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Real Estate Industry and Independent Innovation Activities of Enterprises: Evidence from panel data of Chinese Cross- region

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Abstract

This paper uses panel data from 30 provinces and autonomous regions from 2004-2010 to theoretically analyze and empirically test the relationship between the real estate industry and the independent innovation activities of enterprises in China. This paper employs the amount of patient authorization and sales of new products as dependent variables, house price and investment in real estate as independent variables, R&D spending, FDI, average consumption, fixed investment as control variables. The research suggests that (1) there exist a negative relationship between house price and the independent innovation output of enterprises (the amount of patient authorization) in China. And at the same time for the upcoming increase of house price has a remarkable influence on the sales of new products. (2) The relationship between the real estate investment, independent innovation output of enterprises, and sales of innovative products is positive. However, this positive relationship is incredible. Therefore, controls of the excessive increase of house price and regulation of the real estate investment play a decisive role in the independent innovation activities of enterprises in China.

1. Introduction

The attention given by real estate market in China has accentuated a trend over the past ten years to relegate manufacturing to a secondary role in economic growth strategies. The growth rate of real estate price has maintained 20%-40% annually every year, some of the first-tier cities even up to 50%.

It is not just a research focus of many domestic experts and scholars, but a hot topic concerned by a lot of people. Many companies especially some of state-owned enterprises participated in the real estate market are attracted by the high profit

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margin. Real estate industry is accounted for almost 10% of gross domestic products (GDP) in China 2011. However, it has a great impact on China's market structure, investment structure and consumption structure, and these aspects are closely related to the independent innovation of enterprises in China. The report of The 18th National Congress of the Communist Party of China pointed out that" Independent technology innovation is critical to an advanced economy's long-term growth". What is especially important is the fact that China has entered a critical period of 'steady growth, adjusting the structure'. Independent innovation has become the main way for the transformation of economic development in China, especially high-tech applications. China's economic development will really depend on the innovation to achieve endogenous growth. Enterprise is the mainstay of technological innovation, research and development activities is a key to enterprises' independent innovation.

As the National Science and Technology funding Statistical Bulletin 2010, China's R&D funding for the total investment reached 706.26 billion yuan, an increase of 126.05 billion yuan over the previous year, an increase of 21.7%, with GDP ratio reached 1.76%, but not yet to reach the target of 2% of the national long-term science and technology development planning framework in China. There is still a considerable gap in science and technology between China and the country with international advanced level. This attracted the attention of many experts and scholars, an important point is that the real estate industry has a certain impact on independent innovation of China's enterprises. On the one hand, by the high profits of real estate and 'demonstration effect' of many businesses, a lot of funds entered into the real estate market, and the funds used to support the activities of independent innovation would reduce. Coupled with the high R&D costs and risks, many companies are not positive to its main products' R&D. On the other hand, with the rising of house price, the crowding-out effect of domestic market demand reduced the market demand for high value-added products. The views above merely stay in the theoretical analysis of the level and lack the support of the relevant data.

There are two aspects of the research on influencing factors of independent innovation activities of enterprises. First, the behavior of government, Dominique Guellec and Bruno van Pottelsberghe de la Potterie (1997) [1] have argued the government's fiscal stimulus and direct subsidies, at least in the short term to promote the increase of R&D investment. Zhu Pingfang and Xu Weimin (2003) [2] have utilized the data of Shanghai and empirical studies have shown that the government's science and technology incentives for investment in R&D of large and medium-sized enterprises have a very positive effect. However, taking into account China's national conditions, Gu Yuanyuan and Shen Kunrong (2012) [3] found that the officials promoted competition and fiscal decentralization under the current governance structure, thus led to the low level of our nation's R&D investment. Second, institutional aspect, Daniel Lederman and William F. Maloney (2003) [4] analyzed the process of change and development of R&D, the results showed that the state's financial policy, the protection of intellectual property rights and the ability to make use of government resources were main factors of the R&D development. Bernard M. Hoekman et al. (2004) [5] found that FDI are of great help in technology transfer for extremely underdeveloped countries.

Among lots of factors of independent innovation activities, there is rare literature report on how the real estate affects the independent innovation activities, especially in China. Closely related to the topic of this article is as follows. Lin Song (2012) [6] took advantage of the panel data of the real estate industry and entrepreneurial activity, used the number of entrepreneurial activities as the dependent variable, real estate investment and house prices as the independent variable, which told us that estate industry had the crowding-out effect on the number of entrepreneurial activities. Zhu Mohan (2007) [7] studied the relationship between house prices and consumption structure and industrial structure. It

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showed that and the high house prices would absorb a lot of purchasing power of residents, thereby suppressing domestic demand and the upgrading of the industrial structure. The above researches and analyses are from the point of the macro level of the country, not from the enterprise itself, to explore the unique influence of the real estate activities on its independent innovation.

After the reform and opening up, China began to shift the focus to economic development, continuing to attract foreign investment, China's economy has undergone enormous changes, market economic system constantly improving. However, a main potential problem is that companies are strictly restricted in terms of market access [8]. So most of the companies will be rent-seeking in order to get more resources, after that the cost of enterprises operating is improved, thereby reducing the enthusiasm of its independent innovation. In addition, the great risk of corporate R&D and the existence of technology spillover lead to the emergence of 'free-riding' among industry competitors. Lin et al. (2010) [9] carried on a research based on a 2003 World Bank survey data of more than 2400 enterprises. The study results showed that the protection of property rights of enterprises can effectively promote R&D activities. However, due to the vulnerability of intellectual property and the prevalence of local protectionism, the crack on infringement of intellectual property rights is not enough. So it is difficult for enterprises to protect their rights [10].

In this paper, we take advantage of the data of the amount of patent licensing and sales of new products in 2004 - 2010, empirically test the effect of the real estate industry on the independent innovation activities of enterprises. The results show that, as an important indicator of the real estate industry, real estate price is the most obvious negative factor of independent innovation of China's enterprises. The aim is to provide a valuable reference for the improvement of the capability of independent innovation of China's enterprise.

2. Theory and Methods

2.1 Theory analysis between the real estate and innovation

Hot real estate market has caused the increasing attention of the government and media. The CPC Central Committee has repeatedly introduced a series of policies to curb the excessive growth of house prices. There is a range of literature on the study of the impact of real estate on the national economy, but how it affects the real estate market in the field of independent innovation of China's enterprises has rarely reported. In theory, the link between the real estate industry and the independent innovation of China's enterprises is the following two aspects.

(1) The real estate industry has an effect on the output of independent innovation of China's enterprise, the output here is indicated with the amount of patent granted. The real estate industry will firstly affect the investment of independent innovation of enterprises. Investment is the foundation of independent innovation of enterprises; of course, this is not to say that the more R&D funding capability of innovation, the stronger the company will be able to win the fierce market competition. Take The Apple as an example, its R&D investment is not the largest among lots of technology companies, but it has enormous gains that many other companies are not comparable undeniably. But the R&D investment in the enterprise exists significant positive correlation with market value [11]. Studies have shown that R&D investment determine the size of the corporate patent applications and patent level of a corporation. It also reflects the strength of independent innovation capability. In fact, innovation activities of an enterprise require not only large-scale investment of funding and stuff but also taking great risks, which make many companies on the research and development of high value-added products prohibitive. In contrast, the hot real estate of China brings high profits to attract a large number of enterprises to chase

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more profits. So the funds to support the independent innovation of the enterprise will be decreased. The above analysis shows that China's real estate industry has had a negative impact of the increase in the number of patents granted.

(2) Real estate industry has an inhibiting effect on the demand for high value-added products. Liangyun Fang; Gao Tiemei and He Shuping (2006) [12] analized the relationship between economic fundamentals and real estate. Real estate investment had a positive impact on the national economy and played a leading role in other related industries. However, it is not appropriate as the premise of this article because the unconventional development of real estate precisely after the conclusion of the study. The demand for the high value-added products has much to do with people's income and consumption level. Many scholars believe that the real estate industry is essential to our national economy, house is a necessity, its demand is rigid, the roaring house prices brought from the hot real estate market will inevitably occupy the demand for other consumer goods [13]. People will invest more funds for housing, in addition, we have the habit of saving, thus further reducing the consumption of high value-added products.

Through the above analysis, we can draw the basic assumptions that the real estate industry has a negative impact on China's independent innovation activities.

2.2 A setup of the model

In this paper, we applied a multivariate econometric model to illustrate and validate the relationship between the development of China's real estate industry and enterprise's independent innovation.

(1) The dependent variable. The dependent variable in this article was indicated with the number of patent licensing and new products sales. These are two indicators which can reflect the development and progress of independent innovation of enterprise in China directly. Some literature also divided patents into three forms: Invention patents, utility model patents, design patents. Technical content in the three patents is different, the highest technical content of which is invention patent [14]. In this paper, we classify the patents into three types. The invention patent number and the total number of patents act as the dependent variable for regression analysis. In addition, sales of the new product also have a close relationship with the marketing capabilities and it may not fully reflect the level of the enterprise independent research and development of innovation, after all it largely reflects the benefits of the new products [15].

(2) Independent variable. The development of the real estate industry generally has two indicators: the average price of housing every year and amount of real estate investment. There is no denying that real estate prices affect the sensitive nerves of thousands of families, it is not only an important indicator of reference by households and economic institutions, but also a preferred indicator of experts and scholars to analyze the real estate-related issues. Another indicator is the amount of real estate investment. The real estate investment quota, expressed in monetary construction and the workload activities of fixed assets, is an indicator of reflection of the real estate investment scale, speed, proportional relationships. In this article, we select this indicator to measure the amount of money into real estate.

(3) The control variable. The amount of patent licensing and sales of new products are not enough as all the factors that affect the activities of independent innovation. So, the other important factors for the economic activities should be used as control variables of real estate-the independent innovation activities. In this article, we select R&D investment, the number of R&D person, foreign direct investment, average consumption, the fixed assets investment.

Based on the above analysis and assumptions, we can establish the following analytical model, as shown in Figure 1.

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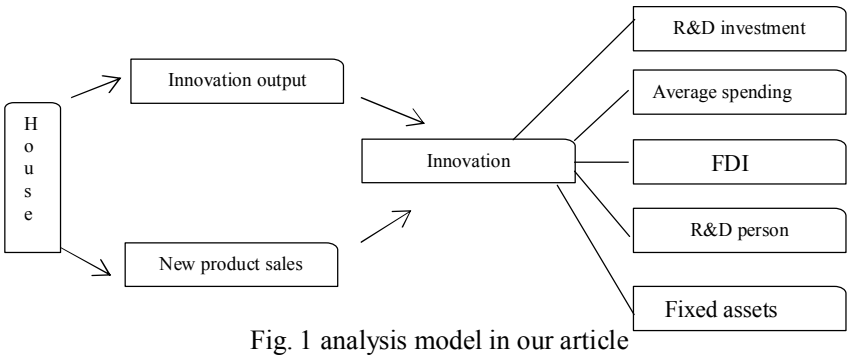

Fig. 1 analysis model in our article

Table 1 Descriptive statistics of very variable

		hprice	rfunds	hconsump	hinvest	finvest	rperson	sincome	psum	isum	fdi
2004	Mean	2216.444	2351.991	1943.403	446.4757	2304.419	18705.07	680.7	4625.57	541.967	419.9839
	Maxi	5855	23467.24	5930.47	1274.52	6970.62	108508	3055	31446	3216	2609.57
	Mini	1325	70.66	172.27	28.94	289.18	868	4	70	21	9.59
	Std	1037.857	4318.319	1387.67	373.3236	1794.051	20613.82	853.7642	6332.86	684.409	646.3798
2005	Mean	2667.282	2763.632	5874.933	512.2709	2897.144	18734.37	184.6667	5269.73	608.233	487.8183
	Maxi	6842	26786.23	18396	1386.533	9307.299	108991	1508	36894	3476	2889.2
	Mini	1528.675	78.71	3140	27.8488	329.8142	863	9	79	24	7
	Std	1368.449	4974.224	3470.487	403.5878	2240.593	20866.57	335.7038	7530.97	741.526	749.3871
2006	Mean	2949.469	3046.978	6631.767	642.6951	3593.982	18844.8	1041.133	6956	740.967	569.0333
	Maxi	8279.51	28883.79	20944	1697.624	11111.42	112202	4217	43516	3864	3243
	Mini	1707.992	99.33	3499	40.583	408.5366	881	38	97	30	20
	Std	1611.624	5378.834	3952.671	472.7692	2689.228	21393.71	1225.954	9753.54	885.331	858.1672
2007	Mean	3495.167	3646.342	7660.333	830.3067	4484.094	20137.9	1365.933	9454.53	939.233	687.3848
	Maxi	11553	33900.1	24260	2246.6	12537.7	119441	4995	56451	4824	3820.296
	Mini	2072	118.19	4057	50.3	482.843	896	39	222	28	21.8252
	Std	2138.226	6329.072	4505.301	603.2356	3143.194	22987.39	1540.589	13344.6	1181.12	978.841
2008	Mean	3698.733	4128.779	8862	1026.201	5626.119	20449.13	1709.72	11097.7	1353.73	753.7152
	Maxi	12418	37753.94	27343	2756.238	15435.93	124933	7103.476	62031	7604	4159.297
	Mini	1958	101.43	4426	65.3222	583.2406	809	48.4338	228	23	24.49178
	Std	2233.323	7019.97	4971.954	733.7238	3859.411	23916.86	1983.479	15865.8	1876.13	1066.042
2009	Mean	4401.6	19335.35	9663.767	1212.52	7281.361	10751.6	1932.454	16102.5	1950.23	800.8316
	Maxi	13799	70195.29	29572	2915.202	19034.53	83251	7854.799	87286	11355	4443.948
	Mini	2483	578.06	5044	100.2678	798.23	386	10.1895	368	35	25.29309
	Std	2811.935	20523.9	5349.757	818.2323	4795.593	15312.01	2212.8	24580.8	2742.85	1126.349
2010	Mean	5212.9	23537.07	11090.9	1528.571	9030.001	22097	2428.797	23976.1	2460.13	14824.67
	Maxi	17782	85794.91	32271	3706.903	23280.52	138688	11300	138382	13691	93756
	Mini	3005	702.035	5879	177.864	1016.869	840	17.0695	264	41	499
	Std	3485.174	25417.19	5875.483	1009.296	5821.817	26439.63	2966.566	36529.3	3352.66	20388.08

Note: data source is China Statistical Yearbook on science and technology and China Statistical Yearbook.

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Table 2 The meaning of the variables and units

Name	meaning	unit
hprice	House price	Yuan
rfunds	R&D funds	hundred million
aconsump	Average consumption	Yuan
hivest	Real estate investment	hundred million
finvest	Fix assets investment	hundred million
rperson	R&D person	Person
sincome	Sales of new products	hundred million
psum	Sum of patent	Piece
isum	Sum of invent patent	Piece
fdi	Foreign direct investment	hundred million dollar

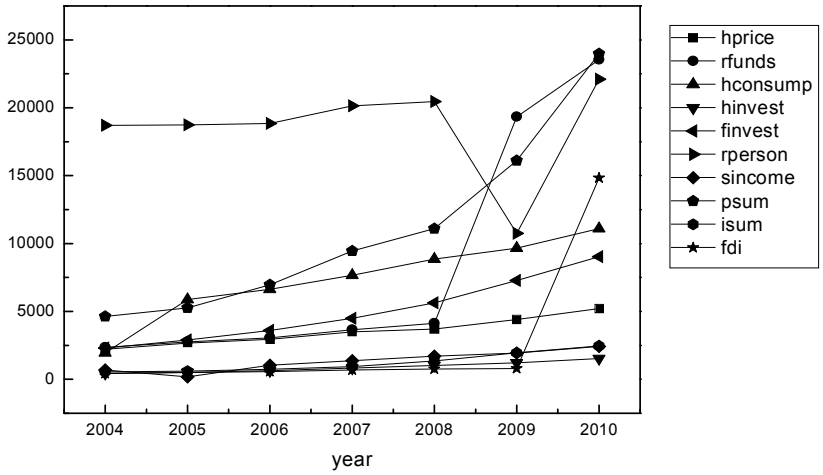

Fig. 2 the trend of development of every index every year

Figure 2 is a more intuitive representation of the trend of the individual variables in the average level. Each variable has an upward trend. That is to say the Chinese economy is rising overall. China is a country that is in transition. A variety of complex international and domestic factors are intertwined, some variables have changed a lot in a year. For instance, research person had a significant decline in 2008. It was likely because China's job market came across a little shock before the emergence of government's policies. Companies began to layoff. Total amount of patent licensing has been in a growth trend especially in the last several years, which shows that the awareness of patent of the corporation. Growths of fixed assets investment, Real estate investment and house price have been very steady and in the figure below, the high-speed growth of these three variables did not occur from the point of average level. That is because the high prices emerge in the several first-line cities whereas housing prices have not been fully entered a period of rapid growth in remote cities. Figure 2 is a trend of the average level of each variable

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from which we can tell the difference between the various provinces is not obvious.

3. Results and Discussion

In this article I processed the data on eviews6.0 software. First, carry the hausman inspection and likehood test to determine that the sample data uses individual fixed effects model. The total number of new product sales revenue, patent license and invention patents as the dependent variable to make regression analysis. In order to eliminate heteroscedasticity caused by unbalanced development between the various provinces and regions, we can use the cross-section weight regression methods. The following is regression results:

Table 3 the regression results of panel data

	Model 1		Model 2		Model 3	
	Sincome	p	Psum	p	Isum	p
c	-8.27797 (-0.046694)	0.9628	2534.956*** (3.037170)	0.0028	161.8144 (1.677865)	0.0952
hprice	-0.09217*** (-4.620231)	0	-0.75895*** (-6.497266)	0	-0.01289 (-0.503919)	0.615
rfunds	0.043676*** (6.268010)	0	0.480756*** (13.17945)	0	0.064084*** (16.00220)	0
aconsump	0.018444* (1.862737)	0.0642	0.165221*** (3.502581)	0.0006	0.042245*** (4.567641)	0
hinvest	1.191274*** (5.183733)	0	9.954046*** (11.41167)	0	0.867212*** (5.419163)	0
finvest	-0.06241* (-1.852452)	0.0657	-1.20273*** (-10.99612)	0	-0.16847*** (-5.950867)	0
rperson	0.022754*** (3.024846)	0.0029	0.131069*** (3.955708)	0.0001	0.014894*** (4.087833)	0.0001
fdi	0.003243 (0.344108)	0.7312	0.238752*** (5.593446)	0	0.008331 (1.405540)	0.1617

Note: the t values are shown in brackets. ***, **and * indicates significance at the 1%, 5%and 10% level.

Model 1, model 2 and model 3 use sincome (new products) sales, psum (the total number of patent license) and the Isum (invention patents authorization number) respectively as the dependent variable in the regression results. Results show that the real estate industry is influenced by independent innovation activities of enterprises in China significantly. The relationship between hprice and sincome (Sales of new products) and psum (Sum of patent) is consistent with the assumptions (model 1, b = -0.092. P <0.01; model 2, b = -0.758, P <0.01). The model 1 and model 2 show that the impact of prices on sales of our new products is negative. Every yuan rises in house price, sales of new products to reduce nearly 10 million, the amount of patent granted to a decrease of 0.75, the two results are significant. From the result of model 3 we know hprice is not significant to the psum, indicating that they have little correlation between the quantity of patent licensing and house prices. This is mainly for two reasons: First, the amount of foreign patent licensing in China accounts for a sizeable proportion among the patent licensing in China and is increasing year by year. China is a huge market and it has attracted many countries such as the United States, Germany, Japan, Korea, and these countries with stronger capital strength and more advanced technical levels than China. Second, the patent has been greatly improved in quantity, but their quality and effectiveness need to be further strengthened. 2010 China valid patent annual reports pointed out that the effectiveness of China's invention patents accounted for only 14.9%, with the core competitiveness of high-tech invention patents

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has a large gap compared with foreign countries. The cost of our patient is still lower comparatively. There exists a lot of "junk patents". Therefore, the impact of house prices for invention patents has no significant effect.

Hinvest (real estate investment) is another important variable we can see in these three models which show the positive correlation with the China's independent innovation, contrary to assumption we supposed(model 1, b = 1.191, P <0.01; model 2, b = 9.954, P <0.01; Model 3, b = 0.8672, P <0.01). The reasons are as follows. First, China's real estate investment to a certain extent can promote the development of China's economy, drive the development of related industries such as steel, construction and decoration, and play a positive role in the independent innovation of enterprises in China. Second, the negative impact on the real estate investment of Chinese enterprises independent innovation is not apparent yet. Because the real estate investment is hot just in recent years, the data in this article only up to 2010, funds of the real estate investor are still not fully returned, its demonstration effect remains existence, urbanization continues to make the real estate market price of the second and third tier cities rise. But with the adjustment of land policy and local government debt turning up, the adverse consequences of real estate investment appear slowly. The blindness of real estate market regulation and long-term real estate markets investment lead to its positive relationship.

The other control variables also achieve the desired effect. Rfunds (R&D expenditures) is in line with expected conclusion (model 1, b = 0.044, P <0.01; model 2, b = 0.481, P <0.01; model 3, b = 0.0640, P <0.01). The increasing R&D funding will bring the increase of the output of innovation, R&D spending is the basis of independent innovation, and the more investment in R&D funding will also increase the output of innovation.

Aconsump (the consumption level of resident across the country) also achieves a certain significance (model I, b = 0.018, P <0.1; model 2, b = 0.165, (P <0.01); model 3, b=0.043, P<0.01). The stronger the spending power, the more independent research and development of enterprises in China can promote, because the consumer demand for new products of people increases with the increase in consumption.

Finvest (investment in fixed assets) is a negative impact for the output of innovation, the result is also significant (model 1, b = -0.062, P <0.1; model 2, b = -1.203, P <0.01; model 3, b = -0.168, P <0.01). The impact of the investment in fixed assets on the total amount of patent authorization is enormous. For the increase of every one hundred million, the total number of patents granted will decrease by 1.2. During the global financial crisis in 2008, in order to save the economic crisis and maintain the economic growth, the Chinese government invested forty thousand million which were mainly used in the infrastructure construction. The real estate has become a pillar of the local industry. Therefore, the first-tier city house prices rose. Even the second and third tier cities were scrambling to launch large-scale development projects. Most of the funds flow into the railway, bridge, and real estate, which had a negative impact on the independent innovation of China's enterprises.

The regression results of Rperson (the number of R&D personnel) is also very significant positive (model 1, b = 0.023, P <0.01; model 2, b = 0.131, P <0.01; model 3, b = 0.0149, P <0.01). The increase of R&D staff shows that the enterprises pay attention to the research and development and begin to conduct independent research and development. But in terms of the regression coefficient, it is necessary to improve the quality of R&D personnel, especially in the application for invention patents because the coefficient model 3 is significantly less than the coefficient of model 2.

The regression result of FDI (foreign direct investment) is not significant. The reasons are as follows. First, the main styles of FDI are Sino-foreign joint ventures and foreign-owned enterprises in China. Chinese companies want to make technological progress through learning by

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doing, but Chinese enterprises are difficult to obtain the core technology which is often mastered by foreign enterprises. Second, although there is technical spillover which is brought from the foreign investors, it is conditional and related to the digestion and absorption capacity of China's enterprises. For now, the labor-intensive manufacturing accounts for most of the enterprises in China and the optimization and upgrading of enterprises are not yet complete.

4. Conclusions

According to the results of this study, the negative impact that China's real estate industry on the independent innovation of enterprises mainly reflects the real estate price, and the impact is significantly. For per Yuan increase of house price will bring nearly ten million decreases in sales of new products and have 0.75 reductions in the number of patent grants. For every increase of one billion residential investments will have a billion growths in sales of new products and bring 10 increases in the number of patent grants. However, the impact of residential investment on the independent innovation of enterprises is much less than the impact of real estate prices. The excessively fast growth of the real estate price is detrimental to the independent innovation activities of Chinese enterprises. Extravagant housing prices in urban leads to the roaring living cost, therefore, the R&D personnel are more and more difficult to settle down. It is difficult to attract talented people to gather in the small and medium enterprises (SME) away from the big cities because the urban-rural gap is too large or the SME do not have their own R&D platform. At the same time a lot of money wills not flow to manufacture or high-tech industries due to the hot real estate. The positive effect of residential investments on the independent innovation activities of enterprises in China is much less than the effect of housing prices and it mainly focuses on the industry related to the real estate. So this paper shows that in order to encourage independent innovation activities of China's enterprises to achieve the optimization and upgrading of industrial structure, we must control the growth of the housing prices, regulate the real estate investments, and regulate the capital flows.

The impact of the investment in fixed assets of the enterprise independent innovation is negative, the per capita consumption, R&D spending and the number of R&D personnel are positive. Therefore, we have the following recommendations: first, increase the support of independent innovation activities of enterprises, especially in the high-tech industry, and strengthen the cooperation between universities or research institutes and enterprises in order to establish their own R&D platform by using the human resources of universities. Encourage the high-quality personnel to the enterprises and establish the protected wages in the early time in order to make the high-level personnel flow to enterprises, thus practically to realize the economic growth turn into depending on the improvement of the quality of workers. Second, slow down the speed of the fixed asset investment; reduce the amount of investment in fixed assets; ensure the funds flow to the field of independent innovation of enterprises; give some financial support for independent innovation areas. SME, in particular, should improve the core competitiveness of enterprises and change from the survival enterprise to competitive enterprise. Third, expand domestic demand and stimulate consumption, increase the ability of domestic residents' demand for high value-added products. The consumption level of the residents affected by many factors, so the party and government should continue taking measures to increase income and improve the social security system.

In summary, this paper explores, to some extent, the effect of China's real estate industry on independent innovation activities of enterprises in China, in particular, the negative impact of the prices on the independent innovation output and demand for new products with high added value. Given that the internal data of enterprises are difficult to obtain we do not conduct the in-depth research on the mechanism of the effect of each

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variable on independent innovation, which is left for further research.

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