As the Guangdong-Hong Kong-Macao Greater Bay Area has been upgraded as a national strategy, it is specified in the Planning for New-type Urbanization in Guangdong Province (2016-2020) to build three new urban areas, basically consisting of "Guangzhou, Foshan and Zhaoqing + Qingyuan, Yunfu and Shaoguan", "Shenzhen, Dongguan and Huizhou + Heyuan and Shanwei" and "Zhuhai, Zhongshan and Jiangmen + Yangjiang". Among them, the concept of "Shenzhen-Dongguan-Huizhou metropolitan area" was first proposed, marking the official establishment of the Shenzhen-Dongguan-Huizhou urban agglomeration (metropolitan area).

3.1.2 Development of the real estate industry in Shenzhen, Dongguan and Huizhou

(1) The situation in Shenzhen

Since the reform and opening up, Shenzhen has emerged as a new modern city, with its real estate development always at the forefront of the country. It can be said that Shenzhen is one of the earliest cities witnessing development of the real estate industry in China.

Prior to 1998, China mainly implemented the policy of welfare housing allocation, and the real estate market was underdeveloped. Therefore, the development process of the real estate industry in Shenzhen may be roughly divided into two stages. The first stage is from the beginning of the reform and opening up to 1998, when the demand for real estate was in fact low due to

influence from the welfare housing allocation system, although the real estate market had developed to a certain extent. At the same time, the real estate industry in Shenzhen became the first to implement many initiatives:

In 1981, Shenzhen Municipal Real Estate Administration drew from the advanced experience of Hong Kong to establish the first property management company in China - Shenzhen Property Management Co., Ltd., to break through the welfare housing management mode for over more than 30 years.

In November 1985, the OCT project was commenced. Over the land of 4.8 square kilometers, a number of landmarks of Shenzhen were completed, including the Windows of the World, Splendid China Folk Culture Village, Happy Valley and Konka Group, to form a new model of tourism plus real estate of the special economic zone.

On December 1, 1987, Shenzhen took the lead to make the "first deal of land auction" in China. The right to use a commercial residential land with an area of 8,588 square meters with the parcel number H409-4 was transferred to Shenzhen Special Economic Zone Real Estate& Properties (Group) Co., Ltd. for the first time by means of public bidding. The land was priced RMB 5.25 million yuan, and the term of use was 50 years. The public bidding marked the official formation of China's land use rights compensation and market allocation system of land resources in both theory and practice. It stimulated the land auction market in Shenzhen and even across the country, and realized significant theoretical and practical breakthroughs in the land management system in China.

On December 28, 1988, China's first real estate agent Shenzhen International Real Estate Consulting Co., Ltd. was established. The birth of the real estate

agent has promoted the improvement of China's real estate industry chain and promoted the circulation and development of the entire real estate industry.

In August 1989, Shenzhen Property Exchange was formally established.

In May 1991, Shenzhen Real Estate Auction Company hosted the first public auction of mortgaged property in the city and even in the country.

On September 1, 1997, the initial registration system of real estate was put into trial use in Shenzhen.

The second stage is from the official end of the welfare housing system in 1998 to the present, when the real estate industry has developed into one of the most important industries of the national economy. The real estate industry in Shenzhen has thus entered the prime of the fastest development. Although such industries as high-tech, finance, logistics and culture have become the main pillar industries in Shenzhen in recent years, the real estate market still boasts high-level maturity and value. During the stage:

From 1998 to 2002, the real estate industry gradually became market-oriented and standardized. In 1998, the State Council approved and forwarded the Opinions on Strengthening Real Estate Price Regulation and Accelerating Housing Construction by the State Development Planning Commission, which specified that all units in China should currently suspend the housing allocation system, and accelerate the reform of commercialization of real estate and housing. From then on, housing became a focus of expenditure of Chinese residents, and the real estate industry has also become an important aspect of the economic growth of Shenzhen.

From 2002 to 2005, the real estate market progressed steadily. After the rapid development stage of the real estate in Shenzhen, the pre-sale area approved in

2002 reached a peak of 9,614,200 m^2. With the rapid development of the real estate industry, such problems as expensive housing prices and unreasonable structure and supply attracted general attentions from the society for the real estate industry. After 2004, with the further intensified national macro-control policies and the implementation of the national "Eight Control Regulations on House Prices" the local "Ban on Pre-sale" in Shenzhen, the soaring trend of real estate prices in Shenzhen was thus initially curbed.

From 2005 to 2007, affected by residents' strong demand for real estate, the housing prices in Shenzhen rose by about 5% per year after 2005. After 2006, with the further implementation of the government's control policy of real estate prices, the national government has launched several real estate control policies for the structural imbalances in the real estate industry, including the Six Control Regulations on House Prices, and the 15 Control Regulations by Nine Ministries and Commissions. The influence of those policies was not reflected in the year when they were promulgated, and played their role since 2007.

In the mid 2007 to 2012, in response to the rapid rise in real estate prices, the Chinese government strengthened the regulation and control over the real estate, and at the same time, began to adjust the market order of the real estate industry. The Shenzhen Municipal Government also promulgated various comprehensive control measures, for example the ten rectification measures for the real estate market launched by the original Shenzhen Land and Property Bureau in 2007, and started a special rectification campaign for real estate transaction order in the city, so that the housing prices began to have a rational return. The relatively sluggish real estate market and land trading market from

2009 to 2011 also put a lot of pressure on local governments, while the long-term market downturn also caused residents to overestimate the trend of real estate prices.

In 2012-2017, as China intensified investment in driving economic growth, the real estate industry has developed rapidly, and the real estate market has risen rapidly in Shenzhen and seems to maintain the high level of prices.

(2) The situation in Dongguan

The real estate industry in Dongguan began to develop in the 1990s, with a short-term glory in 1992-1994. The earliest commercial houses in Dongguan included Bubugao, Venture New Village and Garden New Village. After a period, in the favorable conditions, the real estate market in Dongguan attracted numerous investors, and Zhangmutou Town became the famous "small Hong Kong". In 1995, affected by the national regulatory policies, the real estate market in Dongguan gradually embraced an adjustment period. In 1997, it was badly hit by the financial crisis in Asia, when investors and capital from Hong Kong were forced out from the real estate market of Dongguan.

From 1998 to now, with the continuous economic prosperity, the real estate industry in Dongguan has developed steadily. It has ushered the time of "commercial housing" from the time of the "houses built for personal use", developed from a small town on the border to a metropolis, and from dominance by local developers to the trend of diversified developers.

In 1999, after the real estate market in Dongguan calmed down to an adjustment period, the "housing system reform" was implemented in Dongguan. Dongguan took the lead to carry out the open auction system of land and officially

launched the housing provident fund system, so that the real estate industry entered a new speed-up period.

In 2001, Dongguan officially launched the city-building movement, following the principles of "building the city, building roads, improving mountains, and controlling water" to plan and design the city as a whole.

In 2003, Dongguan ushered in the first year of commercial real estate, and the structure of the housing market had also undergone quiet changes. The large and medium-sized units became unsalable, while small-sized apartments were developed like mushrooms after rain.

In 2004, developers from Shenzhen entered Dongguan. Vanke successfully won a plot numbered 2004G002, marking its official operations in Dongguan. Real estate companies from Shenzhen, such as Futong Group, Shenzhen Construction Group, Jinzhong Group, Shenye Real Estate, Shenzhen International Investment, Zhongxi Real Estate, Zhengzhong Real Estate, and Greater China Real Estate, have successively won land in Dongguan and started to show their capabilities.

In 2005-2007, the real estate in Dongguan ushered in a rising period, when small-sized apartments in the city were "plundered", attracting a large number of investors from Shenzhen.

In 2008, the real estate in Dongguan witnessed the first winter. After the central government successively introduced tight monetary policies, including raising the interest rate, the real economy of Dongguan was damaged. Many factory owners who invested in real estate began to sell their properties in exchange for funds due to liquidation of their factories.

In 2009-2013, with the adjustment of the central credit policy, the real estate in Dongguan once again entered the upward channel, with housing prices rising steadily, and the volume of transactions expanding continuously.

In 2014-2017, as the restrictions on purchases in Shenzhen and Guangzhou became stricter, investors from neighboring cities continued to invade in Dongguan, causing the real estate prices in Dongguan to keep rising to a high-level and mature stage.

(3) The situation in Huizhou

The real estate industry in Huizhou started earlier. In 1989, it had experienced a real estate bubble. At that time, welfare housing was the main channel for residents to obtain houses. There were few buyers of completely market-oriented commercial housing, thus causing the situation of oversupply.

From 1994 to 1996, due to imperfect infrastructure and facilities, the real estate market in Huizhou suffered from another overstock. The fact that houses were seldom pursued become the biggest trouble for real estate developers.

In 1998, after the end of the welfare housing system, the real estate market in Huizhou was gradually cultivated. The local real estate enterprises started to enclose land and expand greatly, to seize the opportunity. They expanded their land in a simple and rude manner to advance towards the farther urban border.

In 2004, the real estate industry in Huizhou embraced a period of rapid development. Shenzhen's residents and real estate enterprises began to enter Huizhou. Famous brands, such as R&F Group, Vanke Group, Poly Real Estate and Agile Property, entered Huizhou successively to initiate the booming development of the real estate industry in Huizhou contributed by various developers.

In 2007, stimulated by the merchants from Shenzhen, the housing prices in Huizhou continued to rise. In 2007, the average pre-sale price of commercial housing in Huizhou was RMB 4,732 yuan/m^2, up by 70% compared with RMB 2,943 yuan/m^2 in 2006.

In 2008, the national regulation began to take effect. Under the influence of the financial crisis, the transaction fell sharply, and the average price in the first half fell to 3,631 yuan/m^2.

In 2009-2013, the real estate industry in Huizhou was subject to a certain period of regulation, but the housing prices still rose steadily. In the face of the risk of economic downturn, the central government introduced policies to save the market in the second half of 2008, and the market stopped falling immediately. In 2009, the housing prices increased steadily, to be basically around RMB 5,000 yuan/m^2. In 2010, the most stringent regulation of the "Ten Control Regulations on House Prices" was introduced, but the market did not immediately shut down. In 2011, the central bank continued to tighten the monetary policy, so that the real estate market in Huizhou became tepid with slightly rising transaction volume and average prices. In 2012, the regulation continued, to control the average transaction price of the year at 5,763 yuan/m^2, up 5.2% year-on-year. In 2013, the total transaction in Huizhou recorded 105,862 units, with the average transaction price of 5,762 yuan/m^2, and a total transaction area up 65.3% compared to that in the same period in 2012.

In 2014-2015, Huizhou ushered in the period of loose policy with continuous favorable conditions for loans. In the two years, the benchmark interest rate was lowered for 6 times, from 6.55% on July 6, 2012 down to 4.9%. In 2014, the total transaction in Huizhou recorded 78,943 units, at the average transaction

price of 5,950 yuan/m^2. In the second half of 2015, affected by the situation in Shenzhen, the transaction volume in the region close to Shenzhen embraced an explosive growth. In 2015, the average transaction price in Huizhou was 6,372 yuan/m^2, up 7.09% compared with that in the same period of 2014.

The year of 2016 was a brilliant time in the history of the real estate in Huizhou. That year, Huizhou raised the top 20 standards of performance indicators to RMB 1.2 billion yuan, and the RMB 2 billion yuan club expanded from 7 to 13 companies. For the first time, there were giants selling over RMB 10 billion yuan, and also the miracle of over RMB 10 billion yuan sales by a single property. In 2016, the total residential transactions recorded 155,896 units in Huizhou, up 44,941 units compared to 110,955 units in 2015, with an increase of 40.5%. In 2016, Shenzhen investors rushed into the Huizhou market, to raise the products originally priced RMB 5,000-6,000 yuan/m^2 to over RMB 10,000 yuan.

In 2017, regulations were implemented again, to stabilize the housing prices with slight increases. The regulatory policy then seemed to be more stringent. There were not only the traditional restrictions on purchases, loans and prices, but also newly invented restrictions on sales, that is, houses could only be sold after 2 or 3 years of ownership. Although the housing prices stopped soaring, they did not show any downward trend. The unit prices were generally over RMB 10,000, and the unit prices of the bay area in Huizhou was nearly RMB 20,000 yuan. Unlimited purchases made Huizhou a highly sought-after city among people from other places. According to statistics from the China Index Academy, the housing price in Huizhou in June 2017 recorded 11,424 yuan/m^2. In the first half of 2017, the total transaction of newly built houses in Huizhou

was 63,049 units, down 24.6% compared with 84,722 units in the first half of 2016.

(4) Comparison of the real estate prices in Shenzhen, Dongguan and Huizhou in 2003-2017

After inquiry, the data including real estate prices, investment in real estate, and permanent resident population in Shenzhen, Dongguan and Huizhou in 2003-2017 are shown in the following table (Table 3-1).

Table 3-1 Comparison of the real estate prices and other data in Shenzhen, Dongguan and Huizhou in 2003-2017

	Shenzhen - Real estate price (yuan)	Shenzhen-Investment in real estate development (100 million yuan)	Shenzhen - Permanent resident population (10,000 people)	Dongguan - Real estate price (yuan)	Dongguan-Investment in real estate development (100 million yuan)	Dongguan-Permanent resident population (10,000 people)	Huizhou - Real estate price (yuan)	Huizhou - Investment in real estate development (100 million yuan)	Huizhou - Permanent resident population (10,000 people)
2003	5879	410	557	2970	33	581	2017	19	355
2004	6419	432	598	3332	67	595	2357	29	362
2005	6964	419	828	4012	144	651	2591	44	371
2006	9055	640	846	5488	164	675	2943	68	376
2007	13417	461	862	6240	209	695	4632	138	388
2008	12655	440	877	6235	270	695	4557	187	393
2009	14975	437	891	7083	278	635	5176	175	398
2010	20106	458	1037	7990	299	423	5839	268	463
2011	18984	590	1047	8971	374	825	6722	378	465
2012	18906	737	1055	8841	377	829	6330	482	467
2013	21626	888	1063	9325	498	832	6666	594	470
2014	23973	1069	1078	9354	588	834	6538	667	473
2015	33426	1331	1138	9667	575	825	6863	610	476
2016	53454	1757	1191	14207	643	826	9862	748	478

2017	54445	2136	1253	14921	702	834	10207	884	478

Note. Data for Real Estate Price and Investment in Real Estate Development in Shenzhen, Dongguan and Huizhou adapted from from Choice Database (2019), for Permanent Resident Populationin in Shenzhen, Dongguan and Huizhou adapted from Shenzhen Statistical Yearbook (2018), Dongguan Statistical Yearbook (2018) and Huizhou Statistical Yearbook (2018).

According to Table 3-1, the real estate prices, investment in real estate development and permanent resident population in Shenzhen, Dongguan and Huizhou have gradually increased as time goes by, reflecting the development characteristics of the real estate industry in Shenzhen, Dongguan and Huizhou.

3.1.3 Raising of problems in this dissertation

Driven by the integrated development of Shenzhen, Dongguan and Huizhou, especially by the national strategy of the Guangdong-Hong Kong-Macao Greater Bay Area, the Shenzhen-Dongguan-Huizhou urban agglomeration became increasingly connected. The real estate industries in those cities are characterized by coordinated and rapid development, and the real estate prices also keep rising along the long-term fluctuations.

At present, the development of the Shenzhen-Dongguan-Huizhou urban agglomeration faces complex internal and external contexts: Firstly, the trend of integrated development of Shenzhen, Dongguan and Huizhou is becoming increasingly obvious. The construction of the Guangdong-Hong Kong-Macao Greater Bay Area has been escalated to be a national strategy, which is bound to exert a positive impact on the long-term development of the Shenzhen-Dongguan-Huizhou urban agglomeration. Secondly, Shenzhen and its radiated cities like Dongguan and Huizhou are clusters of China's high-tech industry with highly active innovation and entrepreneurship. But in the context of the

current China-US trade war, China’s shortcoming of chips, and export slowdown, it is rather worrisome whether the long-term economic growth could be maintained. At the same time, some believed that China's high-tech industry was squeezed by the real estate industry, and “the real estate has kidnapped the real economy”, which caused China's high-tech industry to be bound by the core technology of developed countries. In the future, in order to change that situation, the real estate industry must be suppressed, to free more innovative talents from heavy burden of high housing prices, and instead enable them to work and live more freely, easily and peacefully, so as to stimulate their innovation vitality. Thirdly, the Shenzhen-Dongguan-Huizhou region is deeply affected by Hong Kong in terms of its free trade, industrial development and financial stability. However, the recent increase in interest rates of US dollar and Renminbi deleveraging have caused the depreciation of Hong Kong dollar and foreign investment outflows. Intentional or unintentional “short-selling” in Hong Kong is bound to lead to a decline in the real estate and other industries in Hong Kong, which in turn may be transmitted to Shenzhen, Dongguan and Huizhou and even the entire Pearl River Delta region.

It can be found that the development of the Shenzhen-Dongguan-Huizhou urban agglomeration faces both enormous opportunities and profound challenges. As an important component of the urban industry, the real estate industry plays a huge role in stimulating related industries. At the same time, it is undeniable that it has a certain “extrusion effect” on high-tech industries. The problem how the real estate industry in Shenzhen-Dongguan-Huizhou urban agglomeration will develop and evolve in the future indeed attracts great attentions from numerous people. Price is the most important signal of the real

estate market. To study the development of the real estate industry, we should first probe into the real estate prices.

This dissertation focuses on the interplay between real estate prices in Shenzhen, Dongguan and Huizhou, with the purposes of clarifying the influence mechanism and change trend of the real estate prices in Shenzhen, Dongguan and Huizhou, helping industry, government and resident sectors to better cope with the changes in the future, and promoting industrial coordination and continued prosperity of the Shenzhen-Dongguan-Huizhou urban agglomeration. Generally speaking, the real estate prices in Shenzhen, Dongguan and Huizhou are indeed at a high level, but the formation of the prices is obviously significantly affected by such factors as the overall macro context, Shenzhen-Hong Kong linkage, and the small area of Shenzhen. If those factors do not change greatly, the trend and magnitude of real estate price changes will not be expanded. Therefore, it is crucial for the decision making by the government, industry and residents to clarify the impact of the interaction of the real estate prices in Shenzhen, Dongguan and Huizhou on Shenzhen, especially sub-central cities such as Dongguan and Huizhou, through the research on the interplay between real estate prices in Shenzhen, Dongguan and Huizhou.

Therefore, this research includes the following guiding problems:

(1) What is the interplay between the prices in Shenzhen, Dongguan and Huizhou? Is there a time lag?

(2) How do the reasons for the interplay between real estate prices in Shenzhen, Dongguan and Huizhou function in economic, psychosocial and political terms?

(3) How should the industry, government and resident sectors respond to the impact and changes in the real estate prices in Shenzhen, Dongguan and Huizhou?

3.2 Methodology reference and data sources

3.2.1 Methodology reference

We may find from the above literature review that the previous researches on real estate prices mainly adopted the multivariable linear regression model, VAR model, Granger causality test, time series data analysis, co-integration equation and vector error correction model. Some of the commonly used methods in the analysis of the influencing factors of real estate prices will be analyzed in the following text.

Multivariable Linear Regression Model In practical economic problems, a variable is often influenced by multiple variables, and the optimal combination of multiple independent variables is used to jointly predict or estimate the dependent variables, thereby forming a multivariable linear regression model. Real estate prices are affected by multiple influencing factors. Therefore, when analyzing the influencing factors of real estate prices, multivariable linear regression models are often employed. For example, Long and Wu (2003) analyzed the significant influence of population on real estate investment by means of a multivariable linear regression model.

The VAR model is a commonly used econometric model that uses all the current variables in the model to regress several lag variables of all variables. It can be used to estimate the dynamic relationship of the joint endogenous variables without any prior constraints, so that the univariate autoregressive model is generalized to a “vector” auto-regression model consisting of multiple

time series variables. Some time series may have explosive properties, so when building a VAR model, you should pay attention: (1) whether there is a co-explosive possibility; (2) whether there is a possibility of spurious regression. The VAR model is widely used in the analysis of the influencing factors of real estate prices. For example, Ma and Yuan (2008) concluded that land prices, money supply and economic growth are positively correlated with real estate prices by establishing a VAR model.

The Granger causality test is a statistical method of hypothesis verification, testing whether a set of time series x causes another set of time series y. It is based on an autoregressive model in regression analysis. Regression analysis usually only yields the contemporaneous correlation between different variables. The autoregressive model can only obtain the correlation between the pre- and post-variation of the same variable, while the Granger causality test resorts to a series of verifications in the autoregressive model, to reveal the time difference correlation between different variables. In recent years, Granger causality test has been used many times in the analysis of the influencing factors of real estate prices. For example, Wang and Shen (2007) used the Granger causality test to show that the land price increase caused by the undervaluation of the exchange rate further caused the housing price to rise.

Time series analysis is one of the quantitative prediction methods. It includes general statistical analysis, establishment and inference of statistical models, and optimal prediction, control and filtering of time series. The basic idea of time series analysis is: to establish a mathematical model that can accurately reflect the dynamic dependencies contained in the time series, based on the finite-length operational record (observation data) of the system, and thus to

predict the future of the system. Common methods for time series analysis include trend fitting and smoothing: The trend fitting method is a method of using time as an independent variable and corresponding sequence observations as dependent variables to establish a regression model of series values varying with time; the trend smoothing method is a commonly used method for trend analysis and prediction, by using smoothing technology to weaken the influence of short-term random fluctuations on the series to make the series smooth, thus showing the law of long-term trend changes. The trend of real estate prices can be analyzed in time series. For example, Liang and Gao (2006) applied time series data from Q1 1999 to Q4 2005 to analyze the causes of fluctuations in the sales price of commercial housing in China.

Among the above methodologies, as the influence mechanisms of different factors on real estate prices are not completely the same, some have obvious time lag and some are not obvious, so multivariable linear regression models that are suitable for describing the influence of multivariable are sometimes adopted, the VAR models suitable for describing the lag effects of current variables are employed in some cases, and the Granger causality test describing lad effects of multivariable is also used by some researchers.

This dissertation focuses on the empirical relationship of the interplay between real estate prices in Shenzhen, Dongguan and Huizhou, with mainly monthly statistical data, and will mainly adopt the VAR model plus the Granger causality test for the research.

3.2.2 Data sources

The main content of this research is the statistical analysis and quantitative analysis of the real estate prices in Shenzhen, Dongguan and Huizhou, and

finally form the VAR model of the interplay between real estate prices in Shenzhen, Dongguan and Huizhou. Therefore, it must be supported by continuous data.

Through retrieval and search, it is found that the real estate prices in Shenzhen, Dongguan and Huizhou are mainly monthly data, which can be acquired via public channels, such as fang.com (https://www1.fang.com/) and Eastmoney choice (http://choice.eastmoney.com/). After comparison, the real estate price data of 100 cities in China listed on fang.com (https://www1.fang.com/) and Eastmoney choice (http://choice.eastmoney.com/) are consistent, including those of Shenzhen, Dongguan and Huizhou, from the source of China Real Estate Index System, prepared by China Index Academy.

The China Real Estate Index System (CREIS) prepared by China Index Academy is a set of index system and analysis method that reflects the operation status and development trend of the real estate market in major cities across the country in the form of price index, which was first launched by the Development Research Center of the State Council, China Real Estate Association, and China Real Estate Development Group in 1994, and has been reviewed by the appraisal committee made up of famous experts and scholars from the Development Research Center of the State Council, the Ministry of Construction, the Ministry of Land and Resources, the China Banking Regulatory Commission, the China Real Estate Association, Tsinghua University, Peking University, etc. in 1995 and 2005 respectively.

The China Real Estate Index System (CREIS) currently covers major cities in China, and regularly publishes real estate price indexes of major cities in China, including HPI-100, city comprehensive price index, residential price index,

hedonic index, office building index, shop index, villa price index, second-hand housing sales and leasing price index. It is the price index system with the widest coverage and the greatest number of cities, and is called the "barometer" of China's real estate market and the "wind vane" for guiding property investment and buying.

The CREIS is not the official statistics released by the Chinese government. Instead, it is prepared by cross-reviews in certain ways based on the data collected by the China Index Academy and fang.com's direct personnel in different cities from project data information, enterprise filing data, data provided by agents and brokers, public information of governments and enterprises, etc., to ensure the accuracy and objectivity of the sample data.

Through the search, CREIS is found to be the only time series data that contains the real estate prices of Shenzhen, Dongguan and Huizhou over a continuous period (monthly) of more than 50 tine series. Thus, it is applicable to the modeling analysis of this dissertation.

3.3 Research design

This dissertation will mainly use statistical data to construct an empirical relationship model of the interplay between real estate prices in Shenzhen, Dongguan and Huizhou, and then carry out a comprehensive qualitative analysis of the reasons for the interplay between real estate prices in Shenzhen, Dongguan and Huizhou and analysis of the countermeasures for industry, government and resident sectors.

3.3.1 Empirical analysis: Clarifying the interplay

The monthly data of the real estate prices in Shenzhen, Dongguan and Huizhou are adopted in building a VAR model for verification and clarification of the

interplay relationship between real estate prices in Shenzhen, Dongguan and Huizhou, and then the internal mathematical connections are observed, including Granger causality relationship and time lag.

3.3.2 Qualitative and comparative analysis: Cause analysis and strategy recommendations

In addition to the quantifiable interplay between real estate prices in Shenzhen, Dongguan and Huizhou, we may further analyze the economic, psychosocial and political reasons of the interplay. Based on the quantitative analysis, this dissertation will also conduct a qualitative analysis of the economic, psychosocial and political reasons of the interplay between real estate prices in Shenzhen, Dongguan and Huizhou to develop general explanations and judgments.

At the same time, based on the research on the interplay between real estate prices in Shenzhen, Dongguan and Huizhou, this dissertation will combine the comparative analysis, inductive analysis and other forms of analysis to present relevant suggestions for industry development, government intervention and residents' property investment and buying.

Chapter 4 Empirical analysis of interplay between real estate prices in Shenzhen, Dongguan and Huizhou

In this chapter, empirical analysis is performed to examine interplay between real estate prices in Shenzhen, Dongguan and Huizhou with statistical data and judgment and verification is provided to investigate Granger causality and time lag between these prices.

4.1 Data processing, unit root test and Granger causality test

Monthly real estate prices of Shenzhen, Dongguan and Huizhou from July 2010 to December 2017 (90 periods in total) can be obtained via public data on Fang.com (https://www1.fang.com/) and Eastmoney Choice (http://choice.eastmoney.com/) (Table 4-1).

Table 4-1 Real estate prices in Shenzhen, Dongguan and Huizhou from July 2010 to December 2017 (RMB/m^2)

Month	Shenzhen	Dongguan	Huizhou	Month	Shenzhen	Dongguan	Huizhou
2010/7	21935	7606	5684	2014/4	31155	9584	6764
2010/8	22115	7545	5566	2014/5	30890	9594	6811
2010/9	22776	7544	5556	2014/6	30322	9658	6756
2010/10	22948	7624	5661	2014/7	30198	9612	6715
2010/11	22995	7738	5745	2014/8	30141	9552	6622
2010/12	23277	7990	5839	2014/9	30168	9402	6621
2011/1	23372	8133	6000	2014/10	30243	9368	6543
2011/2	23496	8194	6067	2014/11	30530	9354	6487
2011/3	23605	8322	6217	2014/12	30719	9197	6538
2011/4	23741	8522	6170	2015/1	30916	9066	6477
2011/5	23996	8658	6222	2015/2	30972	9041	6452
2011/6	24022	8742	6449	2015/3	31155	9040	6357
2011/7	24124	8710	6440	2015/4	31495	9043	6298
2011/8	24011	8916	6604	2015/5	32339	9109	6266
2011/9	23999	9152	6859	2015/6	34467	9055	6343

2011/10	24067	9110	6849	2015/7	37821	9259	6421
2011/11	24003	8985	6745	2015/8	38093	9294	6377
2011/12	23835	8971	6722	2015/9	38767	9327	6426
2012/1	23869	8881	6649	2015/10	40120	9540	6643
2012/2	23789	8729	6619	2015/11	41139	9487	6753
2012/3	23989	8970	6431	2015/12	42591	9667	6863
2012/4	23792	9224	6362	2016/1	44823	10157	7237
2012/5	23779	9129	6338	2016/2	47248	10582	7323
2012/6	23969	9065	6371	2016/3	48963	11293	7766
2012/7	23986	9033	6402	2016/4	50354	11741	8255
2012/8	24037	8902	6390	2016/5	51361	12167	8466
2012/9	24049	8887	6499	2016/6	52373	12430	8619
2012/10	24147	8878	6503	2016/7	53384	12548	8835
2012/11	24215	8812	6483	2016/8	54478	13031	9145
2012/12	24525	8841	6330	2016/9	55001	13527	9484
2013/1	25060	8948	6220	2016/10	55150	13746	9739
2013/2	25699	8973	6178	2016/11	55040	13945	9787
2013/3	26221	8935	6210	2016/12	54886	14207	9874
2013/4	26729	9233	6234	2017/1	54551	14186	9862
2013/5	27135	9279	6259	2017/2	54333	14116	9882
2013/6	27542	9322	6332	2017/3	54213	14171	9879
2013/7	27883	9163	6374	2017/4	54148	14287	9954
2013/8	28256	9270	6501	2017/5	53937	14346	10003
2013/9	29146	9207	6555	2017/6	53894	14323	10036
2013/10	29971	9250	6638	2017/7	53959	14382	10120
2013/11	30330	9224	6583	2017/8	53937	14536	10040
2013/12	30591	9325	6666	2017/9	53942	14607	10095
2014/1	30615	9493	6763	2017/10	53937	14660	10156
2014/2	30970	9399	6949	2017/11	53926	14746	10192
2014/3	31208	9614	6800	2017/12	53931	14921	10207

Note. Data adapted from Choice Database (2019).

4.1.1 Data processing

According to Table 4-1, real estate price in Shenzhen has large base and is followed by Dongguan and Huizhou respectively. In order to keep in line in economic sense with real estate price rise, in this paper relevant data is processed as follows:

(1) Calculate natural logarithm of absolute number of real estate prices in Shenzhen, Dongguan and Huizhou;

(2) Calculate month-on-month growth rate of real estate prices in Shenzhen, Dongguan and Huizhou based on natural logarithm since August 2010 and record as lnszr, lndgr and lnhzr respectively.

Lnszr, lndgr and lnhzr are all time series of 89 periods.

4.1.2 Unit root test

Stationarity of lnszr, lndgr and lnhzr time series can be determined via ADF unit root test according to the method used in EViews software.

ADF unit root test has the following three forms:

(I)$\Delta y_t = \varphi y_{t-1} + u_t$

(II)$\Delta y_t = C + \varphi y_{t-1} + u_t$

(III)$\Delta y_t = C + \gamma t + \varphi y_{t-1} + u_t$

Equivalent to the following three scenarios:

(I)$y_t = \rho y_{t-1} + u_t$

(II)$y_t = C + \rho y_{t-1} + u_t$

(III)$y_t = C + \gamma t + \rho y_{t-1} + u_t$

Judgment rule: if the original hypothesis is not rejected, y_t refers to non-stationary time series with unit room; if the original hypothesis is rejected, y_t in scenario (I) and (II) is stationary time series and y_t in scenario (III) is trend stationary time series.

Unit root test is performed lnszr, lndgr and lnhzr time series as follows.

(1) lnszr series is tested in scenario (I) without intercept term and trend term and the result is as follows (Table 4-2):

Table 4-2 Unit room test result of lnszr series in scenario (I)

Null Hypothesis: LNSZR has a unit root				
Exogenous: None				
Lag Length: 0 (Automatic - based on SIC, maxlag=11)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.37104	0.0010
Test critical values:	1% level		-2.591505	
	5% level		-1.94453	
	10% level		-1.614341	
***MacKinnon (1996) one-sided p-values.**				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LNSZR)				
Method: Least Squares				
Date: 06/01/19 Time: 23:05				
Sample (adjusted): 2010M09 2017M12				
Included observations: 88 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNSZR(-1)	-0.229956	0.068215	-3.37104	0.0011
R-squared	0.115482	Mean dependent var		-0.000919
Adjusted R-squared	0.115482	S.D. dependent var		0.126587
S.E. of regression	0.119053	Akaike info criterion		-1.40719
Sum squared resid	1.233114	Schwarz criterion		-1.379038
Log likelihood	62.91634	Hannan-Quinn criter.		-1.395848
Durbin-Watson stat	2.028097			

As indicated in Table 4-2, unit room test result of lnszr series in scenario (I) rejects the original hypothesis.

(2) lnszr series is tested in scenario (II) with intercept term and the result is as follows (Table 4-3):

Table 4-3 Unit room test result of lnszr series in scenario (II)

Null Hypothesis: LNSZR has a unit root			
Exogenous: Constant			
Lag Length: 0 (Automatic - based on SIC, maxlag=11)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.993194	0.0023
Test critical values:	1% level	-3.506484	
	5% level	-2.894716	
	10% level	-2.584529	
***MacKinnon (1996) one-sided p-values.**			

Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LNSZR)				
Method: Least Squares				
Date: 06/01/19 Time: 23:25				
Sample (adjusted): 2010M09 2017M12				
Included observations: 88 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNSZR(-1)	-0.314884	0.078855	-3.993194	0.0001
C	0.029968	0.014671	2.042721	0.0441

R-squared	0.156413	Mean dependent var	-0.000919
Adjusted R-squared	0.146604	S.D. dependent var	0.126587
S.E. of regression	0.11694	Akaike info criterion	-1.431842
Sum squared resid	1.176052	Schwarz criterion	-1.375539
Log likelihood	65.00104	Hannan-Quinn criter	-1.409159
F-statistic	15.9456	Durbin-Watson stat	1.949497
Prob(F-statistic)	0.000137		

As indicated in Table 4-3, unit room test result of lnszr series in scenario (II) rejects the original hypothesis.

(3) lnszr series is tested in scenario (III) with intercept term and time trend and the result is as follows (Table 4-4):

Table 4-4 Unit room test result of lnszr series in scenario (III)

Null Hypothesis: LNSZR has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 0 (Automatic - based on SIC, maxlag=11)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.979833	0.0128
Test critical values:	1% level		-4.065702	
	5% level		-3.461686	
	10% level		-3.157121	
***MacKinnon (1996) one-sided p-values.**				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(LNSZR)				
Method: Least Squares				
Date: 06/01/19 Time: 23:26				
Sample (adjusted): 2010M09 2017M12				
Included observations: 88 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNSZR(-1)	-0.317824	0.079859	-3.979833	0.0001
C	0.023513	0.025801	0.911329	0.3647
@TREND("2010M08")	0.000152	0.000497	0.30489	0.7612
R-squared	0.157334	Mean dependent var		-0.000919
Adjusted R-squared	0.137507	S.D. dependent var		0.126587
S.E. of regression	0.117562	Akaike info criterion		-1.410208

Sum squared resid	1.174768	Schwarz criterion	-1.325753
Log likelihood	65.04913	Hannan-Quinn criter.	-1.376183
F-statistic	7.93519	Durbin-Watson stat	1.945864
Prob(F-statistic)	0.000692		

As indicated in Table 4-4, unit room test result of lnszr series in scenario (III) rejects the original hypothesis.

(4) According to information criteria of unit root test, it can be further judged that the scenario lnszr series falls into (Table 4-5):

Table 4-5 Information criteria judgment table of lnszr series

lnszr series	*AIC*	*SC*	*HD*
Scenario I	-1.407190	-1.379038*	-1.395848
Scenario II	-1.431842*	-1.375539	-1.409159*
Scenario III	-1.410208	-1.325753	-1.376183

According to information criteria, lnszr series falls into scenario II, namely stationary with intercept term.

(5) Unit room test result of lndgr series can also be obtained in the manner and steps (Table 4-6):

Table 4-6 Information criteria judgment table of lndgr series

lndgr series	*AIC*	*SC*	*HD*
Scenario I	-0.825654	-0.825654	-0.842464
Scenario II	-0.898408*	-0.842105*	-0.875725*
Scenario III	-0.796445	-0.796445	-0.846875

According to information criteria, lndgr series falls into scenario II, namely stationary with intercept term.

(6) Unit root test result of lndgr series is as follows (Table 4-7):

Table 4-7 Information criteria judgment table of lndgr series

lndgr series	*AIC*	*SC*	*HD*
Scenario I	-0.681836	-0.653684	-0.670494
Scenario II	-0.711219*	-0.654916*	-0.688536*
Scenario III	-0.691721	-0.607266	-0.657696

According to information criteria, lndgr series falls into scenario II, namely stationary with intercept term.

4.1.3 **Granger causality test**

Causality between any two stationary time series can be determined via Granger causality test. Of course, Granger causality only indicates causal time series association in statistic terms. Economic causality of such two stationary time series can only be defined when economic analysis is combined.

Granger causality test can be expressed as follows, if:

$$(\mathrm{I}) y_t = \sum_{i=1}^{m} \alpha_i X_{t-i} + \sum_{i=1}^{m} \beta_i y_{t-i} + \mu_{1t}$$

$$(\mathrm{II}) X_t = \sum_{i=1}^{m} \lambda_i Y_{t-i} + \sum_{i=1}^{m} \delta_i X_{t-i} + \mu_{2t}$$

Then:

If X unidirectionally Granger causes Y: α as a whole is not null, while λ as a whole is null;

If Y unidirectionally Granger causes X: λ as a whole is not null, while α as a whole is null;

In case of bidirectional causality between X and Y: α and λ as a whole are not null;

In case of no causal relationship between X and Y: α and λ as a whole are null. Granger causality test built in EViews can be used to calculate Granger causality between lnszr, lndgr and lnhzr time series as follows (Table 4-8):

Table 4-8 Granger causality tests results of lnszr, lndgr and lnhzr time series

Pairwise Granger Causality Tests			
Date: 06/02/19 Time: 00:05			
Sample: 2010M08 2017M12			
Lags: 1			
Null Hypothesis:	Obs	F-Statistic	Prob.
LNDGR does not Granger Cause LNSZR	88	0.97817	0.3255
LNSZR does not Granger Cause LNDGR		7.57369	0.0072
LNHZR does not Granger Cause LNSZR	88	0.0064	0.9364
LNSZR does not Granger Cause LNHZR		5.19851	0.0251
LNHZR does not Granger Cause LNDGR	88	4.29599	0.0412
LNDGR does not Granger Cause LNHZR		12.0107	0.0008

We can see from Table 4-8 that:

(9) At 95% confidence level, "lndgr does not Granger cause lnszr" passes the original hypothesis and therefore is true; lnszr does not Granger cause lndgr" rejects the original hypothesis and therefore is false, which means lnszr does Granger cause lndgr, i.e. the hypothesis that rise in real estate price in Shenzhen causes rise in real estate price in Dongguan has been supported by statistical data.

(9) At 95% confidence level, "lnhzr does not Granger cause lnszr" passes the original hypothesis and therefore is true; lnszr does not Granger cause lnhzr" rejects the original hypothesis and therefore is false, which means lnszr does Granger cause lnhzr, i.e. the hypothesis that rise in real estate price in Shenzhen causes rise in real estate price in Huizhou has been supported by statistical data.

(9) At 95% confidence level, "lnhzr does not Granger cause lndgr" rejects the original hypothesis and therefore is false, which moans the hypothesis that rise in real estate price in Huizhou causes rise in real estate price in Dongguan has been supported by statistical data; lndgr does not Granger cause lnhzr" rejects the original hypothesis and therefore is false, which means lndgr does Granger cause lnhzr, i.e. the hypothesis that rise in real estate price in Dongguan causes rise in real estate price in Huizhou has been supported by statistical data.

lnszr, lndgr and lnhzr time series have certain Granger causality and therefore models including VAR can be established for further analysis.

4.2 VAR model analysis of interplay between real estate prices in Shenzhen, Dongguan and Huizhou

Vector auto-regression (VAR), as a model established based on statistical property of data, builds models with functions using every endogenous variable in the system as lagged values of all endogenous variables in the system and expand application of univariate auto-regression to "vector" auto-regression models consisting of multivariate time series variables. Its expression is as follows:

$$Y_t=c+A_1(y_{t-1})+A_2(y_{t-2})+....+A_p(y_{t-p})+e_t \qquad (1)$$

In Equation (1): c is constant vector of $n\times1$ and A_i is $n\times n$ matrix. e_t is $n\times1$ error vector and p is largest lag order of model, satisfying that:

Mean value of error term is 0;

Covariance matrix of error term is Ω (a $n\times n$ positive definite matrix);

(Satisfy every k that is not 0) error term has no autocorrelation.

4.2.1 **Building VAR model**

In EViews, VAR model is built for lnszr, lndgr and lnhzr time series proved to be stationary in unit root test.

(1) Determine lag order

Lag order is analyzed for the VAR model to be built in EViews with the result as follows (Table 4-9):

Table 4-9 VAR model lag order of interplay between real estate prices in Shenzhen, Dongguan and Huizhou

VAR Lag Order Selection Criteria

Endogenous variables: LNSZR LNDGR LNHZR

Exogenous variables: C

Date: 06/02/19 Time: 01:28

Sample: 2010M08 2017M12

Included observations: 81

Lag	LogL	LR	FPE	AIC	SC	HQ
0	97.96694	NA	1.92E-05	-2.344863	-2.256179	-2.309282
1	144.5861	88.63391	7.60e-06*	-3.27373	-2.918997*	-3.131406*
2	150.2843	10.41157	8.26E-06	-3.192205	-2.571422	-2.943138
3	160.3747	17.68936	8.06E-06	-3.219128	-2.332295	-2.863319
4	163.3793	5.044804	9.39E-06	-3.071095	-1.918212	-2.608543
5	168.1108	7.593683	1.05E-05	-2.965698	-1.546765	-2.396404
6	181.1882	20.01972	9.60E-06	-3.066375	-1.381392	-2.390338
7	191.0457	14.36041	9.55E-06	-3.087549	-1.136517	-2.304769
8	208.1801	23.69197*	7.97E-06	-3.288398*	-1.071315	-2.398875

*** indicates lag order selected by the criterion**

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

According to information criteria, VAR model lag order of interplay between real estate prices in Shenzhen, Dongguan and Huizhou p=1, which means this model is VAR(1) model.

(2) Build VAR model

When rebuilding VAR(1) model for lnszr, lndgr and lnhzr time series, the result from EViews is shown in the following table (Table 4-10):

Table 4-10 VAR model output result of interplay between real estate prices in Shenzhen, Dongguan and Huizhou

Vector Autoregression Estimates			
Date: 06/02/19 Time: 00:08			
Sample (adjusted): 2010M09 2017M12			
Included observations: 88 after adjustments			
Standard errors in ( ) & t-statistics in [ ]			
	LNSZR	LNDGR	LNHZR
LNSZR(-1)	0.707447	0.262605	0.191552
	(-0.08569)	(-0.10615)	(-0.11394)
	[8.25593]	[2.47390]	[1.68123]
LNDGR(-1)	-0.09891	0.298308	0.365328
	(-0.08969)	(-0.11111)	(-0.11926)
	[-1.10277]	[2.68483]	[3.06335]
LNHZR(-1)	0.040177	0.169368	0.249218
	(-0.07988)	(-0.09896)	(-0.10621)
	[0.50295]	[1.71153]	[2.34635]
C	0.032836	0.021159	0.010338
	(-0.01513)	(-0.01875)	(-0.02012)
	[2.16993]	[1.12877]	[0.51380]
R-squared	0.475086	0.327721	0.360423
Adj. R-squared	0.456339	0.303711	0.337581
Sum sq. resids	1.159182	1.778846	2.049345
S.E. equation	0.117472	0.145522	0.156195

F-statistic	25.34204	13.64936	15.77895
Log likelihood	65.6368	46.79377	40.56534
Akaike AIC	-1.400836	-0.972586	-0.831031
Schwarz SC	-1.28823	-0.85998	-0.718424
Mean dependent	0.097172	0.083815	0.077427
S.D. dependent	0.159321	0.174395	0.191912
Determinant resid covariance (dof adj.)		6.00E-06	
Determinant resid covariance		5.22E-06	
Log likelihood		160.576	
Akaike information criterion		-3.376728	
Schwarz criterion		-3.03891	
Number of coefficients		12	

According to Table 4-10, the following matrix equation can be built:

$$\begin{bmatrix} \hat{lnszr} \\ \hat{lndgr} \\ \hat{lnhzr} \end{bmatrix} = \begin{bmatrix} 0.7074 & 0.2626 & 0.1916 \\ -0.0898 & 0.2983 & 0.3653 \\ 0.0402 & 0.1694 & 0.2492 \end{bmatrix} \begin{bmatrix} lnszr_{t-1} \\ lndgr_{t-1} \\ lnhzr_{t-1} \end{bmatrix} + \begin{bmatrix} 0.0328 \\ 0.0216 \\ 0.0103 \end{bmatrix}$$

When converted into mathematical expression:

$$\hat{lnszr}_t = 0.7074*lnszr(-1) - 0.0989*lndgr(-1) + 0.0402*lnhzr(-1) + 0.0328 \quad (2)$$

$$\hat{lndgr}_t = 0.2626*lnszr(-1) + 0.2983*lndgr(-1) + 0.1694lnhzr(-1) + 0.0216 \quad (3)$$

$$\hat{lnhzr}_t = 0.1916*lnszr(-1) + 0.3653*lndgr(-1) + 0.2492*lnhzr(-1) + 0.0103 \quad (4)$$

Equations (2), (3) and (4) are regression equation of effect on Shenzhen, Dongguan and Huizhou real estate prices.

According to the regression equations in Table 4-10, coefficient of determination of lnszr R^2 is 0.4751, lndgr R^2 is 0.3277 and lnhzr R^2 is 0.3644, which means regression equations have moderate R-squared, meeting statistical requirement (>0.3). At 95% confidence level, F-statistic of lnszr, lndgr and lnhzr are 25.3420, 13.6494 and 15.7790 respectively, all larger than F-statistic critical value (one-sided) 3.60 with variable of 3 and degree of freedom of ∞, which means F-test is passed. It means the regression equations meet general requirements.

It can be found after economic test of equations (2), (3) and (4) that:

(1) In regression equation of real estate price rise in Shenzhen as represented in equation (2), lnszr(-1) has coefficient of 0.7074 and largest absolute value and real estate price rise in Shenzhen (lnszr) is mainly positively affected by its lnszr(-1) of previous period. It should be noted that lndgr(-1) has coefficient of -0.0989, which means real estate price rise (lnszr) is negatively affected by real estate price in Dongguan from the previous period; but lndgr(-1) has small absolute value, indicating that the effect is not significant. lnhzr(-1) has coefficient of 0.0402, which means real estate price rise in Huizhou from the previous period has positive effect on real estate price rise in Shenzhen; but its absolute value is small, indicating limited degree of effect.

(2) In regression equation of real estate price rise in Dongguan as represented in equation (3), coefficients of lnszr(-1), lndgr(-1) and lnhzr(-1) are 0.2626, 0.2983 and 0.1694 respectively, indicating that real estate price rise of Shenzhen, Dongguan and Huizhou from the previous period has positive effect on current real estate price rise in Dongguan, in which real estate price rise of

Dongguan from the previous period has the greatest effect, followed by Shenzhen and Huizhou.

(3) In regression equation of real estate price rise in Huizhou as represented in equation (4), coefficients of lnszr(-1), lndgr(-1) and lnhzr(-1) are 0.1916, 0.3653 and 0.2492 respectively, indicating that real estate price rise of Shenzhen, Dongguan and Huizhou from the previous period has positive effect on current real estate price rise in Huizhou, in which real estate price rise of Dongguan from the previous period has the greatest effect, followed by Huizhou and Shenzhen.

Surely regression equations of real estate price rise in Shenzhen, Dongguan and Huizhou require further test and in-depth interpretation in terms of economics and statistics will follow.

4.2.2 **Exogenous test**

In EViews, exogenous test is performed for VAR(1) model of interplay between real estate prices in Shenzhen, Dongguan and Huizhou with result as follows (Table 4-11):

Table 4-11 VAR model exogenous test output result of interplay between real estate prices in Shenzhen, Dongguan and Huizhou

VAR Granger Causality/Block Exogeneity Wald Tests			
Date: 06/02/19 Time: 00:10			
Sample: 2010M08 2017M12			
Included observations: 88			
	Dependent variable: LNSZR		
Excluded	Chi-sq	df	Prob.
LNDGR	1.216111	1	0.2701
LNHZR	0.252954	1	0.615
All	1.22253	2	0.5427
	Dependent variable: LNDGR		

Excluded	Chi-sq	df	Prob.
LNSZR	6.120169	1	0.0134
LNHZR	2.929342	1	0.087
All	10.67494	2	0.0048
Dependent variable: LNHZR			
Excluded	Chi-sq	df	Prob.
LNSZR	2.826527	1	0.0927
LNDGR	9.384088	1	0.0022
All	15.09536	2	0.0005
Roots of Characteristic Polynomial			
Endogenous variables: LNSZR LNDGR			

According to exogenous Granger test:

(1) At 95% confidence level, lnszr as a whole does not reject the original hypothesis and does not reject the original hypothesis to lndgr and lnhzr as well, which means change in growth rate of real estate prices in Dongguan and Huizhou does not Granger cause change in growth rate of real estate price in Shenzhen.

(2) At 95% confidence level, lndgr as a whole rejects the original hypothesis, rejects the original hypothesis to lnszr and does not reject the original hypothesis to lnhzr, which means change in growth rate of real estate prices in Shenzhen and Huizhou Granger causes change in growth rate of real estate price in Dongguan in general, in which Shenzhen is the cause of change but Huizhou is not.

(3) At 95% confidence level, lnhzr as a whole rejects the original hypothesis, does not reject the original hypothesis to lnszr and rejects the original hypothesis to lndgr, which means change in growth rate of real estate prices in Shenzhen and Dongguan Granger causes change in growth rate of real estate

price in Huizhou in general, in which Dongguan is the cause of change but Shenzhen is not.

4.2.3 **Stability test**

In EViews, stability test is performed for VAR(1) model of interplay between real estate prices in Shenzhen, Dongguan and Huizhou with result as follows (Fig. 4-1 and Table 4-12):

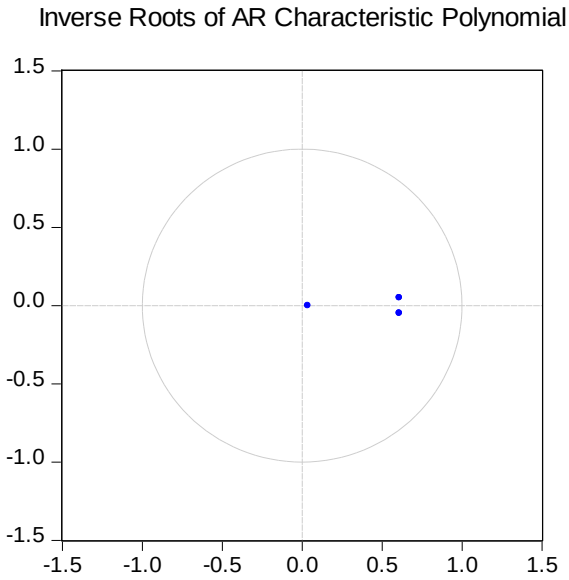


Fig. 4-1 Diagram of VAR model stability test of interplay between real estate prices in Shenzhen, Dongguan and Huizhou

According to Fig. 4-1, characteristic roots of three time series fall within the circle, indicating that VAR model of interplay between real estate prices in Shenzhen, Dongguan and Huizhou is stable.

Table 4-12 VAR model stability test result of interplay between real estate prices in Shenzhen, Dongguan and Huizhou

Roots of Characteristic Polynomial	
Endogenous variables: LNSZR LNDGR LNHZR	
Exogenous variables: C	
Lag specification: 1 1	
Date: 06/02/19 Time: 00:12	
Root	Modulus

0.609226 - 0.049371i	0.611223
0.609226 + 0.049371i	0.611223
0.036521	0.036521

No root lies outside the unit circle.

VAR satisfies the stability condition.

Meanwhile according to modulus list of characteristic roots of three time series in Table 4-12, moduli of lnszr, lndgr and lnhzr are smaller than 1, which means established VAR model of interplay between real estate prices in Shenzhen, Dongguan and Huizhou is stable.

4.2.4 **Impulse response analysis**

Impulse response is the response of an endogenous variable to residual shock. To be more specific, it describes the influence (dynamic influence) on current and future values of the endogenous variable after imposing a shock (from inside or outside the system) equivalent to one standard deviation upon stochastic error term.

In EViews, impulse response analysis of ten periods is performed for VAR(1) model of interplay between real estate prices in Shenzhen, Dongguan and Huizhou with result as follows (Table 4-13 and Fig. 4-2):

Table 4-13 Impulse response list result of VAR model of interplay between real estate prices in Shenzhen, Dongguan and Huizhou

Response of LNSZR:			
Period	LNSZR	LNDGR	LNHZR
1	0.117472	0	0
	(-0.00885)	(0)	(0)
2	0.081996	-0.012219	0.005832
	(-0.0114)	(-0.0114)	(-0.0116)
3	0.055318	-0.011108	0.003148
	(-0.01375)	(-0.01218)	(-0.01001)

4	0.036743	-0.008832	0.001512
	(-0.01378)	(-0.01083)	(-0.00788)
5	0.024102	-0.006606	0.000661
	(-0.01252)	(-0.00866)	(-0.00596)
6	0.015641	-0.00475	0.00024
	(-0.0107)	(-0.00648)	(-0.00437)
7	0.010053	-0.003319	4.58E-05
	(-0.00877)	(-0.00462)	(-0.00312)
8	0.006406	-0.00227	-3.40E-05
	(-0.00696)	(-0.0032)	(-0.00218)
9	0.004049	-0.001526	-5.85E-05
	(-0.00538)	(-0.00216)	(-0.0015)
10	0.002541	-0.001011	-5.86E-05
	(-0.00408)	(-0.00143)	(-0.00101)

Response of LNDGR:

Period	LNSZR	LNDGR	LNHZR
1	0.023198	0.143661	0
	(-0.01541)	(-0.01083)	(0)
2	0.042763	0.051249	0.024586
	(-0.01359)	(-0.01482)	(-0.01448)
3	0.04078	0.02306	0.014993
	(-0.01372)	(-0.01198)	(-0.00911)
4	0.033616	0.009473	0.008536
	(-0.01268)	(-0.00973)	(-0.00691)
5	0.02572	0.002947	0.00478
	(-0.01116)	(-0.00764)	(-0.00534)
6	0.01878	5.18E-05	0.002634
	(-0.00951)	(-0.00588)	(-0.0041)
7	0.013274	-0.001038	0.001424
	(-0.00789)	(-0.00446)	(-0.0031)
8	0.009157	-0.001284	0.000751
	(-0.00639)	(-0.00332)	(-0.0023)
9	0.006199	-0.001176	0.000383

	(-0.00507)	(-0.00242)	(-0.00168)
10	0.004132	-0.000954	0.000186
	(-0.00396)	(-0.00174)	(-0.0012)

Response of LNHZR:

Period	LNSZR	LNDGR	LNHZR
1	0.029487	0.049558	0.14516
	(-0.0165)	(-0.01592)	(-0.01094)
2	0.038325	0.064834	0.036177
	(-0.01515)	(-0.01633)	(-0.01566)
3	0.04088	0.03254	0.019115
	(-0.01513)	(-0.01341)	(-0.01037)
4	0.035682	0.014406	0.010844
	(-0.01417)	(-0.01097)	(-0.00782)
5	0.028212	0.005359	0.006111
	(-0.01256)	(-0.00862)	(-0.00601)
6	0.021044	0.001147	0.003396
	(-0.01073)	(-0.00662)	(-0.00461)
7	0.015101	-0.000605	0.001855
	(-0.00892)	(-0.005)	(-0.00349)
8	0.010538	-0.001166	0.000991
	(-0.00724)	(-0.00373)	(-0.0026)
9	0.007199	-0.001194	0.000515
	(-0.00575)	(-0.00273)	(-0.0019)
10	0.004834	-0.00102	0.000257
	(-0.00449)	(-0.00197)	(-0.00137)

Cholesky Ordering: LNSZR LNDGR LNHZR

Standard Errors: Analytic

As seen in Table 4-13, for Shenzhen, lnszr has the largest impact upon itself, gradually decreasing from 0.1175 in period 1 to 0.0025 in period 10. Lndgr has small impact on lnszr, mainly negative one. Its impact coefficients are all negative numbers and reach peak in period 2, which can be considered that real

estate price rise in Dongguan mainly serves to cool real estate price rise in Shenzhen. It is consistent with lndgr(-1) coefficient of -0.0989 in Shenzhen real estate price rise model equation (2). Lnhzr has the smallest impact on lnszr with both positive and negative impact coefficients and negative coefficients mainly appear after later period and can almost be ignored.

For Dongguan, lnszr has large impact on lndgr, which reaches the peak at period 2 of 0.0428 and then gradually decreases. lndgr has the largest impact on lndgr with the peak of 0.1437 appearing in period 1 and gradually decreasing afterwards. lndgr has the smallest impact on lndgr with peak of appearing in period 3 and gradually decreasing afterwards.

For Huizhou, lnszr has the smallest impact on lnhzr, increasing from period 1 to period 3 at the peak of 0.0409 and gradually decreasing. lndgr has large impact on lnhzr with the peak of 0.0648 appearing in period 2 and gradually decreasing afterwards. lnhzr has the largest impact on itself, gradually decreasing from the peak of 0.1452 in period 1.

Fig. 4-2 is the impulse response diagram of VAR model of interplay between real estate prices in Shenzhen, Dongguan and Huizhou and its result is consistent with that in Table 4-13.

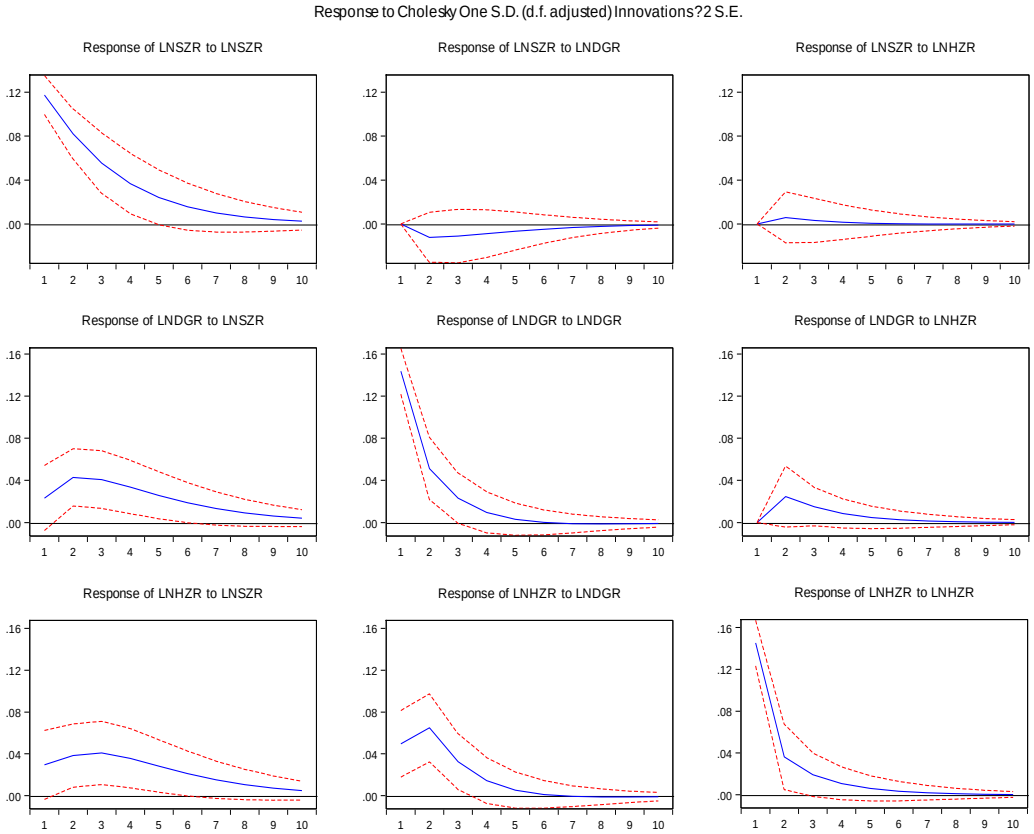


Fig. 4-2 Impulse response diagram of VAR model of interplay between real estate prices in Shenzhen, Dongguan and Huizhou

4.2.5 **Variance decomposition**

Variance decomposition can further evaluate contribution of various endogenous variables to forecast variance. Variance decomposition analyzes proportion of impact of forecast residual standard deviation by different error terms, which is also the proportion of contribution to standard deviation by corresponding endogenous variable.

In EViews, variance decomposition of ten periods is performed for VAR(1) model of interplay between real estate prices in Shenzhen, Dongguan and Huizhou with result as follows (Table 4-14 and Fig. 4-3):

Table 4-14 VAR model variance decomposition result of interplay between real estate prices in Shenzhen, Dongguan and Huizhou

Variance Decomposition of LNSZR:				
Period	S.E.	LNSZR	LNDGR	LNHZR

1	0.117472	100	0	0
2	0.143897	99.11474	0.721	0.164263
3	0.154595	98.67528	1.140956	0.183768
4	0.159154	98.43311	1.384479	0.182413
5	0.161106	98.301	1.519293	0.179703
6	0.161933	98.23206	1.589845	0.178092
7	0.162279	98.19774	1.624916	0.177342
8	0.162421	98.18136	1.641602	0.177036
9	0.162479	98.17382	1.649255	0.176923
10	0.162502	98.17046	1.652658	0.176886
Variance Decomposition of LNDGR:				
Period	S.E.	LNSZR	LNDGR	LNHZR
1	0.145522	2.541187	97.45881	0
2	0.161976	9.021158	88.67498	2.303865
3	0.169281	14.06287	83.04337	2.893758
4	0.173056	17.22907	79.75875	3.01218
5	0.175047	18.9983	77.98308	3.01862
6	0.176072	19.91559	77.07842	3.005989
7	0.17658	20.36614	76.63865	2.995208
8	0.176824	20.57828	76.43295	2.988766
9	0.176937	20.67475	76.33983	2.98542
10	0.176987	20.71736	76.29883	2.983814
Variance Decomposition of LNHZR:				
Period	S.E.	LNSZR	LNDGR	LNHZR
1	0.156195	3.563784	10.06671	86.36951
2	0.177138	7.452017	21.2233	71.32468
3	0.18567	11.63069	22.38913	65.98018
4	0.189926	14.64505	21.97241	63.38254
5	0.192182	16.45819	21.53738	62.00442
6	0.193364	17.44203	21.2784	61.27956
7	0.193962	17.94072	21.14824	60.91104

8	0.194254	18.18112	21.08828	60.73059
9	0.194392	18.29252	21.06219	60.64529
10	0.194455	18.34248	21.05131	60.60621

Cholesky Ordering: LNSZR LNDGR LNHZR

According to Table 4-14, for Shenzhen, lnszr has the largest proportion of contribution to the standard deviation of itself, decreasing from 100% in period 1 to 98.1705% in period 10. Lndgr has large proportion of contribution of the standard deviation of lnszr, increasing from 0 in period 1 to 1.6527% in period 10; Lnhzr has the smallest proportion of contribution to the standard deviation of lnszr, increasing from 0 in period 1 to 0.1769% in period 10.

For Dongguan, lnszr has large proportion of contribution to the standard deviation of lndgr, increasing from 2.5412% in period 1 to 20.7174% in period 10. Lndgr has the largest proportion of contribution of the standard deviation of lndgr, decreasing from 97.4588% in period 1 to 76.2988% in period 10; Lnhzr has the smallest proportion of contribution to the standard deviation of lndgr, increasing from 0 in period 1 to 3.0186% in period 5 and decreasing to 2.9838% in period 10.

For Huizhou, lnszr has the smallest proportion of contribution to the standard deviation of lnhzr, increasing from 3.5638% in period 1 to 18.3425% in period 10. Lndgr has large proportion of contribution of the standard deviation of lnhzr, increasing from 10.0667% in period 1 to 22.3891% in period 3 and decreasing to 21.0513% in period 10; Lnhzr has the largest proportion of contribution to the standard deviation of itself, decreasing from 86.3695% in period 1 to 60.6062% in period 10.

Fig. 4-3 is the variance decomposition result diagram of VAR model of interplay between real estate prices in Shenzhen, Dongguan and Huizhou and its implication is consistent with that in Table 4-14.

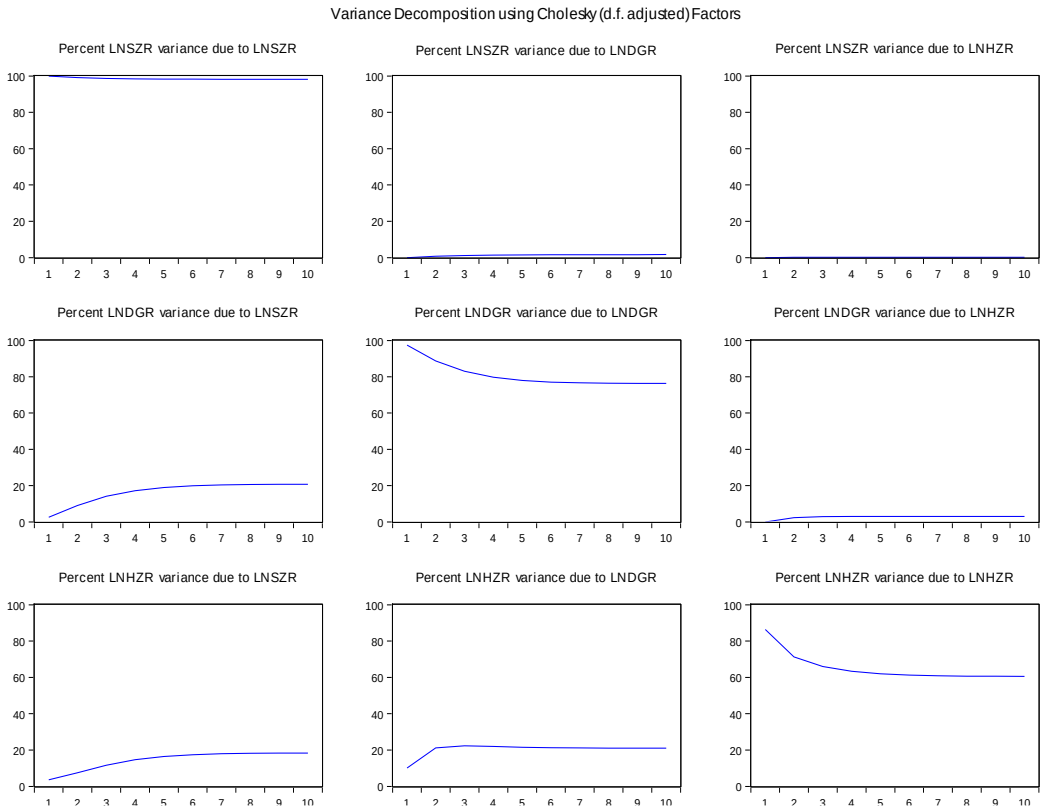


Fig. 4-3 VAR model variance decomposition diagram of interplay between real estate prices in Shenzhen, Dongguan and Huizhou

4.3 Conclusion of empirical analysis of interplay between real estate prices in Shenzhen, Dongguan and Huizhou

In this chapter, statistical data is used for Granger cause test and VAR model analysis for interplay between real estate prices in Shenzhen, Dongguan and Huizhou and its results and meanings are further discussed as follows.

4.3.1 **Causal association**

In empirical analysis of interplay between real estate prices in Shenzhen, Dongguan and Huizhou, Granger causality test results of lnszr, lndgr and lnhzr time series are different from exogenous test result of VAR model.

Table 4-15 Result comparison of Granger causality test and VAR model exogenous test

	Granger causality test		**VAR model exogenous test**	
	P value	Reject hypothesis or not	P value	Reject hypothesis or not
From lnszr to lndgr	0.0072	Reject	0.0134	Reject
From lnszr to lnhzr	0.0251	Reject	0.0927	Not reject
From lndgr to lnszr	0.3255	Not reject	0.2701	Not reject
From lndgr to lnhzr	0.0008	Reject	0.0022	Reject
From lnhzr to lnszr	0.9364	Not reject	0.6150	Not reject
From lnhzr to lndgr	0.0412	Reject	0.0870	Not reject

Table 4-15 shows that Granger causality test result of lnszr, lndgr and lnhzr time series differs from exogenous test result of VAR model in that:

(1) In Granger causality test results, it is considered that real estate price rise in Shenzhen and Huizhou Granger causes real estate price rise in Dongguan; while VAR model exogenous test result shows that only real estate price rise in Shenzhen rather than in Huizhou Granger causes real estate price rise in Dongguan.

(2) In Granger causality test results, it is considered that real estate price rise in Shenzhen and Dongguan Granger causes real estate price rise in Huizhou; while VAR model exogenous test result shows that only real estate price rise in Dongguan rather than in Shenzhen Granger causes real estate price rise in Huizhou.

However, these two tests agree in that real estate price rise in Dongguan and Huizhou does not Granger cause real estate price rise in Shenzhen. Real estate price rise in Shenzhen is mainly caused by situations in Shenzhen itself, possibly including issuance of paper money and GDP growth at macro level as well as increase in urban permanent residents and per capita disposable income at micro level and excluding real estate price rise in Dongguan and Huizhou. This will be further explored in the next chapter.

The reason Granger causality test result of lnszr, lndgr and lnhzr time series differs from exogenous test result of VAR model is that the former compares between two of lnszr, lndgr and lnhzr, while the latter examines lnszr, lndgr and lnhzr within a system. Generally, pairwise comparison will enhance correlation and examination within a system will weaken correlation, because systematic examination adds other dimensions of changes in variables to be explained caused by other explaining variables, and pairwise comparison only explores correlation between two variables, therefore the results are different.

As intensified integration of Shenzhen-Dongguan-Huizhou urban agglomeration, it can safely be inferred that interplay between real estate prices in Shenzhen, Dongguan and Huizhou will be tighter. Therefore in this paper, we are inclined to believe that real estate price change in Shenzhen will drive changes in real estate prices in Dongguan and Huizhou; real estate prices in Dongguan and Huizhou interact with each other to cause change in real estate price in each other; real estate prices in Dongguan and Huizhou has no effect on that in Shenzhen generally. This conclusion is consistent with Granger causality test result.

4.3.2 Degree of direction of interplay

According to coefficients (Table 4-16) of regression equations (equations 2, 3 and 4) derived from Granger causality test result and VAR empirical model, degree and direction of interplay between real estate prices in Shenzhen, Dongguan and Huizhou can be further explored.

Table 4-16 Time series Granger causality test p-value and VAR model regression equation coefficient

	Granger causality test p-value		**VAR regression equation coefficient**	
	P-value	Reject hypothesis or not	Coefficient	Positive or negative number
From lnszr to lndgr	0.0072	Reject	0.2626	+
From lnszr to lnhzr	0.0251	Reject	0.1916	+
From lndgr to lnszr	0.3255	Not reject	- 0.0989	-
From lndgr to lnhzr	0.0008	Reject	0.3653	+
From lnhzr to lnszr	0.9364	Not reject	0.0402	+
From lnhzr to lndgr	0.0412	Reject	0.1694	+

It can be told from Table 4-16 that:

(1) Granger causality tests from lndgr to lnszr and from lnhzr to lnszr accept the original hypothesis, which means real estate price rise in Dongguan and Huizhou does not Granger cause real estate price rise in Shenzhen and no further discussion concerning degree and direction of interplay is necessary. However, it should be noted that in regression equation (1), Lndgr(-1) has coefficient of -0.0989, which means real estate price rise in Shenzhen is negatively affected by real estate price in Dongguan, i.e. real estate price in Dongguan drives real estate price in Shenzhen down. This is the only negative coefficient in three regression equations.

(2) Granger causality test p-value reflects the degree of acceptance of the original hypothesis: at the five percent level of significance, p-value over 5% will be considered as accepting the hypothesis and p-value lower than 5% will be considered as rejecting the hypothesis. The lower the p-value, the higher the probability of rejecting the hypothesis. To compare four pairs of relations rejecting the hypothesis: p-value from lndgr to lnhzr (0.0008) < p-value from lnszr to lndgr (0.0072) < P-value from lnszr to lnhzr (0.0251) < P-value from lnhzr to lndgr (0.0412).

It means that real estate price in Dongguan has the highest probability of affecting real estate price in Huizhou, real estate price in Shenzhen has the second highest probability of affecting real estate price in Dongguan, real estate price in Shenzhen has the third highest probability of affecting real estate price in Huizhou and real estate price in Huizhou has the lowest probability of affecting real estate price in Dongguan. Meanwhile, since coefficients of corresponding regression equations are all positive, which means positive effect, they change along the same direction.

This is only comparison for relations rejecting the hypothesis. Relations from Dongguan to Shenzhen and from Huizhou to Shenzhen not rejecting the hypothesis have no statistical significance and therefore are ignored here.

4.3.3 **Lag period**

In VAR empirical analysis of interplay between real estate prices in Shenzhen, Dongguan and Huizhou, VAR (1) model with one lag order is established for lnszr, lndgr and lnhzr and relevant lag cycle and resulting lag effect can be further analyzed as follows with reference to impulse response analysis.

(1) One lag order means lagging one period behind and for lnszr, lndgr and lnhzr time series, it is one month, which means changes in real estate prices in Shenzhen, Dongguan and Huizhou can be judged from data of previous period (lagging one period). Such lag period is relatively short and changes in real estate price of previous month probably and mainly affect changes in real estate price of current month. Since such effect is mainly from Shenzhen to Dongguan and Huizhou and between Dongguan and Huizhou, time interval of such effect is short and it can be considered that changes in real estate price in Shenzhen will affect Dongguan and Huizhou one month later; mutual effect between Dongguan and Huizhou also has a cycle of one month. From the perspective of decision making, quick decision is required, otherwise it will not be possible to keep up with the trend of changes.

(2) Lag order relates mainly to the entire system and minor lag period can be observed from further discussion of impulse response analysis result. Real estate price in Shenzhen is little affected by that of Dongguan and Huizhou, therefore these relations will be ignored in this paper.

When Dongguan is affected by Shenzhen and Huizhou, lnszr has the largest impact on lndgr in period 2 (starting from period 1), which means there is one-month lag period; impact of lnhzr on lndgr reaches the peak in period 3, which means there is two-month lag period. Currently Shenzhen ranks higher than Dongguan and Dongguan ranks higher than Huizhou in terms of urban comprehensive ranking. It is thus clear that Shenzhen affects Dongguan in short time and Huizhou affects Dongguan in long time.

When Huizhou is affected by Shenzhen and Dongguan, lndgr has the largest impact on lnhzr in period 2, which means there is one-month lag period; impact

of lnszr on lnhzr reaches the peak in period 3, which means there is two-month lag period. In other words, Dongguan affects Huizhou in short time and Shenzhen affects Huizhou in long time.

Taken together, it can be generally considered that Shenzhen first affects Dongguan and then Dongguan affects Huizhou both with a lag period of one month. And Shenzhen affects Huizhou and Huizhou affects Dongguan in two months. This also shows stepped development between Shenzhen, Dongguan and Huizhou.

4.3.4 **Predication role of VAR model**

The VAR model of interplay between real estate prices in Shenzhen, Dongguan and Huizhou offers three regression equations (equations 2, 3 and 4) of growth rate of logarithm of real estate prices in these three cities and then variance decomposition of the model is combined to further analyze its predication role in interplay between real estate prices in Shenzhen, Dongguan and Huizhou.

(1) Lag periods can be used for prediction. As we know real estate prices in Shenzhen, Dongguan and Huizhou of current period, the current period can be considered as period (t-1) to be used in the regression equations to predict real estate prices of the next period; then predicated values of such next period will again be considered as period (t-1) to be used to predict real estate prices of the period after that, and so on. However, result from such dynamic fitting can only show the trench of change in series rather than describing potential fluctuations caused on unknown reasons. Therefore, VAR model is only useful for short-time prediction where it can have high predication accuracy. The longer the prediction term, the lower the prediction accuracy. This is in line with the law

of development in this world. We can hardly use current monthly data to predict real estate prices in Shenzhen, Dongguan and Huizhou after 20 years.

(2) Variance decomposition helps to locate the exact pair of relation that mainly causes fluctuations in real estate prices in Shenzhen, Dongguan and Huizhou.

As to Shenzhen, lnszr has the greatest proportion of contribution to the standard deviation of itself, dropping from 100% in period 1 to 98.1705% in period 10. By contract, contributions of Dongguan and Huizhou fluctuate more greatly as time passes, which means in the future, effect from Dongguan and Huizhou on real estate price in Shenzhen will increase. Of course in consideration that no support from statistical data is available for effect of Dongguan and Huizhou on real estate price in Shenzhen, such change does not make much sense.

As to Dongguan, the proportion of lnszr's contribution to the deviation of lndgr is increasing, rising from 2.5412% in period 1 to 20.7174% in period 10; while contribution of lnhzr to the standard deviation of lndgr increases from 0 in period 1 to 3.0186% in period 5 and drops afterwards It means that real estate price fluctuation in Shenzhen has increasing contribution to that in Dongguan and contribution of Huizhou to fluctuation in Dongguan increases in short term but drops in middle and long terms.

As to Huizhou, the proportion of lnszr's contribution to the deviation of lnhzr increases from 3.5638% in period 1 to 18.3425% in period 10; while contribution of lndgr to the standard deviation of lnhzr increases from 10.0667% in period 1 to 22.3891% in period 3 and drops to 21.0513% in period 10. It means that real estate price fluctuation in Shenzhen has increasing contribution to that in Huizhou and contribution of Dongguan to fluctuation in Huizhou increases in short term but drops in middle and long terms.

It can be considered that real estate price fluctuation in Shenzhen has increasing contribution to that in Dongguan and Huizhou; while mutual contribution of real estate price fluctuations in Dongguan and Huizhou to each other increases in short term but drops in middle and long terms. It means Shenzhen has increasing influence on real estate price fluctuations in Dongguan and Huizhou, while mutual influence of real estate price fluctuations in Dongguan and Huizhou on each other may increase in short term and drop in middle and long terms. This is basically consistent with the integration trend in Shenzhen, Dongguan and Huizhou since these three cities will one day become a metropolitan area.

Chapter 5 Cause analysis of interplay between real estate prices in Shenzhen, Dongguan and Huizhou

Interplay between real estate prices in Shenzhen, Dongguan and Huizhou has statistical rule behind it and mainly reflects as influence of Shenzhen on Dongguan and Huizhou and mutual influence between Dongguan and Huizhou. At the same time we should know that there is solid economic foundation for mutual influence of real estate prices in Shenzhen, Dongguan and Huizhou and these prices are mainly driven up by real estate price in Shenzhen. Real estate price in Shenzhen has positive influence and mutual influence on Dongguan and Huizhou in social, psychological and policy dimensions. In this chapter, qualitative analysis and discussion will be performed concerning causes of interplay between real estate prices in Shenzhen, Dongguan and Huizhou.

5.1 Economic causes of interplay between real estate prices in Shenzhen, Dongguan and Huizhou

We can tell from analysis in the previous chapter that real estate price in Shenzhen is mainly affected by itself rather than by Dongguan and Huizhou. Meanwhile, despite obvious influence of Shenzhen on Dongguan and Huizhou and mutual influence between Dongguan and Huizhou, this is only the Granger cause. The essential causes of real estate price rise in Shenzhen are complex economic causes; while growing real estate prices in Dongguan and Huizhou alongside Shenzhen are also attributable to various economic causes in addition to overflow effect of real state price in Shenzhen.

5.1.1 Macro causes

It is generally considered that such macroeconomic indexes as money supply in broad sense (M2), GDP, CPI, interest rate and exchange rate (see Appendix for relevant data) have major influence on real estate prices.

(1) M2

Money supply in broad sense provides liquidity for economic growth and also drives real estate prices up. Stock market and real estate market are two reservoirs of money market. Money is excessively oversupplied in China and its growth rate is far beyond economic grow rate. Since the stock market is weak in China, the reservoir functions poorly and therefore overly supplied money goes to the real estate market. The real estate market in China absorbs large amount of liquidity and pushes the real estate price up. Money oversupply drives nationwide real estate price rise and this to some extent explains increase in real estate prices in Shenzhen, Dongguan and Huizhou.

In this paper, an attempt has been made to explore relation between M2 in China and real estate prices in Shenzhen, Dongguan and Huizhou. But M2 is national, while real estate prices in Shenzhen, Dongguan and Huizhou are regional and therefore their relation has no great statistical significance. However, such economic relation cannot be ignored.

From July 2010 to December 2017, M2 in China has increased from RMB 67.4051 trillion to RMB 167.6769 trillion with an increase rate of 148.76%. Within the same period, real estate prices in Shenzhen, Dongguan and Huizhou have increased by 145.87%, 96.17% and 79.57% respectively. Since the same trend of growing in time is visible, we believe that M2 oversupply is one the economic drivers of real estate price rise in Shenzhen, Dongguan and Huizhou.

In recent two years, as U.S. has started another cycle of interest rate rises, global liquidity drops and China is unable to continue its policy of oversupply as before. Such practice as driving economic growth with investment has to be restrained. In this way, M2 growth slows down in order to eliminate building up of systematic risks. It is generally considered that M2 growth is a major causes of continuous growth in real estate prices in China, including Shenzhen, Dongguan and Huizhou. Slowing down in M2 growth will have negative impact on real estate price rise.

(2) GDP growth

GDP growth drives real estate price up to some extent. From July 2010 to December 2017, China has maintained annual and quarterly GDP growth rate over 6.5%. But a continuous trend of slowdown in GDP growth appears in the same period with GDP growth rate dropping from two digits to one digit.

This is noteworthy because on one hand, GDP growth is the foundation of real estate prices and on the other hand, drop in GDP growth rate has not resulted in obvious slowdown of real estate price growth rate. Main cause of this may be that since 2010 or before, the first measure taken by Chinese government in face of economic growth slowdown is to loose monetary policy in order to stimulate economic growth, resulting in real estate price growth due to increased liquidity; when economic grow rate is stable, real estate price grows mildly due to conservative monetary policy. Therefore the relation between GDP growth and real estate prices in Shenzhen, Dongguan and Huizhou is complicated. But we can at least safely believe that GDP growth is a foundation of real estate prices in Shenzhen, Dongguan and Huizhou and the relation with GDP growth rate remains to be explored.

In 2018, gross GDP in China exceeded RMB 90 trillion for the first time with an increase rate of 6.6% and the trend of slowdown in GDP growth rate continues. China is at the crucial moment of transforming its extensive and resource-intensive economic growth mode of earning foreign exchange through exports and driving economic growth with investment to resource-saving, consumption growing, innovation-driven and intensive growth pattern. The power driving economic growth is shifting and it takes some time before the process is finally completed. This will have some effect on real estate prices in China, including Shenzhen, Dongguan and Huizhou.

(3) CPI

Consumer price index (CPI) reflects the trends of national or regional price changes and will have some effect on real estate prices. It is generally believed that as prices go up and money depreciates, the price of real estate, as a kind of commodity will also rise. It can be considered that CPI and real estate prices change along the same direction.

However, there might be some exception in relation between CPI and real estate prices in China: (1) Chinese real estate prices contain only house rental price rather than social products and services included in CPI; (2) there is some crowding-out effect between real estate purchase and consumption of social products and services because very large amount of fund is required for real estate purchase (known as requiring "six wallets" from parents, grandparents and maternal grandparents). People have to scrimp and save in order to purchase houses, resulting in reduced purchasing power. Therefore CPI and real estate prices may go in the opposite directions to some extent (Peng, 2018). In

other words, real estate purchase crowds out consumption fund and results in consumption downgrading. This has been heatedly debated in China.

Generally, CPI in China remains relatively stable, which means the prices in general are stable. Although in the context of money oversupply, tremendous function of the reservoir of the real estate market keep the prices flat.

(4) Interest rate

Interest rate refers to the ratio of amount of interest against loan fund, namely principal within certain period of time. Interest rate directly affects the cost of residents to borrow funds from banks when purchasing real properties. Changes in interest rate can be considered as closely related to real estate prices. Interest rate reflects level of tightness of monetary policy. When the policy loosens (interest rate drops), it is very likely that real estate price may rise; when the policy tightens (interest rate increases), it is very likely that real estate price may fall. Therefore, real estate price generally goes in the opposite direction with interest rate.

It is generally considered that in the year to come, the monetary policy in China may aim to stabilize real estate price in order to prevent systemic risk. Therefore, interest rate will stay flat to guarantee sufficient liquidity and monetary policy tools that can be chosen include reducing deposit reserve ratio, medium-term lending facility (MLF) and targeted medium-term lending facility (TMLF). But the possibility of interest rate cut is low and it is good for stabilizing or keeping down real estate prices in Shenzhen, Dongguan and Huizhou.

(5) Exchange rate

Exchange rate refers to the ratio or price ratio of currency one country against currency of another country. Rise or fall in national or regional foreign

exchange quotation will affect imports & exports, economic structure and production distribution. The most important indicator of Chinese exchange rate market is the average exchange rate of USD against RMB.

For an open urban agglomeration like Shenzhen-Dongguan-Huizhou, the relation between exchange rate change and real estate price may be that on one hand, RMB local currency depreciates and real estate price rises mainly due to increased local currency liquidity; on the other hand, as local currency appreciates, hot money pours in and as local currency depreciates, hot money flows out. This has some negative effect on real estate price and may partly offset positive effect of increased liquidity.

Meanwhile, it should also be noted that Shenzhen, Dongguan and Huizhou locate near Hong Kong which is a free market where fluctuation of exchange rate directly affects real estate price. If exchange rate increases in Hong Kong, its real estate price rises; if exchange rate decreases, its real estate price falls. Effect of exchange rate on real estate price in Hong Kong may radiate to Shenzhen, Dongguan and Huizhou, but in general there is no strong connection between real estate prices in Shenzhen, Dongguan and Huizhou and RMB exchange rate.

In Chinese mainland, a floating exchange rate regime has been put in place with market supply and demand as basis and adjusted and managed with reference to a basket of currencies. Exchange rate of RMB against USD has become basically market-oriented. However, China imposes some regulation upon purposes of foreign exchange for fear of its excessively fast outflow. Foreign currencies used for non-compliant purposes will not be exchanged. Therefore exchange rate in the future may stay relatively stable. When exchange rate,

interest rate and real estate price are at risk, China tends to use macro policy to stabilize interest rate and real estate price. Thus in the year to come, the possibility of interest rate increase is slim, exchange rate will stay stable and its effect on real estate price will be greatly weakened.

(6) Comprehensive analysis of macro causes

Macro causes of interplay between real estate prices in Shenzhen, Dongguan and Huizhou are complicated. Although M2, GDP, exchange rate, interest rate and CPI contribute to some extent to formation and mutual effect of real estate prices in Shenzhen, Dongguan and Huizhou, there are still correlated factors failing to be revealed and further investigation is required.

It can be sure that there are macro causes underlying rise of real estate price. Mutual effect and upgoing trends of real estate prices in Shenzhen, Dongguan and Huizhou will not be possible without the macro environment of fast growing economy in China.

As anti-globalization movement intensifies in recent two years, influence of trade wars, geopolitical conflicts and currency policy orientation of major economies in the world becomes more and more visible. China has risen up to such challenges with supply-side structural reform and deleveraging strategy and achieved significant results. However, in the context of global tightening cycle, the pressure of China to stabilize employment rate, finance, foreign trade, foreign fund, investment and expectations increases, posing challenges to regional economic development and real estate industry for areas including Shenzhen, Dongguan and Huizhou.

5.1.2 Regional causes

In market economy, a balanced state can promise the highest efficiency. But it is hard to keep total supply and demand in constant balance. Both oversupply and overdemand will break market balance. Therefore, imbalance is the normal state of actual economic operation. An effective way to improve economic operation efficiency is to change the nature of imbalance and optimization of allocation of resources in the state of imbalance. Regional causes of interplay between real estate prices in Shenzhen, Dongguan and Huizhou mainly include imbalance in economic and social development sectors and imbalance in real estate industry development.

(1) Imbalance in economic and social development sectors

Economic and social development level is the basic conditions of difference between real estate prices in Shenzhen, Dongguan and Huizhou. We can tell from GDP per capita, per capita disposable income and permanent resident population of these three cities that there is a trend of stepped development among Shenzhen, Dongguan and Huizhou (Table 5-1).

Table 5-1 Comparison of regional factors of interplay between real estate prices in Shenzhen, Dongguan and Huizhou from 2003-2017

	Shenzhen - GDP per capita (RMB)	Shenzhen - per capita disposable income (RMB)	Shenzhen-permanent resident population (10,000)	Dongguan - GDP per capita (RMB)	Dongguan - per capita disposable income (RMB)	Dongguan-permanent resident population (10,000)	Huizhou-GDP per capita (RMB)	Huizhou-per capita disposable income (RMB)	Huizhou-permanent resident population (10,000)
2003	47029	25936	557	22174	18471	581	20758	12674	355
2004	54236	27596	598	27554	20526	595	23642	13822	362
2005	60507	21494	828	33287	22882	651	21896	14881	371
2006	69450	22568	846	39490	25320	675	25043	15991	376
2007	79645	24870	862	46146	27025	695	29976	17310	388

2008	89814	26729	877	53301	30275	695	33077	19481	393
2009	92771	29245	891	56601	33045	635	35819	21278	398
2010	94296	32381	1037	66351	36350	423	43397	23565	463
2011	110387	36505	1047	57470	39513	825	45331	26609	465
2012	123247	40742	1055	60556	31369	829	50873	29965	467
2013	136947	44653	1063	66109	46594	832	57144	32992	470
2014	149497	40948	1078	70604	36764	834	63657	27300	473
2015	157985	44633	1138	75616	39793	825	66231	30057	476
2016	167411	48695	1191	82682	43096	826	71605	33213	478
2017	183127	52938	1253	91329	46739	834	80205	36608	478

Note. Data for GDP per capita and per capita disposable income in Shenzhen, Dongguan and Huizhou adapted from Choice Database (2019), for Permanent resident population in Shenzhen, Dongguan and Huizhou adapted from Shenzhen Statistical Yearbook (2018), Dongguan Statistical Yearbook (2018) and Huizhou Statistical Yearbook (2018).

According to Table 5-1, there is a significant gap between GDP per capital in Shenzhen, Dongguan and Huizhou. For example, in 2017, GDP per capita in Shenzhen, Dongguan and Huizhou are RMB 183,127, RMB 91,329 and RMB 80,205, in which Shenzhen is far ahead and Dongguan has significantly higher level than Huizhou. Per capita disposable incomes of these three cities are RMB 52,938, RMB 46,739 and RMB 36,608, with an obvious gap. These three cities have permanent resident population of 12.53 million, 8.34 million and 4.78 million and the difference is also significant.

Imbalance in economic and social development in Shenzhen, Dongguan and Huizhou can also be told from various other aspects which will not be further discussed here. Imbalance in economic and social development is bound to be reflected in real estate prices. Meanwhile, such imbalance may weaken or

intensify within certain period of time, resulting in mutual effect on real estate prices in Shenzhen, Dongguan and Huizhou.

(2) Imbalance in real estate market development

As the real estate market in China develops quickly, its supply characteristics mainly reflect in the following three aspects: firstly, the level of monopoly is high in the real estate market. In essence, it is the monopoly of lands. Such characteristic takes shape when the right to use lands in China is passed from governments at all levels to land developers via bidding. Long-term partnership between governments and enterprises lays the foundation of monopoly in the real estate market. Secondly, performance of the real estate market is subject to different periods. This is because supply and demand in the real estate market change in different periods and they fluctuate along with changes in housing price and number of houses available within a certain period of time. Thirdly, there is lag and risks in the real estate market. This is because most real estate products in China have long production cycles sand high development values. Such characteristics result in lag and risks in the real estate market and pose negative effect on development of real estate enterprises.

The real estate market in China has three demand features during its construction and development: firstly, regionality. Regionality of Chinese real estate market means that real estate products can only stay where they are rather than being moved in space and residents have to choose. Secondly, diversity. Diversity means that real estate developers will present diversified designs in dwelling size, type and room type of real estate products based on different requirements of consumers. Thirdly, hierarchy. Hierarchy means that real estate developers will divide their products into high, middle and low grades based on

income level of consumers to help people from different classes to choose suitable houses based on their conditions.

There is obvious imbalance in Chinese real estate market in terms of total volume and local structure.

Firstly, there is imbalance in total volume of Chinese real estate market. Its total demand is higher than its effective demand and its actual supply is higher than its effective supply. This is an expression of imbalance in total demand of the real estate market. In short, shortage and surplus of real estate products coexist in the market. This is caused by two main aspects: China has huge housing demand and market supply increases quickly as well, but per capita housing is still at low level. If the people fail to purchase houses, there will be surplus in the market; insufficient effective demand and increasing commodity housing vacancy rate are caused by continuous construction of new houses and resulting oversupply. Meanwhile, many people cannot afford to buy houses. Therefore, quick growth in housing supply and insufficient effective demand directly lead to imbalance in total volume of the real estate market.

Secondly, there is imbalance in structure of Chinese real estate market. Such imbalance in structure is mainly reflected in housing structure. Generally, real estate products can be classified into affordable housing, common housing and high-grade housing. Those housing types have different profit margins and therefore most real estate developers prefer development commodity housing. However in terms of market structure, high-grade housing tend to have greater rise in prices than affordable and common housing and this will cause imbalance in housing structure to some extent.

Imbalance in the real estate market in Shenzhen, Dongguan and Huizhou is mainly reflected in regional imbalance and imbalance in total volume.

Firstly, when these three cities are considered as a whole, core areas in Shenzhen, Dongguan and Huizhou suffer a shortage in housing supply, demand exceeds supply and housing price is rising. This is most obvious in Shenzhen. Moreover, a city always expands from its center to the outskirt. Therefore in areas with disadvantageous commercial location and developed at late stage, supply exceeds demand and destocking of real estate market is not possible within a short time. This is why regional imbalance occurs within the real estate market in Shenzhen, Dongguan and Huizhou.

Secondly, in terms of total volume, supply in the real estate market in Shenzhen always falls short of its demand due to small area of the city. While in Dongguan and Huizhou, supply in their real estate markets exceeds demand in long term. Therefore, there is imbalance with regard to total housing volume.

Such imbalance in the real estate markets in Shenzhen, Dongguan and Huizhou has obvious effect on their real estate prices. Firstly, shortage in total supply of Shenzhen real estate market results in housing price staying at a high level. This, combined with many other factors including economic growth, public expectations and herd behavior causes high housing price to radiate to other areas and leading to increase in real estate prices in Dongguan and Huizhou. Secondly, as integration in transportation and economy intensified in Shenzhen, Dongguan and Huizhou, imbalance in the real estate market will weaken and mismatch between total supply and demand will improve, as reflected in curb on real estate price growth. Finally, as hinterland of Shenzhen, Dongguan and Huizhou have broad lands and their real estate prices in different areas and

positions tend to grow closer to the highest level at the core area, thus a well-distributed price system is formed where housing in different areas has different prices with increasingly small range of fluctuation.

To sum up, as more and more housings are developed in China, there is a trend that the total supply exceeds the total demand and the market shifts from seller's market to buyer's market. Shenzhen, Dongguan and Huizhou are no exceptions. Under such trend of development, there is some downward pressure on real estate price in the future. Meanwhile, the *Development Plan for Guangdong-Hong Kong-Macao Greater Bay Area* released will bring Shenzhen, Dongguan and Huizhou as well as the entire Guangdong-Hong Kong-Macao Greater Bay Area closer economically and their development speed and quality will further improve. As to real estate prices in Shenzhen, Dongguan and Huizhou, the effect of regional factor will be magnified as development of Guangdong-Hong Kong-Macao Greater Bay Area and enhanced integration in Shenzhen, Dongguan and Huizhou.

5.1.3 Internal causes

There are inexhaustible internal causes for interplay between real estate prices of different cities. For Shenzhen, Dongguan and Huizhou, such factors as land area, built-up area, construction land area, real estate investment vary greatly (Table 5-2) ant they may result in difference in housing prices of and mutual effect among the three cities.

Table 5-2 Comparison of internal causes of interplay between real estate prices in Shenzhen, Dongguan and Huizhou from 2003-2017

	Shenzhen - urban built-up area (km^2)	Shenzhen - urban construction land area (km^2)	Shenzhen - real estate development investment (RMB 100 million)	Dongguan - urban built-up area (km^2)	Dongguan - urban construction land area (km^2)	Dongguan - real estate development investment (RMB 100 million)	Huizhou - urban built-up area (km^2)	Huizhou - urban construction land area (km^2)	Huizhou - real estate development investment (RMB 100 million)
2003	516	527	410	246	36	33	63	63	19
2004	551	568	432	650	39	67	74	74	29
2005	713	703	419	42	42	144	94	94	44
2006	720	730	640	119	119	164	94	94	68
2007	764	751	461	75	76	209	101	125	138
2008	788	773	440	83	83	270	180	164	187
2009	813	797	437	87	87	278	161	159	175
2010	830	817	458	92	92	299	215	203	268
2011	841	840	590	101	101	374	221	280	378
2012	863	851	737	107	107	377	229	216	482
2013	871	869	888	112	112	498	237	229	594
2014	890	889	1069	922	922	588	244	229	667
2015	900	895	1331	929	1045	575	217	214	610
2016	923	921	1757	957	1063	643	263	254	748
2017	925	983	2136	989	1075	702	300	279	884

Note. Data for Shenzhen and Dongguan adapted from CEInet Statistics Database (2019), for Huizhou adapted from Huizhou Statistical Year Book (2018).

(1) Land area

According to data query, Shenzhen, Dongguan and Huizhou have land areas of 1,997, 2,697 and 2,460 km^2 respectively in 2017. Land areas are sizes of administrative regions of Shenzhen, Huizhou and Dongguan and remain basically unchanged for a long time, in which Shenzhen has the smallest area, Dongguan has the largest area and Huizhou is in the middle.

We can find in combination of permanent resident population in Table 5-1that Shenzhen has permanent residents of 12.53 million, Dongguan has 8.34 million and Huizhou has 4.78 million. In terms of population density, Shenzhen has the largest density and is followed by Dongguan and Huizhou. This explains to some extent stepped difference in real estate prices of these three cities.

Moreover, Shenzhen has increasing inflow of permanent residents in recent years, while Dongguan has minor net inflow in permanent residents and Huizhou's population increase stays relatively flat. In the future, some areas within these three cities will have net inflows of permanent residents and real estate prices there will rise further.

On the whole, Shenzhen, Dongguan and Huizhou are frontiers of economic development in China and the release of the Development Plan of the Guangdong-Hong Kong-Macao Greater Bay Area (2019) will further consolidate the status of these three cities as hot spots of economic growth. Therefore, Shenzhen, Dongguan and Huizhou will have net inflow of permanent residents in short term and this will provide support for real estate prices.

(2) Built-up area

According to Table 5-2, from 2003 to 2017, built-up area in Shenzhen has increased from 516 km^2 to 925 km^2 with added area of 405 km^2; built-up area

in Dongguan has increased from 246 km^2 to 989 km^2 with added area of 743 km^2; built-up area in Huizhou has increased from 63 km^2 to 300 km^2, with added area of 237 km^2 . Additional built-up area means expansion of cities. In these three cities, Shenzhen has very limited land for further development and therefore second largest expansion area and the slowest expansion speed; Dongguan has the largest area of land for expansion and the second fastest expansion speed; Huizhou has the smallest area for expansion but the fastest expansion speed.

Generally as cities expand, supply of commodity housing will increase. Thus cities with fast speed and large area for expansion will have slow-growing real estate price, or vice versa. Dongguan and Huizhou, who have relatively low real estate prices and slow price growth speed, are solid proof of such fact.

Meanwhile, we all know that the population flows. When real estate price in some cities is too high and become unaffordable for populations without housings, some people choose to leave these cities and move to other cities or purchase housing in rural-urban continuum near these cities. This is common in such cities as Shenzhen, Dongguan and Huizhou. For example, in Songshanhu District between Shenzhen and Dongguan or Daya Bay Area between Shenzhen and Huizhou, many residents from Shenzhen have purchased houses here for living or investment, driving real estate prices in Songshanhu District and Daya Bay Area up. In this way, rise in real estate price due to insufficient built-up area has been diluted by free population movement. This is one of the causes of interplay between real estate prices in Shenzhen, Dongguan and Huizhou.

In the future, built-up area in Shenzhen, Dongguan and Huizhou will increase. But Shenzhen has hardly any more reserve land for development and therefore growth speed of its built-up area will be slower than Dongguan and Huizhou. As built-up area increases, connection between Shenzhen, Dongguan and Huizhou will become tighter in line with development rule of regional integration. Mutual influence between their real estate prices will increase.

(3) Construction land area

Land used for real estate development is part of quota of construction land. Increase in construction land area partly determines the intensity of real estate development and affect real estate prices.

According to Table 5-2, from 2003 to 2017, construction land area has increased from 527 km^2 to 983 km^2 in Shenzhen, from 36 km^2 to 1,075 km^2 in Dongguan and from 63 km^2 to 279 km^2 in Huizhou. Increase in construction land area usually means increase in land area for real estate development. During 2003 - 2017, Dongguan has the fastest increasing construction land area and is followed by Huizhou and Shenzhen.

The difference between construction land area and built-up area represents area of land for future construction. In 2017, the difference is 58 km^2 in Shenzhen, 86 km^2 in Dongguan and -21 km^2 in Huizhou. The negative difference in Huizhou may be caused by failure of some construction lands to obtain land certificate. Many projects start development without obtaining such certificates. In general, lands for construction and development of real estate in the future are in short in Huizhou, Shenzhen and Dongguan. If no major adjustment is made, this may support real estate prices.

(4) Real estate development investment

Real estate development investment is an index of real estate market boom. From 2003 to 2017, real estate investment has increased from RMB 41 billion to RMB 213.6 billion in Shenzhen, from RMB 3.3 billion to RMB 70.2 billion in Dongguan and from RMB 1.9 billion to RMB 88.4 billion in Huizhou.

It is generally believed that increase in real estate development investment will result in increase in real estate supply. Therefore, compared to Shenzhen and Dongguan, there may be some over-development in real estate in Huizhou, leading to negative effect on future real estate price. Real estate development investment can also flow. When real estate investment in one city is too much, some real estate developers may start investment in other cities and thus real estate prices of such cities affect each other.

Meanwhile, real estate development investment is closely connected to expectations of the real estate industry and national regulation policies. In some time in the future, real estate development investment in Shenzhen, Dongguan and Huizhou will remain relatively stable and effects on real estate prices will be limited.

5.2 Socio-psychological causes of interplay between real estate prices in Shenzhen, Dongguan and Huizhou

In addition to major economic causes of interplay between real estate prices in Shenzhen, Dongguan and Huizhou, there are also social and psychological causes, including psychological expectations, market noise and behavioral biases. In this section, causes with obvious effects are analyzed.

5.2.1 Psychological expectations

Among many social factors, real estate price is most sensitive to social psychology. Psychological expectations of the public will have huge influence

on real estate price and play a significant role in forming real estate price. Psychological expectations to some extent determine behaviors of supply and demand sides and in essence affect real estate price, including real estate prices in Shenzhen, Dongguan and Huizhou via influence on supply-demand relationship.

(1) Affecting demand via demand side

Demand side in real estate market can be roughly divided into owner-occupiers, investors and speculators. They have different degrees of sensitiveness to and influence by macro control policies. Influence of macro control on demand side is possible mainly in two ways: adjustment to down payment ratio and interest rate of personal housing mortgage loan.

Demand of owner-occupiers to purchase housing is rigid demand, where macro control has limited influence on their payment ability and serves only to restrain such demand and delay housing purchase of consumers. However, there are signs indicating that the market has entered the interest-rate rise cycle, delay in housing purchase can mean higher interest cost. When payment ability is enough, demanders will be more determined in making housing purchase decision. Even if demand of owner-occupiers is restrained, sharp rise may occur in case of policy adjustment or loosening.

As to speculation demand, housing is bought and sold in short and medium terms to profit via financial leverage. Speculation demand, as elastic demand, is affected the most significantly by macro control and should be regulated the most. For speculators, their willingness to buy is easily affected by market fluctuations and they care most about rise and fall of housing prices in short term. As long as difference of buying and selling prices is big enough, reduced

profit margin due to increased loan cost will not affect them greatly. Therefore, macro control will restrain speculation demand. Especially when differential interest rate policy is introduced for purchase of second house, speculators are greatly affected.

As to investment demand where investors use real estate as a long-term investment, investors have stable willingness to buy and this will support housing price in long term. Investment demand has moderate elasticity and regulation effect between demand of owner-occupiers and speculation demand. For investors, real estate market will continue to attract investment when Chinese capital market is underdeveloped with limited investment channels.

According to relevant economics theories, demand desire and ability affect demanders' recognition of housing price (Zhao, 2016). In fact, various demanders should also make judgment of direction of future housing prices in addition to their own housing purchase demand and ability and form psychological expectations for the future. It means that with demand desire remaining unchanged, if it is favorable to purchase now than in the future, demanders turn to choose to purchase housing now. Choices of a small number of demanders will not affect housing price. But if a majority of demanders share similar expectations of future trend of housing price, they tend to make similar choices. When the majority of demanders take action to purchase or not to purchase temporarily, this will greatly affect market price, significantly increase or decrease current demand and thus affect housing price. Great rise in housing prices in Shenzhen, Dongguan and Huizhou several years ago was closely related to psychological expectations of the public. When people found that housing price rose greatly, they would expect that the housing price would

continue to rise and it would be a loss if they didn't purchase now. The more the housing price increases, the more active the people purchase houses. In this way, actual demand is exaggerated and panic demand is formed, further promoting excessively fast growth of housing price. After regulation of real estate market by the government, especially introduction of new housing loan policy, the public expectation becomes unclear and the people all wait and see what will happen with money in their pocket, resulting in decrease in current demand and fall of housing price.

(2) Affect supply via supply side

Since current real estate market is sellers' market where developers dominate the market rather than buyers. Therefore analysis from the perspective of supply side is simpler.

If housing price rises, developers will have strong expectation of further rise in housing price, resulting in two kinds of trends. On one hand, developers pay higher for lands in land auction market in pursuit of bigger profits, resulting in sustained increasing in land price and thus in housing price; on the other hand, as the public expects that housing price will keep rising, developers can wait for a while before development after land purchase or hold built houses from the market, hoping for greater profits. Such land and housing hoarding further fuels soaring housing price in Shenzhen, Dongguan and Huizhou.

(3) Magnification effect of psychological expectations

Psychological expectation effect means that sometimes behaviors of humans (including some animals) are controlled by results of their expected behaviors rather direct results of their behaviors.

Psychological expectations of humans may deviate during transmission due to distorted acceptance of external information or excessive over-exaggeration or under-exaggeration, resulting in great influence on fluctuations of real estate price. During expansion stage when real estate price soars, over-exaggeration of information psychologically expected or overoptimism of the public may further stimulate rapid expansion of the real estate industry. By contrast, during depression of the industry, pessimistic expectations will be magnified and lead to worse depression of the real estate market.

In practices with psychological expectations, if actual results are consistent with expectations, effect and credibility of such expectations will improve. If expectations are good but don't conform to the reality, there will be cognitive dissonance and cause the people to alter their habitual behaviors. In long-term real estate market transactions in China, continued rise in housing price as a whole, house buyers obtain more gains than those who haven't bought houses and those buying houses earlier obtain more gains than those buying late. Thus, a universal expectation is form in the society in China that real estate price will (never) fall and houses should be bought as early as possible regardless of their purposes for owning & occupying, investment or speculation. The remaining high real estate prices currently in Shenzhen, Dongguan and Huizhou are solid proof.

However, in case of major incidents such as domestic or foreign economic crisis, public psychological expectations of real estate price will be completely reversed: potential buyers wait and sellers sell at low prices, probably resulting in sharp drop in real estate price. Currently as decline in economic growth rate in China and domestic and foreign economic uncertainties increase, it is

imperative to prevent systematic risk caused by collapse of real estate market. In the opinion of the author, the key is to maintain public psychological expectation that real estate price will not drop sharply. One of the important measures to be taken is to maintain all house purchase restrictions, because this will send a signal to the market that the government is still regulating house purchases for fear of excessively fast rise of real estate price rather than drop in the price. If such restrictions lifted, the public may turn to believe that the government hopes to maintain economic growth by coax people into buying houses and public psychological expectation of real estate price will reverse instead, leading to systematic risk in the real estate industry.

For real estate prices in Shenzhen, Dongguan and Huizhou, the influence of psychological expectations and their effect is enormous. Integration of Shenzhen, Dongguan and Huizhou and construction of Guangdong-Hong Kong-Macao Greater Bay Area greatly promote positive expectations of real estate price. In short term, public psychological expectation of continuous high real estate price in Shenzhen, Dongguan and Huizhou is strong.

5.2.2 Market noise

Economists have long been studying information allocation in market fluctuations and one typical view is that market fluctuations originate from market imbalance caused by information asymmetry. But this theory cannot account for within the framework of economics of information market fluctuations at the time of balanced information allocation.

Black (1986) came up with the concept of market noise, which means market transactions of irrational traders are based on biased market information. Market noise is also a kind of signals considered by noise traders as related to

intrinsic value of investment. But actually such relation is not significant. Noise can be false and meaningless information or misunderstood and insufficiently recognized information. A way to maximize efficacy of traders is to understand and trace basic information reflecting asset value. However, the problem is the means to locate and obtain and the time to obtain such information. After all, reliability of various information related to asset value can only be tested via fluctuations in asset value. Therefore, standards for identifying, obtaining and perceiving such information are subjective and transcendental. Market traders are not only collectors, but also senders of information. When the market is full of all kinds of information, information not related to asset value is market noise in theory.

From the perspective of economics of information, the essence of noise transactions in real estate market is price deviating from intrinsic value of the market. Market information cannot be passed completely between buyers and seller due to market noise. On one hand, true information is overshadowed by noise and information transmission efficiency decreases; on the other hand, there is natural deviation when market traders interpret and understand information and thus send and analyze information with bias. Market activities themselves will generate and transmit noise.

Since transaction decisions and level and ability to make such decisions of market traders will be affected by noise, such decisions and transactions based on them will be not completely rational. Irrational decisions and behaviors of individuals, when taken together, give rise to logic of collective irrational behaviors. When a collective trades based on noise, prices of buyers and sellers are sure to deviate from actual market values.

Some noise traders are random traders who follow niche and marginal trading logic rather than using actual information as basis of transactions. Some noise traders have biased information quality, transmission and analysis although they trade based on information and therefore cannot grasp the essence of information. They use wrong or incomplete information for market trading. Some other noise traders have biased expectations of asset incomes and their noise comes from obsessiveness to such expectations and resulting market behavioral biases.

In actual real estate market, noise is formed, transmitted, magnified and received based on human behaviors. Market traders are not only noise makers, but also noise receivers. Different traders produce noises with different contents and structure and transmitted beyond specific group of traders into the entire market. When original noises are picked up and utilized by traders, new noises are produced; other traders will again process such new noises and their scale increases exponentially and their effect is magnified. On the whole, in terms of changes in noises, noise traders are makers, transmitters and receivers of noises.

As the opposite of effective information, noises have clear boundary with effective information, which can be told from their contents, process of transmission and results. Firstly, effective information have contents that can fully reflect values of real estate market factors, while noise is a collection of false and distorted real estate market information; secondly, effective information has only a little disturbance during transmission and its contents can be conveyed in better way to receivers. Once effective information is disturbed during transmission, it will suffer loss and distortion and becomes noise in case of serious distortion; thirdly, effective information has slight

influence on real estate market fluctuations and can appease fluctuations in the long run; while noise will cause the market to deviate further from its value base and intensify market fluctuations.

Limited information is the transition point between effective information and noise and therefore has blur boundary with effective information and noise. Limited information may contain effective information and noise at the same time and a large amount of information in real estate market falls into this category. Limited information can be converted into effective information or noise, depending on level of rationality of market traders. When traders have high level of rationality, they can dig effective information from limited information with high content of noise; when traders have low level of rationality, they are susceptible to effect of noise even relevant limited information has high content of effective information.

Real estate market never falls short of noises and effect of noises on real estate price is direct and obvious. For example, on April 21, 2018, Kim Jong-un, North Korea's supreme leader suddenly announced to give up nuclear test and transcontinental ballistic missile launch test. Six days after such announcement, leaders from South Korea and North Korea met at Peace House on the South Korea side of the truce village of Panmunjom. Such effect had immediate effect on housing price in Dandong, China: on April 24, housing price in Dandong New District was RMB 3,500/m^2; two days later, it rose to RMB 5,500/m^2 with staggering percentage of rise. But later facts show that it would be a long way before North Korea really gave up nuclear weapon. As the meeting between leaders of North Korea and U.S. didn't go well as expected, especially the connection between North Korea giving up nuclear test & opening up of North

Korean economy and improved economy & increase in real estate price in Dandong is not as tight as what people hope, it can only mean that there is too much speculation and too rich imagination in real estate market in China. Later on, housing price in Dandong cooled down. It is a typical example of market noise transaction.

Real estate prices in Shenzhen, Dongguan and Huizhou are also greatly affected by market noises. For example, there was a rumor sometimes ago that a Greater Shenzhen City was to be established by integrating Shenzhen, Dongguan and Huizhou and another rumor that Shenzhen was to become a municipality under direct administration of the central government. There was both truth and market noise in such rumors and they had difference influences on rise and fall of real estate prices.

5.2.3 Behavioral biases

Behavioral biases in real estate transactions have close connection with psychological expectations and market noise mentioned before. Fluctuations in real estate price ultimately come down to human behaviors, while changes in human behaviors originate from changes in human perception of the external world. Sending, transmission and receiving of market information determines the level of human perception of the market and group economic behaviors can have major impact on the market. Therefore, effectiveness of information, preferences in human perception and organization method of human groups have decisive influence on market fluctuations. Information affects perceptions and perceptions guide behaviors. Changes in origins, paths and efficacy of information transmission have differential influence on shocks to perceptions. As information market is built in real estate market in China, efficiency of

transmission with real estate price as main information bundle traditionally is declining because of increased distortion of price due to various effects. Noise affect transaction behaviors of macro trading subjects during information acquisition, output, feedback and overflow, resulting in trading behavioral biases of such subjects.

Behavioral biases cause further fluctuations in real estate market via market prices, supply scale and timing, consumption preferences, trading expectations and loan allocation scale and structure.

(1) Sentiment bias

Many people believe that real estate market bubble is caused by sentiment biases of investors. People always feel that they know a lot or they are highly capable, because they think they get hold of more and better information or are better at interpreting information than others. This is so-called overconfidence bias. According to psychological researches, when people say they have 90% confidence about something, the actual success rate is only about 70%.

Overconfidence has two forms of manifestation: firstly, knowledge illusion, where people usually overestimate their knowledge level, capability and information acquisition ability; secondly, self-attribution bias, where people usually attribute success to themselves and shift responsibility for failure to others. The former is called self-enhancing bias and the latter self-protecting bias. Overconfidence leads to failure to diversify investment portfolios, underestimation of potential adverse factors of portfolios and overestimation of favorable factors by investors, resulting in too many transactions, high trading cost and poor performance.

Investors are usually affected by their own sentiments and psychological biases and their behaviors highly correlated. Such high correlation will drive up asset price far away from its basic level; when deviation from the basic level is too significant, major adjustment will be made. To understand real estate speculation bubble, positive or negative, we have to recognize the basic role of overconfidence of investors.

(2) Herd behavior

Behavioral finance research is related with people's expectations and adjustment to such expectations to a great extent. It is easier for individuals to stay rational, but a collective is usually irrational or vice versa. This shows that rationality or irrationality can only used to describe individuals or collectives respectively. There is certain coordination mechanism between the society and the economy and this is one of the fields under research of finance.

In real estate market, when the public tend to go long rather than short and price rises stably, everyone rushes to buy house and this is herd behavior. In 1980s when the yen surged, Japan was almost going to "buy the entire world". As credit crunched and land price fell after 1990s, bubble economy of Japan collapsed. A typical example was that Japan bought Rockefeller Center at record-high price, but suffered loss of over USD 600 million later (Feng Media, 2019).

Under the influence of psychological expectations, consumers' behaviors in real estate market are affected by own sentiments and external consistent behaviors and ultimately lead to formation or breaking of market balance. The essence of herb effect of economic behaviors is that whether behavior subjects can accurately make judgment and decisions. The role of subjective factors such as

people's sentiments, dispositions and psychological feelings played in judgment and decision making of economic behaviors cannot be ignored. People don't always make economic decisions in rational manner. Their behaviors are not only affected by inherent cognation biases, but also disturbed by external environment. They only show limited rationality most of the time.

Since individual investors can only get hold of part of information that affects expected price, they can only accept rather than influence changes in price. Various related information in the market is presented in the form of changes in price after integration by market players and individual investors can only determine their own behaviors based on behaviors of others in most cases. Conformity is a kind of passive adaptation and herd behavior is its concrete manifestation. Meanwhile, individuals have limited knowledge structure and stock, slow knowledge updating speed and thinking set. Individual ability is extremely limited although there is massive specialized knowledge in the market for learning and accumulating through various channels and one cannot master all relevant knowledge. Therefore, it is natural for investors to listen to analysis of professionals and use it as the basis of their investment and consumption. In this way, conformity becomes a method for individuals to make up for defects in knowledge structure and limited knowledge stock. Finally, it is in human nature to avert risks, losses and regrets and such nature fuels conformity and herd behavior.

5.3 Real estate-related policy causes

Main policy causes of interplay between real estate prices in Shenzhen, Dongguan and Huizhou are systems, regulations, policies and administrative measures in terms of fisc, taxation, finance, land, housing, urban planning &

construction, transportation and social security introduced by national or local governments. Generally, policy causes are from state machinery and therefore have a prominent role in interplay between real estate prices in Shenzhen, Dongguan and Huizhou. At the same time, policy causes effect real estate price quickly. If the effect of economic and social psychological factors is gradual, the effect of policy causes is abrupt.

5.3.1 Land policy

Currently, land policy in China mainly aims to limit land supply in big cities and encourage land development in medium and small cities. However, due to lack in industrial support, slow economic development and fewer employment opportunities in medium and small cities, their population has net outflow or slow growth even if household registration restrictions are lifted. For such cities, lifting control of land supply will aggravate oversupply in real estate market and result in further drop in real estate price.

In contrast, big cities have diversified industries, obvious agglomeration advantages, fast economic growth and lasting demand for employment. Limiting land supply in such cities will intensify the contradiction between population and lands and further aggravate undersupply in the market.

As far as current status in China is concerned, current land supply mode can be reformed to add land supply to the East and big cities such as Shenzhen, Dongguan and Huizhou in order to cool soaring housing price in tier 1 cities and mitigate cumulative risk caused on excessively fast price rise.

5.3.2 Financial policy

There is great contradiction between real estate market in China and the only financial supply mode and it is necessary to build a financial supply system

with multiple layers and structures. Real estate finance can contain multi-structure financial supply channel including real estate securities, real estate trust, real estate fund and real estate insurance. Currently, financial supply for real estate market in China mainly comes from commercial bank loans. In the context of fast developing real estate economy, well-matched financial support is necessary.

In addition, professional real estate finance development should be encouraged. Traditional commercial bank loans cannot cover real estate consumer groups at difference levels and an one-size-fits-all approach to distinguishing target consumer groups of loans cannot help professionally solving the problems of how much to be lent and what is the interest rate. Professional real estate finance institutions can understand different demand credits in real estate market and adopt credit operation mode consistent with such credits.

5.3.3 Tax policy

Real estate transactions involve VAT, land appreciation tax, stamp duty, deed tax and personal income tax. Meanwhile, there are many tax preferences in various substantial laws, some of which have already been abolished. During real estate transactions, changes in tax burden will affect sales & purchase of houses and thus real estate price.

In recent years, there has been a rumor that China is about to introduce housing property tax to fill the blank in real estate possession tax. Moreover, tax policies including housing property tax and urban land use tax based on prices, reform of urban maintenance and construction tax and additional education tax into official taxes and establishment of a general taxation system for urban residential land are under implementation. Changes in real estate tax policy

signal intentions of the government to intervene the market and will have quick and obvious effect on real estate price.

5.3.4 Purchase quota policy

Purchase quota, as a major real estate regulation policy, refers to setting commercial housing purchase quota in central cities for a long term in order to completely curb speculation and over-investment and lifting of non-marketization regulatory measures to ensure long-term stable and healthy development of the industry. Some believe that purchase quota is the policy system with the least market intervention, consistent with development rule and good for long-term stable development of the industry.

After imposing purchase quota for a long time in the real estate industry, the middle class will again become the major force of market demand and housing price will again become affordable. Local government can flexibly adjust supply and demand via land supply and control over public reserve funds and leave others to the market. Purchase quota can meet dwelling and investment requirements of most households and doesn't conflict with the policy of household registration by house purchase in some cities, nor impede the development of house rental and resort property markets. Purchase quota policy is easy for implementation and relies mainly on real estate title registration and network signing systems of city housing authorities with no need of sharing information nationwide.

This policy reduces demand via act of men and actively restrain excessively fast real estate price rise. However, purchase quota doesn't consistent with market-oriented development requirement of the industry and its signaling function is too strong: if implementing purchase quota helps to cool real estate

price rise, does lifting such policy aims to encourage price rise? Or is it that real estate price is about to fall abruptly and the policy is lifted to maintain current housing price? This is a question worth pondering. In a word, purchase quota policy has significant effect real estate price.

5.3.5 Policy factors of interplay between real estate prices in Shenzhen, Dongguan and Huizhou from 2003-2017

Policy factors of real estate price are complicated and systematic. In addition to those mentioned above, there are other national or regional real estate policies that may have effect on housing price. Such other factors will not be further discussed in this paper.

Real estate prices in Shenzhen, Dongguan and Huizhou are greatly affected by policy factors, in which the effect of financial and tax policies is similar with that at national level. As to land and purchase quota policies, these three cities have stricter regulations, in which Shenzhen has the strictest policies and followed by Dongguan and Huizhou respectively. Therefore, land supply in Shenzhen is the tightest and may lead to real estate price rise; meanwhile, its purchase quota policy is also the strictest in order to reduce real estate demand in Shenzhen. This diverts Shenzhen residents to Dongguan and Huizhou real estate markets and thus support and promote real estate prices in these two markets.

On February 18, 2019, the Central Committee of CPC and the State Council issued the Development Plan for Guangdong-Hong Kong-Macao Greater Bay Area. It is planned to build Guangdong-Hong Kong-Macao Greater Bay Area into a vibrant world-class urban agglomeration, an international scientific and technological innovation center, a major support for the "Belt & Road"

Initiative, a demonstration area of deep cooperation between Chinese Mainland and Hong Kong & Macao, a high-quality life circle great for living, working and touring and a paragon of high-quality development. Guangdong-Hong Kong-Macao Greater Bay Area consists of Hong Kong and Macao Special Administrative Region as well as nine cities in Guangdong, including Guangzhou, Shenzhen, Zhuhai, Foshan, Huizhou, Dongguan, Zhongshan, Jiangmen and Zhaoqing, with an area of 56,000 km^2 and a total population of about 70 million at the end of 2017. It is one of regions in China with the highest degree of openness and the strongest economic vitality and occupies a very important position in overall development of China. Shenzhen, Dongguan and Huizhou are all part of this area and real estate-related policies in these three cities will have major adjustment in the future to produce more profound interplay.

As a whole, policy factors with direct effect on interplay between real estate prices in Shenzhen, Dongguan and Huizhou include purchase quota by type, down payment ratio and differentiated mortgage interest rate. These policies have limited effect on real estate price when applicable, but will produce great shock to social expectations at the time of introduction, changes or cancellation, lead to violent response in real estate price and promote interplay between real estate prices in Shenzhen, Dongguan and Huizhou.

Chapter 6 Strategy suggestions for interplay between real estate prices in Shenzhen, Dongguan and Huizhou

After in-depth research on empirical interplay between real estate prices in Shenzhen, Dongguan and Huizhou and various causes, strategy measures in terms of industry development, government intervention and residents' investment and house purchases can be further discussed in order to put this research into practical application.

6.1 Industry development strategy

Forty years of reform and opening up have witnessed quick development of Chinese real estate industry and ranking to be a pillar in national economic development. As a capital-intensive industry, the real estate industry has many related industries, attract large amount of investment, provide many employment opportunities and thus plays a significant role in the entire national economic system. Therefore, stable development of the industry helps secure national economy and the people's livelihood and is closely related to stable operation of the national economy and people's life. Meanwhile, Chinese real estate industry still have a lot of problems, such as uneven distribution of areas and markets under development, lack in long-term planning of real estate developers and low management level of enterprises, impeding long-term development of Chinese real estate enterprises.

The real estate industry in Shenzhen, Dongguan and Huizhou has benefited from continuous economic and social development in China as well as high-speed economic growth and booming high-tech industry in their own cities and their real estate price keeps rising to a high level. From the perspective of mutual influence of real estate prices, the real estate industry and relevant

enterprises in Shenzhen, Dongguan and Huizhou can strengthen in the following aspects in the future.

6.1.1 Establish crisis awareness and face up to periodic fluctuations in economy

In the context of austerity policy of dollars, selling off assets and dollar recycling have occurred in some emerging market economies and led to great depreciation of local currencies against dollar. Since 2018, currencies in countries such as Argentina and Turkey have depreciated quickly, inflation has been high, causing the market to panic. And such panic is about to spread to more countries.

Under such circumstances, China is having a hard time determining their monetary policy. Before outbreak of Sino-US trade war, basic orientation of monetary policy in China is similar with that of U.S. (although without raising interest rate), including deleveraging, curbing continuous rise of real estate price and structural reform in supply side, with an aim to cut local government debt, reduce real estate investment and actively support real economy development including high and new technology. After the trade war broke out, among the "troika" of economic growth, foreign trade growth prospect is unclear and consumption growth is hard to achieve i n short time. To ensure that economic growth speed can be maintained at certain level, investment should be increased. Therefore, sound monetary policy is preferred currently and moderate tightness should be maintained; fiscal policy should be more active and slight increase in construction of railways, highways & airports and intensified infrastructure construction with local government debts are expected. Generally speaking, exchange rate, interest rate and real estate price are similar to the "impossible trinity" of Mondale: it is not possible for them to keep not

falling at the same time. For the moment, China adopts sound monetary supply policy, keep moderate tightness and maintain flat real estate price in order to prevent systematic financial risk. Therefore there is an obvious trend of falling in exchange rate and outflow of foreign capital.

Under such circumstance, China needs to strengthen real estate and infrastructure construction in the short term to secure economic growth speed. However, the real estate industry is not promising in 2019 and beyond due to increased periodic economic fluctuations and troubling internal and external economic environment. In this case, crisis awareness should be established and measures should be taken to cope actively.

Since 2018, real estate leaders in the Pearl River Delta and even the entire country such as Country Garden, Vanke and Evergrande have taken active measures to cope with downgoing economic crisis in China. In internal document of Country Garden in April 2018, it has been pointed out that Country Garden should develop plans as soon as lands are acquired in order to improve turnover and withdrawal of cash and hedge risks brought by reduced financing channels and increased financing cost.

On September 8, 2018, Yu Liang, Chairman of Vanke indicated in monthly meeting of southern region of Vanke: in 2012 there was a prediction that the industry was about to enter silver age. No one knew on what day the turning point would arrive back at that time. While today, such turning point has arrived. Yu stresses that Vanke would never leave real estate industry nor abandon traditional real estate developing thinking and the key was to empower all businesses in Vanke with technology. "All our actions come down to one aim: shrink and focus to ensure that Vanke can live through the hard time." As Vanke

took initiative to change, it means this former real estate leader believes that the turning point has arrived. This sounds the alarm for many other real estate enterprises.

On September 23, 2018, Evergrande invested RMB 14.49 billion in Guanghui Group led by Sun Guangxin, the richest man in Xinjiang and ranked to be the second largest shareholder with 40.964% stock equity. In the future, Evergrande will cooperate with Guanghui Group in industries such as auto sales, energy, real estate and logistics. Before this, Evergrande had just finished acquisition of Faraday Future, an American new energy automobile company by purchasing 100% stock equity of Sanwin Industries Ltd. at a price of 6.746 Hong Kong dollars to obtain 45% equity of Smart King and thus become the largest shareholder of Faraday Future. As the second largest shareholder of Guanghui Group, Evergrande will have larger-scale of commercial layout in the auto industry. This reveals the strategic intention of Evergrande to diversify.

In fact, measures taken by Country Garden, Vanke and Evergrande highlight three major strategies adopted by the real estate industry to cope with crisis: firstly, improving turnover and cash withdrawal and reducing financial cost of financing, as represented by Country Garden; secondly, technology empowering and business shrinking to innovate, focus and ensure that enterprises survive the crisis, as represented by Vanke; thirdly, diversify into industries such as auto, energy, healthcare, football and sports while focusing on main business lines in the real estate industry, as represented by Evergrande.

It is worth mentioning that in the second half in 2018, Chinese economy went through economic and financial pre-crisis period when equity asset price dropped sharply, many private enterprise owners ran away with funds, a lot of

stock mortgage loans blew out, real estate price was at on the verge of collapse and the market was drown in pessimism. Country Garden, Vanke and Evergrande are all real estate enterprises from the Pearl River Delta and among the largest and best real estate enterprises in China. Based in areas with the most developed economy, they are sensitive and their strategic adjustments in 2018 serve as profound inspiration for real estate enterprises in Shenzhen, Dongguan and Huizhou in case of crisis.

6.1.2 Establish risk awareness and prevent reoccurrence of overheating in real estate investment

Real estate industry, as a pillar industry of national economy, drives development in real estate development-related production industries including building materials, steel bars, mechanical equipment, plastic pipes, glass and hardware as well as commodity industry including sanitary products, doors & windows and furniture. However, real estate industry is in essence a traditional and capital-intensive industry with limited effect on innovative development and switching new driving force of the economy. Meanwhile, since real estate industry is one of the industries with the tightest connection to the government, the role of government land auction in promoting land and housing prices and land finance of the government are easily criticized by the public. Therefore, real estate industry is highly susceptible to regulation and control of the government and becomes an industry with very high risk.

Firstly, rapid development of the real estate industry lead to quick rise in housing price. In the tide of urbanization, urban population in China increases significantly, resulting in great increase in demand for urban housing. While the real estate industry in China doesn't match market economy development,

especially in densely populated megacities such as Beijing, Shanghai, Guangzhou and Shenzhen where rise in housing price has far exceeded reasonable range affordable by the public.

Secondly, the level of adaption of the real estate industry to market economy development is low and the real estate market is not mature. Since the real estate market has only emerged for a short time and not been fully developed, no effective buyer's market is formed during development of Chinese real estate economy and actual relation of supply and demand in the market cannot be reflected during development of housing price. Moreover, there is an excessive pursuit of high-level industrial structure during real estate economy development in China, leading to oversupply of high-end housing and undersupply of medium and low-end commodity housing. This has greatly affected basic livelihood of urban residents and significantly lowered their quality of life.

Thirdly, the financial system supporting the real estate industry is not sound enough. As an capital-intensive industry, the real estate industry has huge demand for capital during development. And financial policies put in place by the central bank has major influence on the real estate industry. Once capital from bank loans cannot be secured, land acquisition and construction progress of real estate development projects will be affected. Currently, real estate enterprises have very limited financing channels, mainly including bank loans, advance payment by construction companies and recovered sales. Limited financing channels result in difficulty in financing. Once financing is not available, problems will rise including increased risks.

It is believed that fast rise in real estate price has overshadowed many problems in the industry. But once real estate price drops sharply, accumulated risks in the industry will inflict heavy blow on development of the real estate industry and even the national economy. The real estate industry in Shenzhen, Dongguan and Huizhou has far quicker rise in housing price than central and western areas in China and more and higher accumulated risks, especially in financing.

It is estimated that real estate enterprises in China have a general asset-liability ratio over 70%. Shenzhen, Dongguan and Huizhou start earlier in real estate development with enterprises with national coverage and thus has higher asset-liability ratio. In the future, real estate prices in these three cities have to slow down to prevent overheated investment, acquire lands rationally based on their capability, avoid frequently bid or acquire lands with record-setting prices, develop as soon as lands are bought, finance with various financial tools, improve turnover, refrain from land and housing hoarding, try best to shorten house production cycle and keep cashes in own pocket.

6.1.3 Establish sense of competition and seize high point during industry reshuffle

Currently, most real estate enterprises in China, especially medium and small enterprises generally lack in strategic planning and have weak resistance to market risks due to limited own capability. They have no intention of long-term strategic planning and don't care to study enterprise operation & management mode, products & industry cycle and macroeconomic environment; they have weak awareness of preventing future risks and become overly dependent on single projects and thus highly susceptible to market fluctuations. In addition, real estate enterprises usually adopt extensive management mode without a

complete set of management system and bylaws, resulting in outdated internal management pattern. As to real properties they have developed, no sufficient property services and after-sales can be provided and no clear management system and profiting pattern is available. All these work unfavorably for such enterprises.

There is no doubt that the real estate industry, as a capital-intensive industry, will have considerable absolute value of profits by financing via financial tool despite not very high rate of profit. This is why this industry is teeming with very rich people. However, real estate entrepreneurs have to deeply realize that: (1) in market economy, there is a trend of market saturation in any product market and the real estate market is no exception. As supply increases, the market will finally reach the point of oversupply and then the competition in terms of product, quality, location and price will begin. At such point, rise in real estate price becomes slow and profits shrink. (2) After entering the stage of fierce competition, the real estate industry will be reshuffled and enterprises with insufficient innovation, weak financing ability, poor management and low efficiency and performance will be thrown out. In order to gain competitive edge, real estate enterprises have to establish sense of competition and try best to improve competitiveness from every aspect.

Located at the starting line of Chinese economic development, Shenzhen, Dongguan and Huizhou have more mature real estate industry and more fierce competition. Therefore, in the context of anemic rise in real estate price, enterprises can gain foothold first, improve themselves, seek opportunities and take high point in future competition.

For this purpose, real estate enterprises in Shenzhen, Dongguan and Huizhou should make greater efforts in establishing scientific and reasonable management system and operation mode. These enterprises should pay extra attention to analysis of current market situations, identify their own resources and put in place business models based on their development characteristics. In terms of internal management, care should be taken to strengthen monitoring of product quality, build marketing system and network, give to full play employment and market incentive systems, improve management and service level and enhance market competitiveness. As to strategic development planning, real estate enterprises should determine their self-positioning consistent with own advantages and market requirements, insist in differentiated operation and build up markets in specific regions and for specific target groups in order to excel their competitors.

Secondly, these enterprises should strengthen brand building. Brands are the symbol of soft power of enterprises and reflect strength of enterprises in planning, design, culture, quality, reputation, ability, service and marketing. As standards for the real estate market have been gradually put in place and customer needs diversify, only enterprises with their own brands can obtain enough attraction and appeal, win recognition and favor from consumers and improve product marketing.

Thirdly, real estate enterprises should facilitate their transformation and upgrading via scientific and technological innovations. Sustainable development is the future development direction of real estate enterprises. In an era where knowledge economy becomes increasingly important and innovations update quickly, real estate enterprises have to arm themselves with

scientific and technological innovations. Real estate development has to explore higher-quality houses in line with future development directions from perspectives of improved living environment, intelligent housing, increased resource utilization efficiency and environmental protection.

Fourthly, in consideration of the connection between integration of Shenzhen, Dongguan and Huizhou and real estate development, larger built-up area can render more obvious agglomeration effect of urban population, functions and fortune and improved supporting infrastructure. This may help facilitate development of the real estate industry. Therefore, layout design for new built-up area should be enhanced during property development. Shenzhen has very limited space for expansion of built-up area and construction land area. As the direction of future development in Shenzhen, Dongguan and Huizhou is integration, it is a major opportunity to be seized by real estate developers in these three cities to accelerate industrial distribution in bordering areas and share the benefits of integrated development.

6.2 Government intervention strategy

As real estate prices in Shenzhen, Dongguan and Huizhou stay high, the best strategy in terms of government intervention is keeping the prices from rising or dropping too fast in order to form stable exceptions, prevent explosion of systematic risks and let accumulated bubble disappears as time goes by.

6.2.1 Identify government intervention objectives

Since 2016, global economy has been through a resonant recovery and China has also greatly benefited from it. At the same time, there is complicated relation of deep competition, cooperation and gambling between global economies. For China, its economic development is confronted with extremely

complex external environment, mainly including increased global economic growth but imbalance in regional development, slight recovery in global trade but increased threat of trade wars, upgoing global investment prospect but remained uncertainties, gradually rising global inflation but differentiated monetary policies of different economies as well as increased anti-globalization move but avoiding "Thucydides Trap".

Firstly, trade wars affect international trade and FDI growth. After Donald Trump took office, its government has provoked trade frictions with American trade partners with the excuses of US Sections 201 and 301 and caused tremendous shock on prospect of global trade. On June 15, 2018, Donald Trump denied former U.S.-China trade statement and announced to impose additional tariff on Chinese products worth USD 50 billion. Sino-US trade war intensified. Globally, U.S. has triggered far more trade wars than this. Donald Trump has initiated costly tariff on many trade partners including EU, Canada, Mexico, South Korea and Japan with the purpose possibly to attract and facilitate return of manufacturing industry to U.S.

Direct effect of Sino-US trade war is reduced international trading volume between China and U.S. and damage to part of processing and manufacturing industry in China; its indirect effect is withdrawal of FDI from China into countries and regions without additional tariff such as Southeast Asia, India and Africa and back to U.S. The trade war has severe and more damaging indirect effect than direct effect for its indirect effect has caused worse psychological impact and actual sanctions (such as sanctions on ZTE), resulted in removal of part of processing and manufacturing industry away from China and force others to choose sides and spread trade conflicts to other sectors.

Secondly, geopolitical risks and conflicts threaten global economy. As globalization process continues, global enterprises, including Chinese enterprises actively seek to invest beyond their own countries. While with the implementation of strategies such as the going-out strategy and the "Belt & Road" Initiative, Chinese enterprises have accelerated global expansion and the global economy is becoming a closer-connected whole. But greater influence of geopolitics on enterprises comes along with such closer connection, especially on expansion strategies and investment decisions of multinational enterprises.

Since 2018, exit of U.S. from the comprehensive agreement of the Iranian nuclear issue, US-DPRK dialog and increased sanctions of U.S. on Russian intervention in its general election have led to changes in geopolitics and caused risks and conflicts. Since Iran and Russia are both important nodes in the "Belt & Road", changes in geopolitics risks and conflicts will produce strong influence on going out of Chinese enterprises.

Thirdly, U.S. entering interest-rate rise cycle has caused withdrawal of global funds. As the economy continues to recover, U.S. entered interest-rate rise cycle in December 2015 and initiated monetary tightening policy. From December 2015 to December 2018, FED has increased interest rate for nine times, including four times in 2018. It is expected that FED will increase interest rate once or suspend interest rate rise in 2019 and stop gradual balance sheet reduction in September 2019.

For a long time, great economic achievements in China have been obtained at a price of hug resource investment, energy consumption and degraded environment. Such economic development pattern is unsustainable and China

is faced with the challenge of transforming from resource-consuming, investment-driven and extensive development pattern that earns foreign exchange via export to resource-saving, consumption-growing, innovation-driven and intensive development pattern. With the help of industrial structure evolution, China is switching to be powered by new economic drivers and its innovation driving ability is transforming from quantitative change to qualitative change. New economic drivers have increasing proportion in the national economy with a scale equivalent to that of part of old economic drivers and their increased economic contribution comes from marked growing scale. However, the switching from old drivers to new drivers in China has not completed.

In this context, objectives of intervention of Chinese government in real estate become increasingly clear:

Firstly, make it clear that houses are used for living rather than speculation and contain the trend of excessively fast rise in real estate price. At the end of 2016, the Central Economic Working Conference came up for the first time with the idea of "houses are used for living rather than speculation". After that, real estate-related authorities successively introduced supporting policies with respect to financing by real estate enterprises and house buyer credit, strengthen regulation of real estate market by type, reasonable increase residential land areas in cities with high pressure of housing price rise and set standards for real estate development, sales and agency.

Secondly, prevent systematic financial risk and strictly prevent burst of real estate bubble. Financial crises in many countries are triggered by burst of asset bubbles, such as the financial crisis in Japan in 1990s that had put Japanese

economy into depression for a long time. Currently, the major target of quelling asset bubble is the real estate industry to restore housing to its original purpose: for living.

Real estate is obviously financial in nature. By the end of 2018, various loans in China involving home mortgage have added up to RMB 86.6 trillion and mainly consist of two parts: (1) real estate loan balance of RMB 38.7 trillion by the end of 2018 with year-on-year increase of 20%, in which real estate development loan balance is RMB 10.19 trillion with year-on-year increase of 22.6% and individual housing loan balance of RMB 25.75 trillion with year-on-year increase of 17.8%; and (2) household loan balance in Chinese and foreign currencies by the end of 2018 of RMB 47.9 trillion with year-on-year increase of 18.2%, in which household business loan balance in Chinese and foreign currencies is RMB 10.09 trillion with year-on-year increase of 12.3% and household consumption loan balance of RMB 37.8 trillion with year-on-year increase of 19.9% (f-bosscom, 2018).

It is estimated that the total value of Chinese real market was USD 65 trillion in 2018, amounting to about RMB 440 trillion. Mortgage loans in the market was RMB 86.6 trillion, accounting for around 20%, equaling to GDP of China in the entire year of 2018 (LouPan.com, 2018). If housing price drops sharply, banks will sell off all real properties mortgaged, leading to collapse of the real estate market and even the entire economy. This is unacceptable. Therefore, one of the objectives of government intervention is to prevent plunge of the real estate market.

In essence, it serves that same purpose to prevent quick rise and fall of real estate price, which is to prevent systematic risk. On one hand, if housing price

rises quickly, bigger bubble is accumulated and it will be more lethal when the bubble bursts. Thus further quick rise of real estate price has to be prevented. On the other hand, quick fall of housing price may lead to immediate burst of bubble accumulated in the real estate industry and cause systematic risk. This has to be prevented as well.

Hence the regulation objective of real estate policy in China is to prevent sharp rise and fall of real estate price. Real estate regulation in Shenzhen, Dongguan and Huizhou has the same objective, especially that Shenzhen is located close to Hong Kong. After US dollar enters a tightening cycle, real estate price in Hong Kong is sure to fall. Since housing price in Hong Kong ranks No.1 in the world, once the bubble bursts, there will be a plunge in real estate price. Therefore, Shenzhen, Dongguan and Huizhou have more difficulty and sensitivity in regulation with real estate policy and have become the vane of national real estate market. Any policy in these three cities will stir up a storm in the national market.

6.2.2 Measures of government intervention in real estate markets in Shenzhen, Dongguan and Huizhou

Real estate prices in Shenzhen, Dongguan and Huizhou are very sensitive, especially in Shenzhen and real estate price linkage between Hong Kong and Shenzhen will even affect future economic development trend in China. In this case, any measure of government intervention has to be caution. Of course, there are countless tools for government intervention and for real estate markets in Shenzhen, Dongguan and Huizhou, main measures can be taken as follows.

(1) At macro level --- continue to implement active fiscal policy and sound monetary policy. In the context of downgoing economy, the monetary policy in

China should be kept moderately tight and slightly support structural easing such as use of policy tools such as lowering reserve ratio, MLF and TMLF. The overall policy stays tight, but the capital pool may expand or shrink as long as real economy development requirement is met and real estate price has not benefited much from it.

(2) As to land supply, Shenzhen, as a megacity, should keep limit land supply to prevent changes in expectations that lead to quick fall of real estate price. Land supply in Dongguan and Huizhou has the same objective with regulation policy. When real estate price rises too quickly, the governments can increase land supply; if there is a tendency that the price may drop, the governments need to cut land supply to prevent expectation of fall in real estate price.

(3) As to financial policy for developers, attention has to be paid to difficulty in financing by medium and small-sized real estate enterprises. In today's financial market in China, SMEs have hardly any access to formal capital market for direct financing. This is worsened by incomplete opening of Chinese capital market to SMEs. Development working capital loans, real estate development project loans and real estate mortgage loans have very short terms, not capable of meeting practical need of long development cycle in the real estate industry. This requires to address the difficult financing in the real estate industry fundamentally. The governments should expand financing channels, lower access threshold of financing, provide diversified financing methods for real estate developers, especially small and medium-sized ones and build a financial supply system with multiple levels and structures in order to truly solve the problem of financing for real estate developers. For example, the government can establish reasonable secondary mortgage loan market based on

actual development conditions of the real estate industry, include the real estate market into the development plan of the overall national economy, promote integration of the real estate market with the capital market and increase capitalization level in the industry.

If there are too many players in the real estate market, a threshold can be set during land auctions to shut incapable enterprises out rather than restricting financing by small and medium-sized real estate developers after commencement of development projects, because the latter will lead to inability to complete or accept houses pre-sold and invalid operation of real estate economy and is not good for improving development level of the entire real estate industry.

(4) Policies of loan limit, purchase quota, sales restriction, price limit and restriction on commercial buildings. Loan limit refers to limit on amount, proportion and qualification of loans. Purchase quota refers to limit on qualification and quantity of purchase. Sales restriction refers to restriction on term of house possession and transfer. If minimum possession term has not been met, houses are not allowed to be transferred. Price limit refers to limit on highest and lowest prices of commodities. Registered prices for commodities are required, but actual prices should be consistent with such registered prices. Restriction on commercial buildings aims to prevent converting non-residential buildings used as commercial workspace into apartment buildings or designing of such non-residential buildings into units or dwelling sizes.

Such macro policies combined together are effective in preventing sharp rise and fall of real estate price and should be used by Shenzhen, Dongguan and

Huizhou for real estate regulation in order to form expectations of long-term stable real estate price and basic consistency with economic growth speed.

Such policies, once introduced, should be changed easily in order to prevent change in expectations and thus shift in behaviors, resulting in irrational rise or fall of real estate price.

6.3 Suggestions for investment and housing purchase by residents

Residents are consumers and investors in the real estate market and their purchase and sales of real properties promote boom in the real estate market. During investment and housing purchase, residents can make rational transactions with reference to interplay of real estate prices in Shenzhen, Dongguan and Huizhou and relevant causes.

6.3.1 Suggestions for investment

The major way of investment in the real estate by residents is to purchase housing, wait for rise in price and then sell it. Residents' investment in real estate is good for enlivening the market and can gain incremental benefits from their principal. This is investment behavior with low risk and high returns. Shenzhen, Dongguan and Huizhou have good momentum of economic development and can be considered as one of the regions in the world with the quickest economic growth and high growth quality. So it is natural that real estate prices in these three cities will rise accordingly.

The past decade has witnessed fast rise in real estate price and difficulty in the real economy in China as a whole and such trend has not been reversed fundamentally until now because of the double influence of the Matthew Effect and profit-pursuing nature of capital at root. Returns from the real estate market and the industry determines capital flow direction and these two sectors are two

ends of a seesaw. From the perspective of returns, if returns from the real estate market is higher than that from the actual economy, capital is sure to flow to the real estate market, resulting in higher returns from the real estate market and lower returns from the industry; if returns from the actual economy is higher than that from the real estate market, capital is bound to flow to the actual economy, resulting in higher returns from the industry and lower returns from the real estate market. From the perspective of risk, if returns from real estate investment is rising, its investment risk is low and wealth effect is good; if a turning point appears at returns from real estate investment, its investment risk will increase, vice versa for industrial investment. Hence, seesaw effect between real estate investment and industrial investment cannot be ignored.

The primary reference used by residents during real estate investment is price. According to previous analysis of interplay between real estate prices in Shenzhen, Dongguan and Huizhou, residents should pay attention to the following when investing in real estate industries in Shenzhen, Dongguan and Huizhou.

First, price signals. In the research in chapter 4 of this paper, preliminary conclusions have been reached: (1) it is found via Granger causality test that rise in real estate price will cause rise in real estate prices in Dongguan and Huizhou, while rise in real estate prices in Dongguan and Huizhou will cause rise in real estate prices of each other; (2) real estate price in Dongguan has the highest possibility of affecting real estate price in Huizhou and followed by Shenzhen to Dongguan, Shenzhen to Huizhou and Huizhou to Dongguan in order; (3) in terms of time period, period of mutual influence between real estate prices in Shenzhen, Dongguan and Huizhou is about 1 month, in which

Shenzhen first affects Dongguan and Dongguan then affects Huizhou with both lag period of 1 month; Shenzhen affects Huizhou and Huizhou affects Dongguan in 2 months; (4) influence of Shenzhen on real estate price fluctuations in Dongguan and Shenzhen increases with time and mutual influence of real estate price fluctuations in Dongguan and Huizhou on each other may increase in short term and decrease in medium and long terms.

Such conclusions deeply reveal characteristics of interplay between real estate prices in Shenzhen, Dongguan and Huizhou and future changes and can serve as reference by residents during investment and housing purchase in these three cities. Real estate price signals are major reference for investment and attention should be paid to influence relation, degree of influence, time period and development trends between different prices. Conclusions above well meet such requirements and can be as strong reference.

Moreover, real estate price in Shenzhen has been affected by macro, regional and internal causes, for which some qualitative analysis has been made in this paper. Extra attention should be paid to such causes in order to gain better investment returns. Besides, hot areas at bordering parts of Shenzhen, Dongguan and Huizhou are good choices of investment in order to increase return of investment.

Secondly, risk aversion. There is no market in the world that always rises and never falls and the real estate market is no exception. Although for a long time investors in Chinese real estate market have benefited from continuous rise in real estate price, but the history of market economy is China is short and the history of real estate market is shorter. Therefore, it is necessary to take measures to prevent quick fall of real estate price. It is generally believed that

in the present situation, it is a good choice to observe more, act less and seek opportunity to sell, especially in Shenzhen. It doesn't mean that houses can be sold at the highest price now. But taken together, the risk of possession and waiting for rise overweighs income gained from sales.

From the perspective of investment, no one can accurately predict when the highest price comes in the market. Even though someone has sold their houses in the market at the highest price, it is out of pure luck. The best strategy for investment is to keep income higher than risk for a long time. The risk of real estate price agglomeration is already high in Shenzhen and relatively low in Dongguan and Huizhou. So it is clear what action to take in terms of investment.

Thirdly, rational investment. Since real estate prices in Shenzhen, Dongguan and Huizhou are kept at high level, selling off in such case is an action worth taking. However, there is still sufficient reason to believe that within a longer period in the future, the economy and the society in China will continue to develop and prosper and Shenzhen-Dongguan-Huizhou region and Guangdong-Hong Kong-Macao Greater Bay Area will have a brighter future. Therefore, it is a good strategy to hold for a long term and refuse to sell without good profit as long as investors are not short of money.

Some may argue that it is nonsense to say both selling of and waiting for rise are good choices. On the contrary, it is the way of rational investment. Any decisions to sell off or to hold made by investors after adequate market research and based on their cash flow and risk appetite are good choices. Those who follow the tide and invest blindly without in-depth research and analysis of the market may gain nice profit within a short term, but may also lose everything in the next investment.

Of course, the only judgment standard of good investment is return. Even though one might invest blindly or by luck, it is laudable as long as good return is gained. The only purpose of investment is to make money. Others would have nothing to say when you really make money. This is a philosophical question about how to look upon investment and returns.

6.3.2 Suggestions for housing purchase

The difference between investment and housing purchase is that housing purchase is not always for sales and profiting as investment does. Houses purchased can be used for self-occupation, sales after price rise or leaving to the next generations as an asset.

Some believe that housing purchase can be done at any time since it is not mainly for sales. The author of this paper believes that housing purchase in essence is a shopping behavior and prices and discounts are very important during shopping. Therefore, the right way of housing purchase is to buy at right moment and right price in right location.

It costs a lot to purchase real property in Shenzhen, Dongguan and Huizhou, so caution has to be exercised.

First, choose right moment. Houses can be purchased when prices are expected to rise. If prices are expected to fall, you can wait and see. But it takes intensive research and observation of the market to form right expectations.

Secondly, determine acceptable price range. After adequate and correct judgment of the market, you need to determine price range acceptable to you before starting purchasing real property. Some may argue that they want the housing price as low as possible. It is not rational, because no one would expect that houses will be sold as cheap as daily supplies. Acceptable price range can

be determined after correct judgment of the market is formed. If you hope only for bargains with prices at low as possible without correct judgment of the market or wish the prices to rise to very high in the future, you will lose yourself. In order to form correct judgment, the major way is to learn how to determine direction of national monetary policy, possible influence of construction of Guangdong-Hong Kong-Macao Greater Bay Area and public psychological expectations. Different people may have different opinions in these matters.

Thirdly, learn some principles of housing purchase. For example, location is the most important factor in value adding of real properties. But current prices have taken into account current locational value and value adding in the future depends upon rise in locational price. Realization process after housing purchase is complicated. Real estate has poor realizability and liquidity, not suitable for quick purchase and sales and it takes some time for value to grow. However, real property is also possessed at some cost because capital has time value. If rise in housing price is less than increase in CPI, owners of real properties will suffer loss. When taking account of possible higher income when relevant capital is sued for investment, higher rise in housing price is required to offset loss. Meanwhile, China may one day introduce real estate tax in the future, the cost of possessing real properties will increase further. In short, more knowledge in principles of housing purchase helps residents to make adequate preparations and rational judgment during housing purchase.

Chapter 7 Research summary and prospects

In the last chapter of this paper, it is necessary to look back at research work described above in order to discuss some research conclusions, summarize current problems, look into future research directions and further enhance understanding of interplay between real estate prices in Shenzhen, Dongguan and Huizhou.

7.1 Major works and conclusions

7.1.1 Review of major works

In this paper, real estate prices in Shenzhen, Dongguan and Huizhou are the objects of research to deeply analyze empirical relation, main causes and suggestions of their interplay. Main works carried out during the process include:

Firstly, introduction. Mainly describe research background, purpose, contents, methodology, technical route and possible innovations.

Secondly, literature review and basic theory analysis. Including review of previous researches and relevant basic theories such as urbanization & urban agglomeration, real estate and its price, influence factors of real estate price, signaling function of real estate price.

Thirdly, problem raising and research design. Mainly including basic facts and real estate development in Shenzhen, Dongguan and Huizhou, research methods of influence factors of real estate price, problem orientation and research approach design in this paper.

Fourthly, empirical analysis of interplay between real estate prices in Shenzhen, Dongguan and Huizhou, mainly including unit room test, Granger causality test,

VAR model analysis and in-depth analysis of relevant conclusions and implications.

Fifthly, analysis of causes of interplay between real estate prices in Shenzhen, Dongguan and Huizhou, mainly including economic, socio-psychological and policy causes of such interplay and further analysis of internal link of such interplay.

Sixthly, suggestions for interplay between real estate prices in Shenzhen, Dongguan and Huizhou, mainly including suggestions for industrial development, government intervention and investment & housing purchase.

Seventhly, research summary and prospects, including main works and conclusions, problems and future research direction.

7.1.2 Major conclusions and discussion

During research in this paper, some important conclusions are reached and will be listed below for simple analysis of their application.

(1) Major conclusions

Major conclusions from empirical analysis of interplay between real estate prices in Shenzhen, Dongguan and Huizhou include:

Firstly, influence relation. It is found via Granger causality test that real estate price rise in Shenzhen will cause the same in Dongguan and Huizhou and real estate price rise in Dongguan and Huizhou causes the same in each other.

Secondly, degree of influence. Real estate price in Dongguan has the highest probability of affecting real estate price in Huizhou, real estate price in Shenzhen has the second highest probability of affecting real estate price in Dongguan, real estate price in Shenzhen has the third highest probability of

affecting real estate price in Huizhou and real estate price in Huizhou has the lowest probability of affecting real estate price in Dongguan;

Thirdly, time period. Time period of mutual influence between real estate prices in Shenzhen, Dongguan and Huizhou is about one month, in which Shenzhen first affects Dongguan and then Dongguan affects Huizhou both with a lag period of one month; Shenzhen affects Huizhou and Huizhou affects Dongguan in two months;

Fourthly, development trend. Shenzhen has increasing influence on real estate price fluctuations in Dongguan and Huizhou, while mutual influence of real estate price fluctuations in Dongguan and Huizhou on each other may increase in short term and drop in middle and long terms.

Major conclusions on causes of interplay between real estate prices in Shenzhen, Dongguan and Huizhou include:

Firstly, such causes include economic, socio-psychological and policy causes.

Secondly, economic causes involve three aspect, in which macro causes include M2, GDP growth, exchange rate, interest rate and CPI as one of key economic causes of interplay between real estate prices in Shenzhen, Dongguan and Huizhou; regional causes include imbalance in economic and social development and imbalance in economic and social development; internal causes include land area & built-up area, construction land area and real estate investment amount.

Thirdly, socio-psychological causes include psychological expectations, market noise and behavioral bias.

Fourthly, policy causes include land policy, financial policy, tax policy and purchase quota policy.

(2) Application of research conclusions

In this paper, suggestions in terms of industrial development, government intervention and investment & housing purchase are provided based on empirical analysis and cause analysis of interplay between real estate prices in Shenzhen, Dongguan and Huizhou. Some supplementary opinions of application of research conclusions are provided as follows:

Firstly, real estate industry development and government intervention in Shenzhen, Dongguan and Huizhou are complicated and suggestions based simply on interplay between real estate prices seem inadequate, because objectives of industrial development and government intervention are diversified and relate not only to price. Therefore, analysis of industrial development and government intervention based only on price is far from enough. However, some of the suggestions are worth referring to.

Secondly, interplay between real estate prices in Shenzhen, Dongguan and Huizhou can serve as great guidance for investment and housing purchase by residents. The trend of changes in such interplay can be analyzed and predicted for anticipation of real estate price in order to guide transactions in the real estate market.

Thirdly, it should be noted that in empirical analysis and cause analysis of interplay between real estate prices in Shenzhen, Dongguan and Huizhou in this paper, analysis results can only used for reference. During housing investment and purchase, knowledge of relation and causes of real estate prices in Shenzhen, Dongguan and Huizhou should be obtained, but it is not necessary to use models and data in this paper, because there are other relations sand causes remaining to be revealed. Rationality is the key to investment, but

humans cannot be absolutely rational. Therefore, rational thinking is the most important.

7.2 Problems and future research direction

7.2.1 Problems

There are still problems in research and discussion, mainly in following two aspects:

Firstly, regional integration and economic globalization are irreversible tide despite setback at some point. Real estate industry, as a key economic pillar, plays a major role in greater regions even the entire world. When researching interplay between real estate prices in Shenzhen, Dongguan and Huizhou, only these three cities are analyzed where there should have been analysis and comparison in greater region, such as Guangdong-Hong Kong-Macao Greater Bay Area, or even Southeast Asia including Singapore and Malaysia and other bay areas such as New York Bay Area, San Francisco Bay Area and Tokyo Bay Area for comparison. The author intended to use real estate price in Guangdong-Hong Kong-Macao Greater Bay Area as research object, but not much data is available since the concept of Guangdong-Hong Kong-Macao Greater Bay Area has just been proposed to support thesis writing. Therefore, the author gave up the plan. In general, this paper lacks in international outlook and the author hope to make it up by supplement research in the future.

Secondly, interplay between real estate prices in Shenzhen, Dongguan and Huizhou is very complicated. The author has formed some views during work, but has not obtained powerful support from the research, as can be understood between the lines. For example, the original intent of this paper was to examine influence factors of real estate prices in Shenzhen, Dongguan and Huizhou by

explaining macro, regional and internal causes of formation of real estate prices in Shenzhen, Dongguan and Huizhou. However, the author found after analysis that there is no Granger causality between respective real estate prices in Shenzhen, Dongguan and Huizhou and macro causes including M2, GDP growth, exchange rate, interest rate and CPI; as to regional causes, Granger causality test was performed for Shenzhen, Dongguan, Huizhou, Guangzhou and Hong Kong at first, only to find that there is no Granger causality between Hong Kong and any other city, while real estate price in Shenzhen Granger causes real estate price in Guangzhou; as to internal causes, most data available is annual and the earliest data available is as late as 2003. Since empirical research without large sample support has no statistical significance, the scope of research in this paper is narrowed to what it is now. For another example, the author always believe that real estate in Shenzhen is affected by that in Hong Kong. However, empirical analysis shows no very strong connection, which is not expected by the author. So it is a flaw in this paper to stress Hong Kong in the opening report and the outline and leave some improper impressions. In fact, although empirical research has shown that real estate price in Hong Kong does not Granger cause real estate prices in Shenzhen, Dongguan, Huizhou and Guangdong, the author still believe that the influence of Hong Kong is huge. This might be caused by too strong influence of the author's established perception.

7.2.2 Future research direction

In the author's opinion, research on influence factors of real estate prices in Shenzhen, Dongguan and Huizhou is of great practical significance. Further research can be performed in the future mainly in the following two aspects:

Firstly, geographical area of the research can be expanded to Hong Kong and Macao Special Administrative Regions in Guangdong-Hong Kong-Macao Greater Bay Area and nine cities in the Pearl River Delta including Guangzhou, Shenzhen, Zhuhai, Foshan, Huizhou, Dongguan, Zhongshan, Jiangmen and Zhaoqing in Guangdong Province and comparative analysis with other bay areas can be provided to offer theoretical and practical reference for real estate development in Guangdong-Hong Kong-Macao Greater Bay Area. This is also valuable for the career in real estate development of the author.

Secondly, research on bubble in real estate prices in Shenzhen, Dongguan and Huizhou and how to prevent bubble burst can be performed. As we all know, the consequences of real estate bubble burst is catastrophic, for which the real estate industry, the government and residents are very concerned. However, there is little research on real estate bubble and bubble prevention via price, which is in fact urgently needed. In the future, more researches can be done in this respect.

There is no end in academic research. As a senior manager of a real estate enterprise, the author will continue research on influence of real estate prices in Shenzhen, Dongguan and Huizhou in addition to own management work for promoting enterprise growth and academic accumulation.

References

Abelson, P., Joyeux, R., Milunovich, G., & Chung, D. (2015). Explaining House Prices in Australia 1970–2003. *Economic Record*, *81*, 96-102. https://doi.org/10.1111/j.1475-4932.2005.00243.x

An, H & Wang, R. -D. (2014). Empirical Analysis of Influence Factors of Real Estate Prices in China --- Current Real Estate Regulation Policy. *Finance & Economics*, (3), 115-124. https://doi.org/10.3969/j.issn.1000-8306.2013.03.014

Anari, A., & Kolari, J. (2002). House Prices and Inflation. *R34124 4eal Estate Economics*, *30*(1), 67-84. https://doi.org/10.1111/1540-6229.00030

Baffoe-Bonnie, J. (1998). The Dynamic Impact of Macroeconomic Aggregates on Housing Prices and Stock of Houses: A national and Regional Analysis. *Journal of Real Estate Finance and Economics*, *17*, 179-194.

Bofinger, P., Debes, S., Gareis, J., & Mayer, E. (2015). Monetary Policy Transmission in a Model with Animal Spirits and House Price Booms and Busts. *Journal of Economic Dynamics and Control*, *37*(12), 2862-2881. https://doi.org/10.1016/j.jedc.2013.08.002

Brady, R. R. (2011). Measuring the Diffusion of Housing Prices Across Space and Over Time. *Journal of Applied Econometrics*, *26*(2), 213-231. https://doi.org/10.1002/jae.1118

Cai, Y. (2007). *Research on Influence of Fluctuations of Real Estate Industry in China on National Economy* (doctoral dissertation). Jilin University, Jilin Province.

Cao, Z. -L. (2003). *General Theory of Real Estate Economics.* Beijing: Peking University Press.

Chen, D. -C., & Zong, J. -F. (2004). Housing and Land Tax and Housing Prices: Theoretical Analysing and Policy Evaluation. *Finance and Trade Research*, (1), 57-60.

Chen, S. -Y., & Fu, Z. -Q. (2012). Influence of Real Estate Investment on Economic Growth of Cities with Different Sizes --- Data Analysis based on 70 Large and Medium-sized Cities in China. *Jianghan Tribune*, (11), 24-30. http://dx.doi.org/10.3969/j.issn.1003-854X.2012.11.005

Chen, Z. -X., & Huang, H. (2010). Research on Interactive Relation of Real Estate Prices in the Pearl River Delta Economic Zone --- With Guangzhou, Shenzhen and Dongguan as Example. *South China Finance*, (4), 82-86. http://dx.doi.org/10.3969/j.issn.1007-9041.2010.04.021

Cheng, D. -N. (2005). *Theories, Pattern and Policies of Urbanization and Economic Development*. Beijing: Science Press.

China Economic Information Co., Ltd. (2019, May). *Cities Annual Data: Dongguan.* Retrived from CEInet Statistics Database.

China Economic Information Co., Ltd. (2019, May). *Cities Annual Data: Shenzhen.* Retrived from CEInet Statistics Database.

Cui, G. -C. (2006). Real Estate Price Fluctuations and Macro Control. *Real Estate Market*, (1), 12-14. http://dx.doi.org/10.3969/j.issn.1001-9138.2006.01.004

Ding, F. (2014). *Real Estate Price Influence Factors and Forecasting Research* (Master's thesis). Anhui University of Finance and Economics, Anhui Province.

Ding, J. (2014). *Empirical Analysis of Influence Factors of Real Estate Price in China* (Doctoral dissertation). Central China Normal University, Hubei Province.

Du, M. -J. (2007). RMB Appreciation Expectation and Real Estate Price Changes. *The Journal of World Economy*, (1), 6-7. http://dx.doi.org/10.3969/j.issn.1002-9621.2007.01.009

Du, S. (1988). *Path of Urbanization in China: Reflections and Selection*. Chengdu: Sichuan University Press.

Eastmoney Co., Ltd. (2019, May) *Chinese Macro Data: Currency: RMB Currency.* Retrieved from Business Source: Choice database.

Eastmoney Co., Ltd. (2019, May) *Chinese Macro Data: Deposit Rate: Benchmark interest rate of RMB deposit.* Retrieved from Business Source: Choice database.

Eastmoney Co., Ltd. (2019, May) *Chinese Macro Data: National Balance Sheet: M2.* Retrieved from Business Source: Choice database.

Eastmoney Co., Ltd. (2019, May) *Chinese Macro Data: National Business Accounting: GDP.* Retrieved from Business Source: Choice database.

Eastmoney Co., Ltd. (2019, May) *Chinese Macro Data: Price Index: CPI.* Retrieved from Business Source: Choice database.

Eastmoney Co., Ltd. (2019, May) *Chinese Macro Data: Regional Macro Data-Shenzhen: Regional GDP per capita.* Retrieved from Business Source: Choice database.

Eastmoney Co., Ltd. (2019, May) *Chinese Macro Data: Regional Macro Data: Fixed Assets Investment.* Retrieved from Business Source: Choice database.

Eastmoney Co., Ltd. (2019, May) *Chinese Macro Data: Regional GDP-Guangdong: Dongguan- GDP per capita.* Retrived from Business Source: Choice database.

Eastmoney Co., Ltd. (2019, May) *Chinese Macro Data: Regional GDP-Guangdong: Shenzhen- GDP per capita.* Retrieved from Business Source: Choice database.

Eastmoney Co., Ltd. (2019, May) *Chinese Macro Data: Regional Macro Data: Living Standard of Resident: Dongguan -Per Capita Disposable Income.* Retrieved from Business Source: Choice database.

Eastmoney Co., Ltd. (2019, May) *Chinese Macro Data: Regional Macro Data: Living Standard of Resident: Huizhou -Per Capita Disposable Income.* Retrieved from Business Source: Choice database.

Eastmoney Co., Ltd. (2019, May) *Chinese Macro Data: Regional Macro Data: Living Standard of Resident: Shenzhen -Per Capita Disposable Income.* Retrieved from Business Source: Choice database.

Eastmoney Co., Ltd. (2019, May) *Global Macro Data: Real Estate: Hong Kong CCI.* Retrieved from Business Source: Choice database.

Eastmoney Co., Ltd. (2019, May) *Industry Economics Data: Housing Prices in Hundreds of Cities：Sample Average Prices: Dongguan.* Retrieved from Business Source: Choice database.

Eastmoney Co., Ltd. (2019, May) *Industry Economics Data: Housing Prices in Hundreds of Cities：Sample Average Prices: Huizhou.* Retrieved from Business Source: Choice database.

Eastmoney Co., Ltd. (2019, May) *Industry Economics Data: Housing Prices in Hundreds of Cities：Sample Average Prices: Shenzhen.* Retrieved from Business Source: Choice database.

Fan, L. -L., & Guo, P. (2015). Analysis of Influence Factors of Real Estate Prices in Four Municipalities in China --- Model Based on Gray Slope-correlation. *Rural Finance Research*, (3), 32-36.

F-bosscom. (2019, January 28). Real Estate Loan Balance in 2018 Is RMB 38.7 Trillion with Year-On-Year Growth of 20%. Retrieved from http://news.fzg360.com/home/news/detail/id/516796

Ferreira, O., Defusco, A., Gyourco, Ding，W. -J. (2012). The Role of Contagion in the Last American Housing Cycle. Retrieved from researchgate website: https://www.researchgate.net/publication/314593355_Modelling_United_States_Housing_Prices_1993-2008

Fischer, B, (1986). Noise. *Journal of Finance, 41*(3), 529-543. https://doi.org/10.1111/j.1540-6261.1986.tb04513.x

Fu, H. (2007). Empirical Analysis of Real Estate Price Cycle --- Long-term Perspective Based on International Comparison. *China Price*, (9), 37-40.

Ge, J. (2017). Empirical Test of Effect of Exchange Rate on Real Economy via Real Estate Price in China --- VAR Model Analysis Based on Data Obtained after Exchange Rate Reform in 2007. *Financial Theory & Practice*, (1), 37-44.

Geng, Y. (2014). Empirical Analysis of Influence Factors of Changes in Beijing Real Estate Price --- Relation between Economic Fundamentals and

Housing Price Established Based on Granger Causality Test. *China Market*, (26), 16-19.

Gong, Y. -L., Hu, J. -X., & Boelhouwer, P. J. (2016). Spatial Interrelations of Chinese Housing Markets: Spatial Causality, Convergence and Diffusion. *Regional Science and Urban Economics*, *59*, 103-117. https://doi.org/10.1016/j.regsciurbeco.2016.06.003

Gu, H. -F., & Zhang, Y. -J. (2014). Research on Mechanism of Regulating Real Estate Price in China by Monetary Policy Tools --- Analysis from Interest Rate and Deposit Reserve Ratio. *Review of Economy and Management*, (2), 87-96.

Holly, S., & Jones, N. (1997). House Price Since the 1940s: Co integration, Demography and Asymmetries. *Economic Modeling, 14*, 45-68.

Hu, J. -W. (2003). "Flying Geese Model" Theory and Industrial Structure Optimization and Upgrading in Japan --- Reflections on Decline of "Flying Geese Model". *Asia-pacific Economic Review*, (4), 23-26.

Huang, H. -L. (2007). *Research on Rational Development of Urban Real Estate in China* (Doctoral dissertation). Northeast Agricultural University, Heilongjiang Province.

Huizhou Statistics Bureau (2018) *Huizhou Statistical Yearbook 2018.* Huizhou: China Statistics Press.

Huo, J. -W. (2015). *Empirical Study of Relation Between Real Estate Price and Economic Development in China* (Master's thesis). Dongbei University of Finance and Economics, Liaoning Province.

Jeffrey, J. P., & James, R. R. (1994) Estimating the Effect of Wider Beaches on Coastal Housing Prices. *Ocean and Coastal Management, 22,* 141-152. http://dx.doi.org/10.1016/0964-5691(94)90016-7

Ji, E. -K. (2016). Influence of Factor Flow Difference Based on Grads Transfer Theory on Regional Industrial Transfer Adhesiveness. *Productivity Research,* (5), 31-34.

Jiang, L. -H., & Li, Q. -H. (2005). Analysis of Locational Factors Affecting Real Estate Price. *Urban Development*, (4), 3-6.

Jiao, Z. -Y. & Sun, J. -W. (2011). Research on China's Urban Cohesion Mode and System Design. *Modern Urban Research*, (6), 6-10.

Jin, M. -T. (2009). *Empirical Analysis of Macroeconomic Influence Factors of Real Estate Price in China* (Doctoral dissertation). Jilin University, Jilin Province.

Kuang, W. -D. (2005). Research on Relation Between Housing Price and Land Price: Model and Chinese Data Test. *Finance & Trade Economics*, (11), 56-63.

Kuang, W. -D. (2010). Expectations, Speculations and Fluctuations in Urban Housing Price in China. *Economic Research*, (9), 67-78.

Lewis, W. A. (1954). Economic Development with Unlimited Supplies of Labor. *Manchester School of Economics and Social Studies*, *22*(2), 139-191. https://doi.org/10.1111/j.1467-9957.1954.tb00021.x

Li, C. -J., & Meng, X. -H. (2005). Empirical Analysis of Influence Factors of Real Estate Market and Price in China. *Industrial Economics Research*, (6), 25-27. http://dx.doi.org/ 10.3969/j.issn.1671-9301.2005.06.007

Li, F., & Li Q. -J. (2014). Interactive Relation Between RMB Exchange Rate and Real Estate Price --- MS-VAR Model Analysis Based on Monthly Data from 2005 to 2012. *Studies of International Finance*, (3), 86-96.

Li, H. -B. (2006). Real Estate Development in China From Perspective of Economic Cycle. *On Economic Problems*, (8), 22-23. http://dx.doi.org/10.3969/j.issn.1004-972X.2006.09.009

Li, L., & Li, Y. -F.（2002）. *On Influencing Factors of Current Housing Price and Changing Trends*. Beijing: Peking University Press.

Li, X., & Wang, L. -Y. (2007). Real Estate Price Regression Established with Hierarchical Analysis. *Journal of East China Jiaotong University*, *24*(2), 151-153. http://dx.doi.org/10.3969/j.issn.1005-0523.2007.02.041

Liang, Y. -F., & Gao, T. -M. (2006). Empirical Analysis of Causes of Commodity Housing Sales Price Fluctuations in China. *Management World*, (8), 76-82.

Liang, Y. -F., & Gao, T. -M. (2007). Empirical Analysis of Regional Difference in Real Estate Price Fluctuations in China. *Economic Research Journal*, (8), 133-142.

Liang, Y. -F., Gao, T. -M., & He, S. -P. (2006). Empirical Analysis of Coordinated Development between Real Estate Market and National Economy. *Social Sciences in China*, (3), 74-84.

Liu, D. (20018). *Research on Influence of Differentiated Credit Policy on Real Estate Market* (Master's thesis). Hebei University. Hebei Province.

Liu, R. -H., Chen, Y. -N., & Cheng, K. (2009). Money Illusion and Urban Housing Valuation in China. *Finance & Trade Economics*, (2), 126-130.

Long, F. -J., & Wu, G. -L. (2003). Research on Influence of Urban Population on Real Estate Investment. *China Civil Engineering Journal*, (9), 65-70. http://dx.doi.org/10.3321/j.issn:1000-131X.2003.09.012

Loupan Wang (2018, November 26). Chinese Real Estate Market has A Value of USD 65 Trillion? Pan Shiyi: It is Freaking. Retrieved from http://k.sina.com.cn/article_1873100584_6fa53f2800100dpdc.html

Lu, P. -Y. (2012). Research on Competitiveness and Development Orientation of Three Metropolitan Areas in the Pearl River Delta. *The South Journal*, (9), 15-17. http://dx.doi.org/10.3969/j.issn.1004-1133.2012.09.004

Luo X. -L., Hong, B., & Ma, S. –C. (2012). Research on Influence Factors of Real Estate Price Based on VAR Model. *Journal of Central South University: Social Science Section*, *18*(4), 1-7. http://dx.doi.org/10.3969/j.issn.1672-3104.2012.04.001

Ma, L. -L., & Zhang, H. (2008). Empirical Research on Relationship Between Chinese City Size and Housing Price. *Journal of Yunnan University of Finance and Economics*, (6), 97-99.

Ma, Z. -F., & Yuan, H. (2008). Empirical Analysis of Influence Factors of Real Estate Price in China and Policy Suggestions. *Modern Economics: Modern Logistics (the Second Issue of the Month)*, *7*(9), 7-12. http://dx.doi.org/10.3969/j.issn.1671-8089.2008.09.003

National Bureau of Statistics of China (2019, February 28) Statistical Communiqué of the People's Republic of China on the 2018 National Economic and Social Development. Retrieved from http://www.stats.gov.cn/english/PressRelease/201902/t20190228_1651335.html

Nie, X. -F., & Liu, C. -Z. (2005). Empirical Analysis of Influence of Chinese Monetary Policy on Real Estate Market. *Journal of Henan College of Financial Management Cadres*, *23*(4), 63-65. http://dx.doi.org/10.3969/j.issn.1674-747X.2005.04.017

Paul, K. A., & Forrest, E. H. (2009). The Relative Impacts of Trails and Greenbelts on Home Price. *Journal of Real Estate Finance and Economics*, 38, 408-419. http://dx.doi.org/10.1007/s11146-007-9089-83244

Peng, F. (n.d.). People's Daily on Down Payment with Six Wallets. Retrieved from http://finance.sina.com.cn/money/bank/bank_hydt/2018-05-10/doc-ihaichqz4343454.shtml.

Qu, B., Xie, J. -R., & Wang, W. (2003). Review and Analysis of Real Estate Cyclical Fluctuations in China. *China Real Estate Finance*, (2), 10-13.

Quigley, J. M. (1999). Real Estate Prices and Economics Cycles. *International Real Estate Review*, *2*(1), 1-20.

Qunce Global (2018, December 4). How Did the Crisis of Japan in 1990s Happen That Shocked the World? Retrieved from https://m.sohu.com/a/279569944_100102455

Ren, Z. -P. (2018, November 12). Consumption Upgrading and Downgrading Coexists in China and Upgrading Trend Continues in the Long Run.

Retrieved from https://baijiahao.baidu.com/s?id=1616915863383835592&wfr=spider&for=pc

Sean H., M. Hashem P., & Takashi Y. (2011). The Spatial and Temporal Diffusion of House Prices in the UK. *Journal of Urban Economic, 69*(1), 2-23. http://dx.doi.org/10.1016/j.jue.2010.08.002

Shang, M. (2004). Analysis of Macroeconomic Influence Factors of Building Product Prices. *Northern Economy* (Inner Mongolia), (4), 39-40.

Shen, Y., & Liu, H. -Y. (2002). Research on Relationship Between Real Estate Price and Macroeconomic Index. *Price: Theory and Practice,* (8), 20-22.

Shen, Y., & Liu, H. -Y. (2004). Housing Price and Economic Fundamentals: Empirical Research of 14 Cities in China from 1995 to 2002. *Economic Research Journal*, (6), 78-86.

Shen, Y., & Liu, H. -Y. (2004). Interactive Relation Between Real Estate Development Investment and GDP in China. *Journal of Tsinghua University: Natural Science Section*, (9), 1205-1208. http://dx.doi.org/10.3321/j.issn:1000-0054.2004.09.015

Shenzhen Statistics Bureau (2018) *Shenzhen Statistical Yearbook 2018.* Shenzhen: China Statistics Press.

Shi, J. -J. (1999). Forecast of Total Demand for Town Residence During 1998 – 2010. *The Journal of Quantitative & Technical Economics*, (9), 3-7.

Shi, Y. -D., & Chen, R. -Q. (2008). Determination of Real Estate Price under Uncertainty: Random Model and Empirical Analysis. *Economics*, (4), 211-230.

Song, D. -H. (2015). *Analysis of Influence Factors of Real Estate Price From Macro and Micro Perspectives* (Master's thesis). Dongbei University of Finance and Economics, Liaoning Province.

Song, W. -X., & Liu, C. -H. (2018). Research on Urban Commodity Housing Price Differentiation Mechanism in Integration Region in the Yangtze River Delta. *Geological Research*, (1), 92-102. http://dx.doi.org/10.11821/dlyj201801007

Stuart, A. G., Joe, P. M., & William, L. W. (1999). House Price Differentials and Dynamics: Evidence from the Los Angeles and San Francisco Metropolitan Areas. *Federal Reserve Bank of San Francisco Economic Review*, *1*, 3-22.

Sun, G. -Y. (2018). *Research on Relationship Between Real Estate Bank Loans and Real Estate Price* (Master's thesis). Zhejiang University, Zhejiang Province.

Sun, J. -W. (2010). *A Course in Regional Economics*. Beijing: China Renmin University Press.

Sun, X. -L. (2011, April 14). "Non-economic Principles" in Chinese Real Estate Market. Retrieved from http://bbs.people.com.cn/postDetail.do?id=108670855

Teye, A. L., & Ahelegbey, D. F. (2017). Detecting Spatial and Temporal House Price Diffusion in the Netherlands: A Bayesian Network Approach. *Regional Science and Urban Econo*mics, *65*, 56-64. https://doi.org/10.1016/j.regsciurbeco.2017.04.005

Tiedemann K.H. (2010, January). *Modeling United States Housing Prices, 1993-2008.* Paper presented at the IASTED International Conference on Modeling and Simulation, Canada.

Todaro, M. P. (1969). A Model of Labor Migration and Urban Unemployment in Less Developed Countries. *American Economic Review*. *59*(1), 138-148.

Velma, Z. H., & Geoffrey, K. T. (2008). School Quality, House Prices and Liquidity. *Journal of Real Estate Finance and Economics*, *37*(2), 113-130. http://dx.doi.org/10.1007/s11146-007-9081-3

Wang, A. -J., Shen, Q. -J. (2007). Research on Relevance between RMB Exchange Rate and Real Estate Price. *Journal of Financial Research*, (6), 13-22.

Wang, C. (2008). *Research on Urban Real Estate Price Forecasting Model Based on Multi-factor Logistics* (Master's thesis). Dalian University of Technology, Liaoning Province.

Wang, F. (2018). *Analysis of Real Estate Macro-control Policy Effect in China* (Master's thesis). Capital University of Economics and Business, Beijing.

Wang, H. -X. (2009). *Analysis of Chinese Real Estate Price and Influence Factors* (Master's thesis) Shandong University, Shandong Province.

Wang, X. -W. (2002). Overview of Representative Theories of Urbanization Development. *Journal of Jinan Socialist College*, (1), 25-29. http://dx.doi.org/ 10.3969/j.issn.1672-6359.2002.01.006

Wang, Y. -L., & Wu. -P. (2009). Re-examination of Relation Between Housing Price and Land Price --- Panel Data from 28 Provinces in China. *Nankai Economic Studies*, (4), 131-143.

Wang, Y. (2014). Influence of Flying Geese Model on Chinese Industry and International Division of Labor. *Journal of Jilin Agriculture Science and Technology College*, (2), 36-39. http://dx.doi.org/10.3969/j.issn.1674-7852.2014.02.013

Wu, E. -J. (2013). Status, Problems and Acceleration Measures of Integrated and Coordinated Development of Shenzhen, Dongguan and Huizhou. *Journal of Guangzhou Radio and TV University*, (6), 98-105. http://dx.doi.org/10.3969/j.issn.1672-0385.2013.06.021

Xiao, B. -H. (2008). Credit Expansion and Real Estate Price in China. *Journal of Shanxi University of Finance and Economics*, (1), 24-26.

Xie, B. -H. (2008). Economic Analysis of Herd Behavior of Real Estate Market and Stock Market. *Journal of Guangdong University of Business Studies*, (2), 34-39.

Xu, L. (2009). Determinants and Correlation of Housing and Land Prices in Chinese Cities. *Public Finance Research*, (11), 10-13.

Yan, J. -H., Feng, L., & Bao, X. -H. (2009). Research on Housing Price Fluctuations in Beijing. *Finance & Trade Economics*, (5), 117-123.

Yan, L. -Z., & Yang, M. -W. (2015). Regional Economic Development in Guangdong Based on Growth Pole and Gradient Transfer Theory. *Northern Economy and Trade*, (9), 76-78.

Yao, D. -Q. (2003). Influence of Land Reserve on Real Estate. *Chinese and Foreign Real Estate Times*, (2), 20-22.

Yu, H. -Y. (2010). Do Economic Fundamentals or Real Estate Policies Affect Housing Price in China? *Finance & Trade Economics*, (3), 116-122.

Yuan, Q. (2016). Can Urban Agglomeration Promote Urban Development? *The Journal of World Economy*, (9), 99-123.

Zeng, Q. -H., Deng, J. -L., Zhang, Y. et. al. (2012). Analyzing the Urban Assimilation Process based on New Institutional Economics. *Urban Insight*. (5), 4-11. http://dx.doi.org/ 10.3969/j.issn.1674-4144.2012.05.001

Zhang, H. (2001). Empirical Analysis of Changes in Commodity Housing Price in Beijing. *Gold Master*, (3), 33-36.

Zhang, H., & Li, Z. -F. (2016). Housing Price Expectations, Land Price and Land Agents' Behaviors. *Management Review*, (4), 52-61.

Zhang, H. -L., & Song, S. -F. (2003). Rural-urban Migration and Urbanization in China: Evidence from Time-series and Cross-section Analyses. *China Economic Review*, (14), 386-400. https://doi.org/10.1016/j.chieco.2003.09.018

Zhang, Q. -J., & Zhang, L. (2009). Chinese Real Estate Industry Periodic Fluctuation Characteristics Research and Forecast. *Journal of Yunnan University of Finance and Economics*, (6), 64-69.

Zhang, Y. -L., Liang, Y. -F., & Gao, T. -M. (2011). Expected Income, Rate of Return and Housing Price Fluctuations --- Research Based on Dynamic Panel Data Models of 35 Cities. *Finance & Trade Economics*, (1), 122-129.

Zhao, H. -C. (2004). Follow-up Study of Relation Between Currency Exchange Rate and Real Estate in China. *Dongyue Tribune*, (6), 59-63. http://dx.doi.org/10.3969/j.issn.1003-8353.2004.06.010

Zhao, H. -J. (2015). *Transactional Efficiency, Urbanization and Economic Development*. Shanghai: Shanghai People′s Publishing House.

Zhao, J. (2016). *Empirical Research Based on VAR Model of Relation Between M2 Incremental Changes and Real Estate Price Fluctuation Range* (Master's thesis). Shanxi University of Finance and Economics, Shanxi Province.

Zhao, R. (2016). On Supply & Demand Model of Real Estate Market under Non-equilibrium Theory. *Housing and Real Estate*, (10), 12.

Zhou, J. -K. (2005). Monetary Policy, Bank Loans and Housing Price. *Finance & Trade Economics*, (5), 66-70.

Zhou, T. -Y., & Zhang, M. (2011). Selection of Urbanization Path in China under Urban-rural Dual Structure. *Research on Financial and Economic Issues*, (3), 3-8.

Zhou, W. -Y., Liu, H., & He, Y. -F. (2017). Analysis of Time-varying Relevance Between Real Estate Price Fluctuations and Mocroeconomy. *Contemporary Economic Research*, (9), 88-95.

Zhou, X. (2005). Analysis of Main Influence Factors of Real Estate Periodic Fluctuations in China. *Journal of Yichun University*, (S1), 93-94.

Zhou, Y. -H. (2015). *Research on Influence Factors of Real Estate Price in China* (Master's thesis). Zhengzhou University, Henan Province.

Zhou, Z. -Y. (2007). Lessons and Inspirations from Foreign Real Estate Macro-control Policies. *Special Zone Economy*, (1), 55-60. http://dx.doi.org/10.3969/j.issn.1004-0714.2007.01.031

Appendix 1 Statistical Data of Real Estate Prices and Relevant Indexes in Shenzhen, Dongguan and Huizhou

	Shenzhen (RMB/m^2)	Guangzhou (RMB/m^2)	Dongguan (RMB/m^2)	Huizhou (RMB/m^2)	Hong Kong - Centa-City Index (CCI)	Year-on-year national GDP growth rate (%)	m^2 (RMB 100 million)	CPI (%)	One-year deposit rate (%)	Average exchange rate of USD against RMB
2010/7	21935	12572	7606	5684	81.02	10.8	674051	3.30	2.25	6.78
2010/8	22115	12632	7545	5566	82.73	10.8	687507	3.48	2.25	6.79
2010/9	22776	12688	7544	5556	83.77	9.9	696472	3.61	2.25	6.75
2010/10	22948	12980	7624	5661	85.17	9.9	699777	4.37	2.5	6.67
2010/11	22995	13062	7738	5745	87.27	9.9	710339	5.12	2.5	6.66
2010/12	23277	13157	7990	5839	87.52	9.9	725852	4.59	2.75	6.65
2011/1	23372	13491	8133	6000	89.8	9.9	733885	4.91	2.75	6.60
2011/2	23496	13633	8194	6067	93.37	9.9	736131	4.94	3	6.58

2011/3	23605	13653	8322	6217	95.65	10.2	758131	5.38	3	6.57
2011/4	23741	13660	8522	6170	96.43	10.2	757385	5.34	3.25	6.53
2011/5	23996	13717	8658	6222	98.42	10.2	763409	5.51	3.25	6.50
2011/6	24022	13769	8742	6449	99.36	10	780821	6.36	3.25	6.48
2011/7	24124	13846	8710	6440	97.94	10	772924	6.45	3.5	6.46
2011/8	24011	13929	8916	6604	97.82	10	780852	6.15	3.5	6.41
2011/9	23999	13943	9152	6859	97.73	9.4	787406	6.07	3.5	6.38
2011/10	24067	13840	9110	6849	95.86	9.4	816829	5.50	3.5	6.36
2011/11	24003	13811	8985	6745	95.3	9.4	825494	4.22	3.5	6.34
2011/12	23835	13717	8971	6722	94.13	8.8	851591	4.07	3.5	6.33
2012/1	23869	13676	8881	6649	92.67	8.8	855899	4.55	3.5	6.32
2012/2	23789	13656	8729	6619	94.02	8.8	867171	3.16	3.5	6.30
2012/3	23989	13706	8970	6431	98.11	8.1	895566	3.59	3.5	6.31
2012/4	23792	13604	9224	6362	100.74	8.1	889604	3.37	3.5	6.30
2012/5	23779	13607	9129	6338	102.28	8.1	900049	3.00	3.5	6.31
2012/6	23969	13673	9065	6371	102.44	7.6	924991	2.15	3.25	6.32

2012/7	23986	13761	9033	6402	103.64	7.6	919072	1.80	3	6.32
2012/8	24037	13813	8902	6390	105.55	7.6	924895	2.00	3	6.34
2012/9	24049	13941	8887	6499	108.4	7.5	943689	1.90	3	6.34
2012/10	24147	14086	8878	6503	111.89	7.5	936404	1.70	3	6.31
2012/11	24215	14109	8812	6483	113.39	7.5	944832	2.00	3	6.30
2012/12	24525	14340	8841	6330	113.48	8.1	974149	2.50	3	6.29
2013/1	25060	14647	8948	6220	116.48	8.1	992129	2.00	3	6.28
2013/2	25699	14993	8973	6178	120.12	8.1	998601	3.20	3	6.28
2013/3	26221	15309	8935	6210	121.53	7.9	1035858	2.10	3	6.27
2013/4	26729	15678	9233	6234	116.83	7.9	1032552	2.40	3	6.25
2013/5	27135	16073	9279	6259	116.74	7.9	1042169	2.10	3	6.20
2013/6	27542	16514	9322	6332	118.39	7.6	1054404	2.70	3	6.17
2013/7	27883	16866	9163	6374	118.77	7.6	1052212	2.70	3	6.17
2013/8	28256	17149	9270	6501	118.17	7.6	1061256	2.60	3	6.17
2013/9	29146	17399	9207	6555	117.94	7.9	1077379	3.10	3	6.16
2013/10	29971	17576	9250	6638	117.24	7.9	1070242	3.20	3	6.14

2013/11	30330	17871	9224	6583	117.14	7.9	1079257	3.00	3	6.14
2013/12	30591	18297	9325	6666	116.52	7.7	1106525	2.50	3	6.12
2014/1	30615	18484	9493	6763	115.91	7.7	1123521	2.50	3	6.10
2014/2	30970	18497	9399	6949	115.77	7.7	1131761	2.00	3	6.11
2014/3	31208	18444	9614	6800	115.91	7.4	1160687	2.40	3	6.14
2014/4	31155	18510	9584	6764	116.49	7.4	1168813	1.80	3	6.16
2014/5	30890	18506	9594	6811	117.52	7.4	1182294	2.50	3	6.16
2014/6	30322	18496	9658	6756	118.75	7.5	1209587	2.30	3	6.16
2014/7	30198	18168	9612	6715	121.13	7.5	1194249	2.30	3	6.16
2014/8	30141	18019	9552	6622	123.67	7.5	1197499	2.00	3	6.16
2014/9	30168	17786	9402	6621	124.87	7.1	1202051	1.60	3	6.15
2014/10	30243	17506	9368	6543	126.54	7.1	1199236	1.60	3	6.14
2014/11	30530	17369	9354	6487	127.34	7.1	1208606	1.40	2.75	6.14
2014/12	30719	17468	9197	6538	130.16	7.2	1228375	1.50	2.75	6.12
2015/1	30916	17526	9066	6477	132.51	7.2	1242710	0.80	2.75	6.13
2015/2	30972	17509	9041	6452	135.28	7.2	1257380	1.40	2.75	6.13

2015/3	31155	17265	9040	6357	135.8	7	1275333	1.40	2.5	6.15
2015/4	31495	17173	9043	6298	137.47	7	1280779	1.50	2.5	6.13
2015/5	32339	17198	9109	6266	138.5	7	1307358	1.20	2.25	6.11
2015/6	34467	17152	9055	6343	140.35	7	1333375	1.40	2	6.12
2015/7	37821	17112	9259	6421	142.3	7	1353211	1.60	2	6.12
2015/8	38093	17055	9294	6377	143.46	7	1356908	2.00	1.75	6.31
2015/9	38767	17271	9327	6426	142.09	6.9	1359824	1.60	1.75	6.37
2015/10	40120	17057	9540	6643	138.99	6.9	1361021	1.30	1.5	6.35
2015/11	41139	17001	9487	6753	136.51	6.9	1373956	1.50	1.5	6.37
2015/12	42591	17058	9667	6863	133.13	6.8	1392278	1.60	1.5	6.45
2016/1	44823	17158	10157	7237	129.11	6.8	1416320	1.80	1.5	6.55
2016/2	47248	17268	10582	7323	126.59	6.8	1424619	2.30	1.5	6.53
2016/3	48963	17346	11293	7766	125.42	6.7	1446198	2.30	1.5	6.51
2016/4	50354	17519	11741	8255	125.55	6.7	1445210	2.30	1.5	6.48
2016/5	51361	17780	12167	8466	125.76	6.7	1461695	2.00	1.5	6.53
2016/6	52373	17875	12430	8619	127.22	6.7	1490492	1.90	1.5	6.59

2016/7	53384	17847	12548	8835	128.57	6.7	1491559	1.80	1.5	6.68
2016/8	54478	18069	13031	9145	132.45	6.7	1510983	1.30	1.5	6.65
2016/9	55001	18742	13527	9484	135.83	6.7	1516361	1.90	1.5	6.67
2016/10	55150	19271	13746	9739	140.14	6.7	1519485	2.10	1.5	6.74
2016/11	55040	19585	13945	9787	140.66	6.7	1530432	2.30	1.5	6.84
2016/12	54886	19877	14207	9874	141.17	6.8	1550067	2.10	1.5	6.92
2017/1	54551	20086	14186	9862	142.16	6.8	1575946	2.50	1.5	6.89
2017/2	54333	20277	14116	9882	144.6	6.8	1582913	0.80	1.5	6.87
2017/3	54213	20585	14171	9879	147.24	6.9	1599610	0.90	1.5	6.89
2017/4	54148	20834	14287	9954	151.25	6.9	1596332	1.20	1.5	6.88
2017/5	53937	20990	14346	10003	152.16	6.9	1601360	1.50	1.5	6.88
2017/6	53894	21074	14323	10036	153.53	6.9	1631283	1.50	1.5	6.80
2017/7	53959	21118	14382	10120	154.31	6.9	1628997	1.40	1.5	6.77
2017/8	53937	21167	14536	10040	157.2	6.9	1645157	1.80	1.5	6.67
2017/9	53942	21211	14607	10095	157.92	6.8	1655662	1.60	1.5	6.56
2017/10	53937	21258	14660	10156	158.7	6.8	1653434	1.90	1.5	6.52

2017/11	53926	21279	14746	10192	161.49	6.8	1670013	1.70	1.5	6.62
2017/12	53931	21292	14921	10207	163.22	6.8	1676769	1.80	1.5	6.59

Note: Data adapted from Choice Database.