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Investments in Service Sectors and Housing Prices in China[1]

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Abstract

We argue that housing-price bubbles in China have significantly negative impacts on investment in services such as education and medical care, based on provincial panel and two-stages least squares analysis for the period between 2004 and 2016. This is because housing bubbles cause significant overinvestment in housing-related sectors, such as construction and real estate, and overinvestments in these sectors crowd out investments in service sectors, thus leading to underinvestment. We also carried out a Granger test, which revealed that investment in real estate is causally related to investment in education.

JEL: C6, E2, G1

Keywords: China, housing prices, housing bubble, investment, underinvestment, education, health

1 Introduction

There are currently many economic and social issues in China, even though it has experienced high-speed economic growth for over 40 years, since 1978. The first issue is the shortage and low quality of education; hence, the supply of education does not meet the demand, from kindergarten through to the university level (Lin and Zhang 2006; He and Mai 2015). One reason for this is insufficient investment by government (He and Mai 2015; Zheng, 2018).[3] The second area facing underinvestment is medical care, as reported by Wu et al. (2016). For example, the fact that it is difficult and expensive to see a doctor has attracted attention from people from all sections of society (Gao et al. 2001). The third economic issue is the serious housing bubble, especially in

[3] See details from the following website.
http://jyt.fujian.gov.cn/jyyw/ttxw/201811/t20181124_4682546.htm

big cities. This bubble causes significant damage to the balance of consumption and saving for China's households (Wan 2015), investments and debts of nonfinancial firms (Qiu and Wan 2018; Wan 2018b), and the quality of assets of commercial banks (Wan 2018b).

These issues, namely education, medical care and housing, are also lifelines for the general public, and local and central governments should be partly or entirely responsible for them. Unfortunately, as pointed out by Zhou (2007), the Chinese bureaucratic system is dominated by a short-term performance appraisal mechanism, and the governmental mission has been transformed into gross domestic product (GDP)-based competition rather than maximizing the welfare of the citizenship. Hence, the government prefers investing in fast-earning industries, such as bubble-related sectors, thus leading to overinvestment and overcapacity (Qiu and Wan 2018) and

inducing instability in the financial sector and the entire economy. This emerging issue was a major concern voiced by President Xi Jinping on January 21, 2019.[4]

The current housing bubble in China is ongoing, and many people in China have been enraptured by the wealth accumulated due to the housing bubble. One may question why sufficient resources have not been allocated to essential services such as education or medical care. This seems puzzling, considering the amount of money available in the economy.

To address this question, we should consider the role of the housing bubble mentioned above. The housing bubble causes insufficient investment elsewhere because limited resources have been allocated too heavily to housing-related sectors as argued by Niu and Wan (2019).

[4] See details from the following website.
http://theory.people.com.cn/n1/2019/0122/c40531-30584911.html

Research question

Overinvestment in some industrial sectors, such as mining and construction, as well as real estate, has been identified by Qiu and Wan (2018). As total investment resources are limited, some industries will face underinvestment when there is overinvestment in other industries. This effect is known as crowding out. In this study, we addressed whether crowding-out effects have affected investments in sectors such as education and medical care.

Contribution and organization of this research

We used provincial panel data and a two-stages least squares method and found that housing prices have a stable and significantly negative impact on service sectors

such as education and medical care. This is because overinvestment in housing-related sectors, caused by the housing bubble, crowds out investments in the education and medical care sectors. We also found that investment in the real-estate sector is causally related to investment in the education sector.

The remainder of the paper is organized as follows. In Section 2, we analyze the impact of overinvestment and housing prices on service industries by sector. In Section 3, we outline our conclusions and discuss future research.

2 Investment and housing price

2.1 Data and sample

We use data on annual investments in all industries by sector from the China Statistical Yearbook for the period from 2004 to 2016. Using the classification standard

of the China Statistical Yearbook GB/T4754-02 from 2005 to 2017, we obtained information on 19 industrial sectors for the whole economy from 2004 to 2016, as shown in Table 1. We number the sectors from 1 to 19.

According to Figures 1-3, we can see that the sum of investments in industries III (8), III (9), III (10), III (11), III (12), III (13), and III (14) are obviously and negatively correlated with the sum of the investment in industries II (1), II (4), and III (6). This is indicative of a crowding-out effect because overinvested industries crowd out industries facing underinvestment, such as education and medical care.

2.2 Empirical specification

We determined whether overinvestment and housing prices have an impact on investment in industrial sectors facing issues related to underinvestment by estimating the following:

$$\text{investment of potential underinvestment sector (it)} =$$

$$\beta_0 + \beta_1 \text{investment of overinvestment sector(it)} + c(i) + d(t) + \varepsilon(it). \quad (1)$$

Where the *investment of potential underinvestment sector (it)* is the investment at time *t* in province *i*, for some sectors with potential underinvestment, such as III (8) III (9) III (10) III (11) III (12) III (13) III (14). The *investment of overinvestment(it)* is the investment in overinvested sectors, such as mining, construction and real estate,

which were identified by Qiu and Wan (2018) for industries II(1) II(4) III (6), respectively. The variables c_i, d_t, ε_{it} are error terms.

In Equation (1), the investment in the potentially underinvested sector and the investment in a sector with an overinvestment are determined simultaneously for the same region, because the economic agent, such as a government or a private firm, makes resource allocation decisions simultaneously. This endogeneity is typical of independent variables, and must be curbed using an appropriate instrumental variable. The instrumental variable should be correlated with the independent variable, but not the dependent variable.

Table 2 shows the correlation matrix of investment by sector and housing price, and the significance. The variables are transformed to growth values and then detrended. We can see that investments in potential underinvestment sectors, such as education or

medical care (proxied by health and social services, which is classified as Ⅲ(12)) are not significantly correlated with those in overinvested sectors, such as mining, construction, and real estate. In contrast, though housing prices are not significantly correlated with investment in education or medical care, they are significantly and positively correlated with mining, construction and real estate. This relationship is consistent with the findings reported by Qiu and Wan (2018) in which bubbly housing prices lead to overinvestment in mining, construction and real estate. Hence, housing price bubbles can be used as instrumental variables for analyzing investments in overinvestment sectors. Firstly, we carried out the following regression,

$$\text{investment of overinvestment sector (it)} =$$

$$\beta'_0 + \beta'_1 \text{housing bubble (it)} + c'(i) + d'(t) + \varepsilon'(it). \quad (2)$$

According to Wan (2015, 2018a, c, Qiu and Wan 2018), the housing *bubble(it)* is proxied by the house price. After carrying out panel estimation with fixed effects using Equation (2), we predicted the value of investments in overinvested sectors. Then, we used this predicted value to evaluate investments in underinvested sectors, as follows,

$$\text{investment of underinvestment sector (it)} =$$

$$\beta_0 + \beta_1 \text{predicted investment of overinvestment sector (it)} + c(\text{i}) + d(\text{t}) + \varepsilon(\text{it}). \quad (3)$$

This estimation method is called the two-stages least square (2SLS), and we used it to estimate β_0 and β_1.

2.3 Empirical results

The panel regression results obtained using 2SLS are summarized in Tables 4-6.[5] Using these tables, we found that the impact of investment of overinvested sectors, such as mining, construction, and real estate, on potentially underinvested sectors, such as education and the total for both education and medical care, are always significantly and stably negative. These results indicate that overinvestments caused by housing price bubbles have crowded out investment in education and medical care. This implies that underinvestment in education and medical care can be expected during eras with housing bubbles in China.

We also defined two variables to represent the period from 2004 to 2016. One is the ratio of investment in housing-related industries to total national investment, and the

[5] For investments in III (8), III (9), III (10), III (13), and III (14) sectors, the results by using panel regression (without 2SLS) are similar to Yuan et al. (2017), while we cannot find significant impacts of investments of overinvestment sectors by 2SLS, thus, we do not report these results. The empirical results are available upon request.

other is the proportion of investments in education and medical care to total national investment. The correlations between these two variables are shown in Figures 4-5. The mirror symmetry and significantly negative relationship shown in Figure 4 is consistent with the empirical results summarized in Tables 4-6.

2.4 Robust results

The results of our Granger tests on investment in education and real estate by province are summarized in Table 7. Twenty-one out of thirty-one tests in total support the hypothesis that investment in the real-estate sector leads to underinvestment in the education sector. In contrast, only thirteen tests support the hypothesis that investment in education leads to investment in real estate. These results are consistent with those of the panel regressions presented above.

As shown in Figures 6-7, population of 0-14 years old decreased from 279.47 million in 2004 to 233.48 million in 2017, while number of primary schools deceased from 0.48 million in 2004 to 0.17 million in 2017. The number of schools per 10 thousand persons (0-14 years old) significantly and negatively correlated with the average selling price of commercialized buildings (*coefficient of correlation=-0.992*, *p-value=0.000*).

Therefore, we conclude that investment in education is crowded out by investment in real estate. It implies that investment in education is insufficient or underinvestment in education.

3 Conclusion and future research

We found that housing-price bubbles have a significantly negative impact on

investments in education and medical care in China based on the results of a provincial panel analysis and 2SLS for the period of 2004-2016. Housing-price bubbles caused significant overinvestment in housing-related sectors such as construction and real estate. This overinvestment crowded out investment in education and medical care, thus leading to underinvestment. The results of our Granger tests indicated that investment in real estate is causally related to investment in education.

Our results show that housing bubbles can lead to underinvestment in service industries such as education and medical care. Hence, we conclude that ongoing housing bubbles contribute to difficulties in obtaining education and medical care. Consequently, it is necessary to control or induce a soft landing of the ongoing housing bubble, as argued by Wan (2011; 2015; 2018a, b, c).

In the future, to identify underinvestment by sector, we will measure the efficiency

of investment using a marginal *q* approach, and identify the relationship between underinvestment, marginal *q*, and housing bubbles. Nevertheless, this approach will be limited because education and medical care are regulated industries, and the marginal *q* value will not indicate overinvestment, even when it is less than one. For example, Qiu and Wan (2018) report that the marginal *q* of the water industry was less than one for every year between 2001 and 2016, but we cannot conclude that there is overinvestment in the water industry because it is regulated, and there are always water shortages in China, especially in the north, as reported by Liu and Yan (2012).

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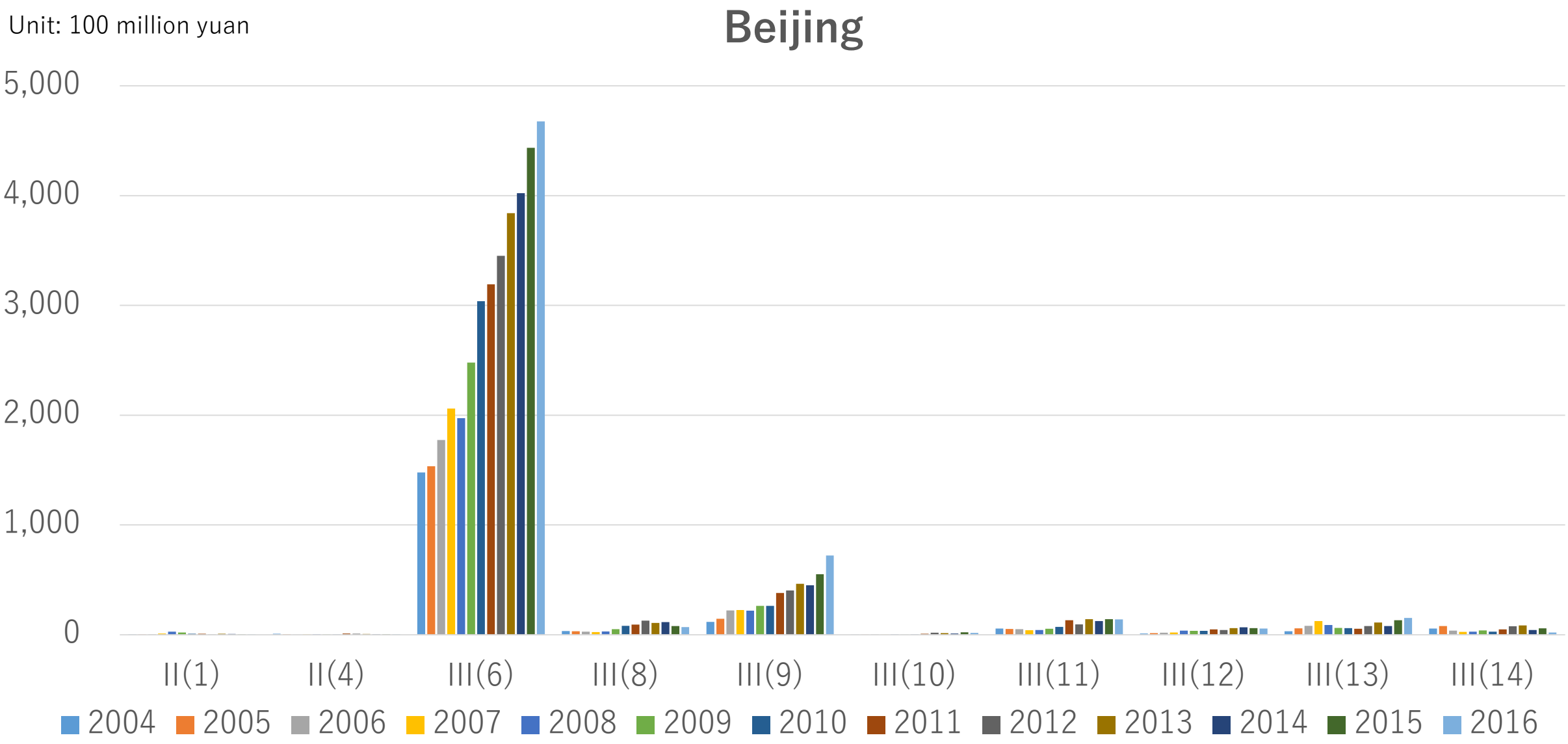
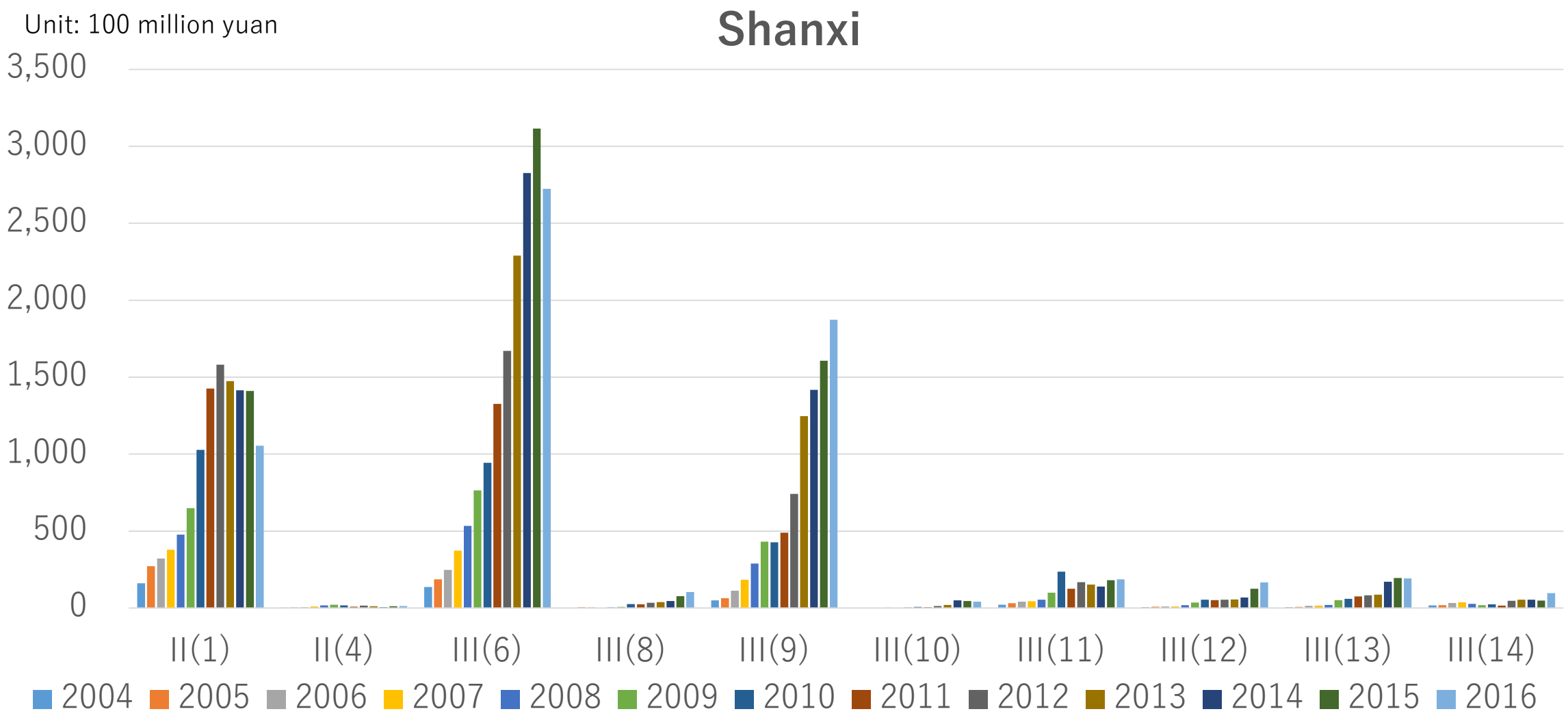
Figure 1: Investment by industrial sector in Beijing during the period Dec. 2004-Dec. 2016



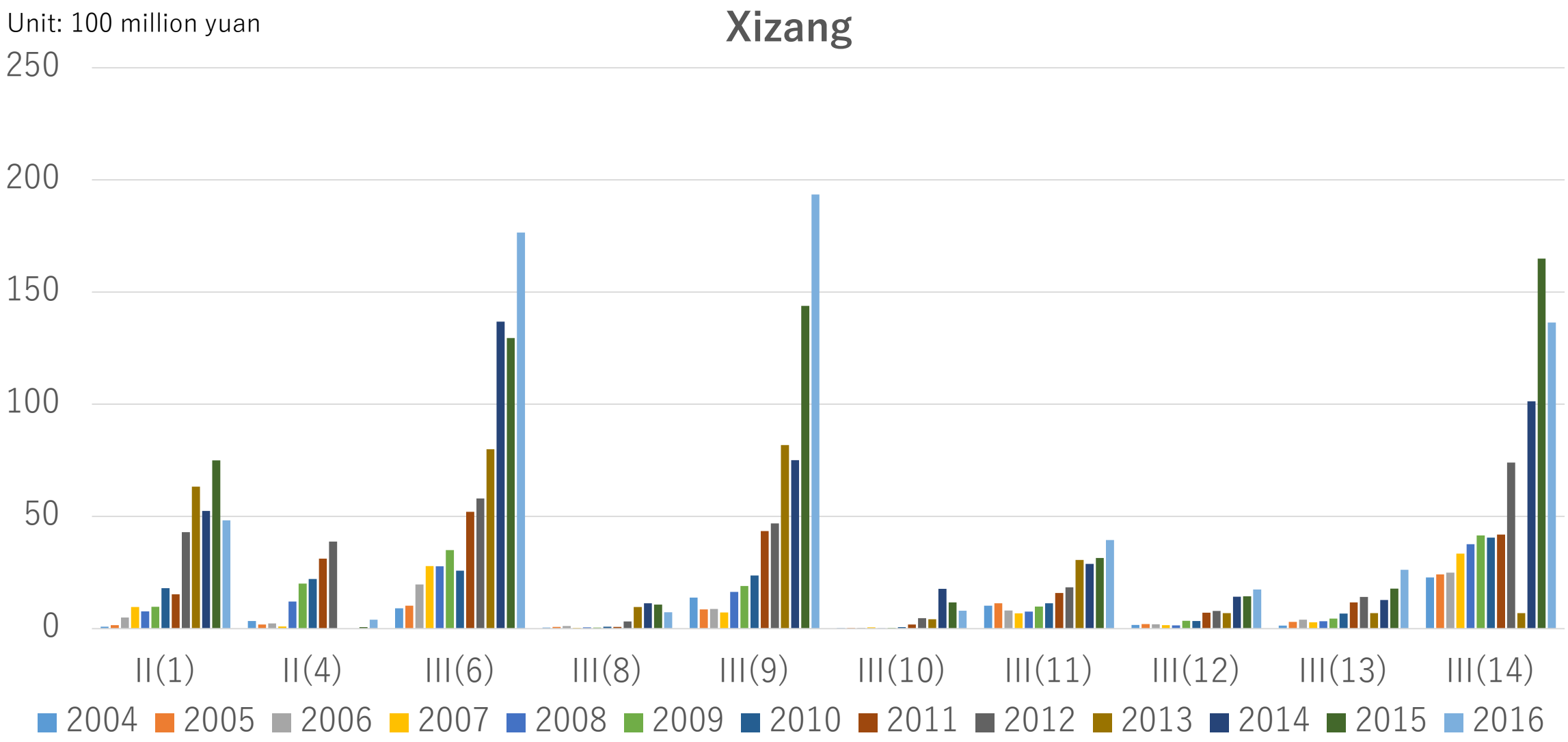
Source: Data from the China Statistical Yearbook from 2005 to 2017.

Figure 2: Investment by industrial sector in Shanxi during the period Dec. 2004-Dec. 2016



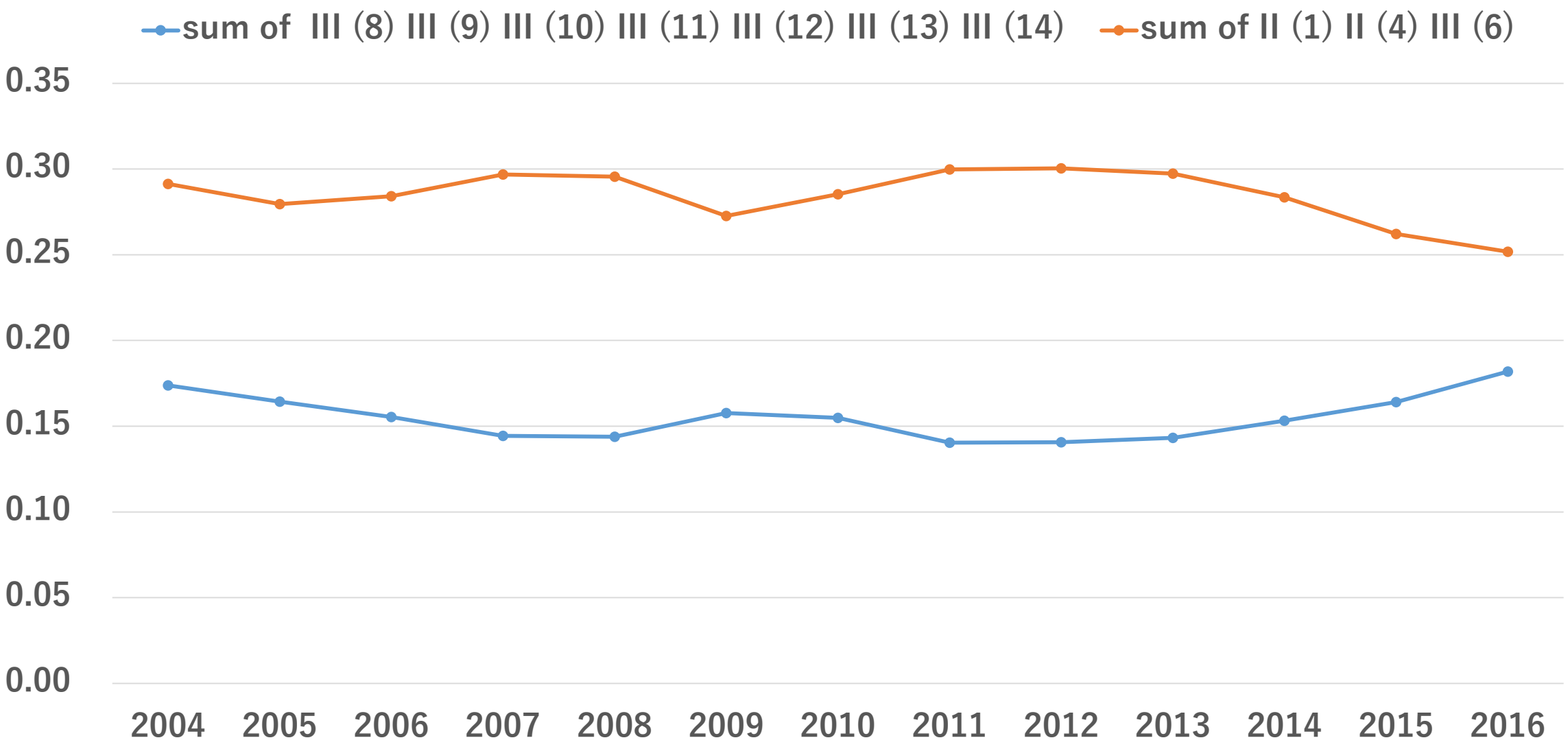
Source: Data from the China Statistical Yearbook from 2005 to 2017.

Figure 3: Investment by industrial sector in Xizang during the period Dec. 2004-Dec. 2016



Source: Data from the China Statistical Yearbook from 2005 to 2017.

Figure 4: Ratio of investment in industry to total national investment during the period Dec. 2004-Dec. 2016



Source: Data from the China Statistical Yearbook from 2005 to 2017.

Figure 5: Ratio of housing-related investment to total investments vs. ratio of investments in education, medical care *etc*., to total investments (coefficient of correlation = -0.8, p-value=0.0003)

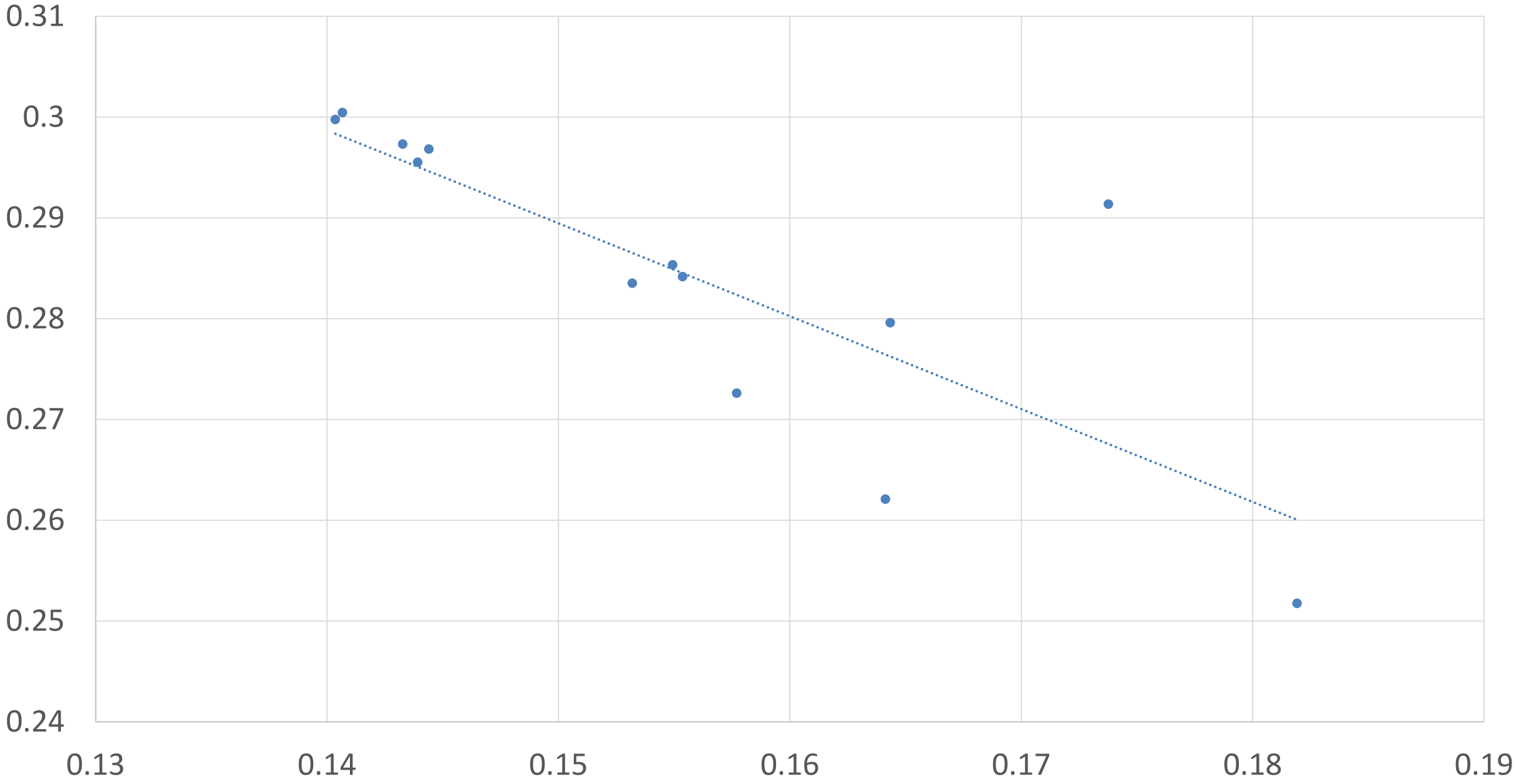
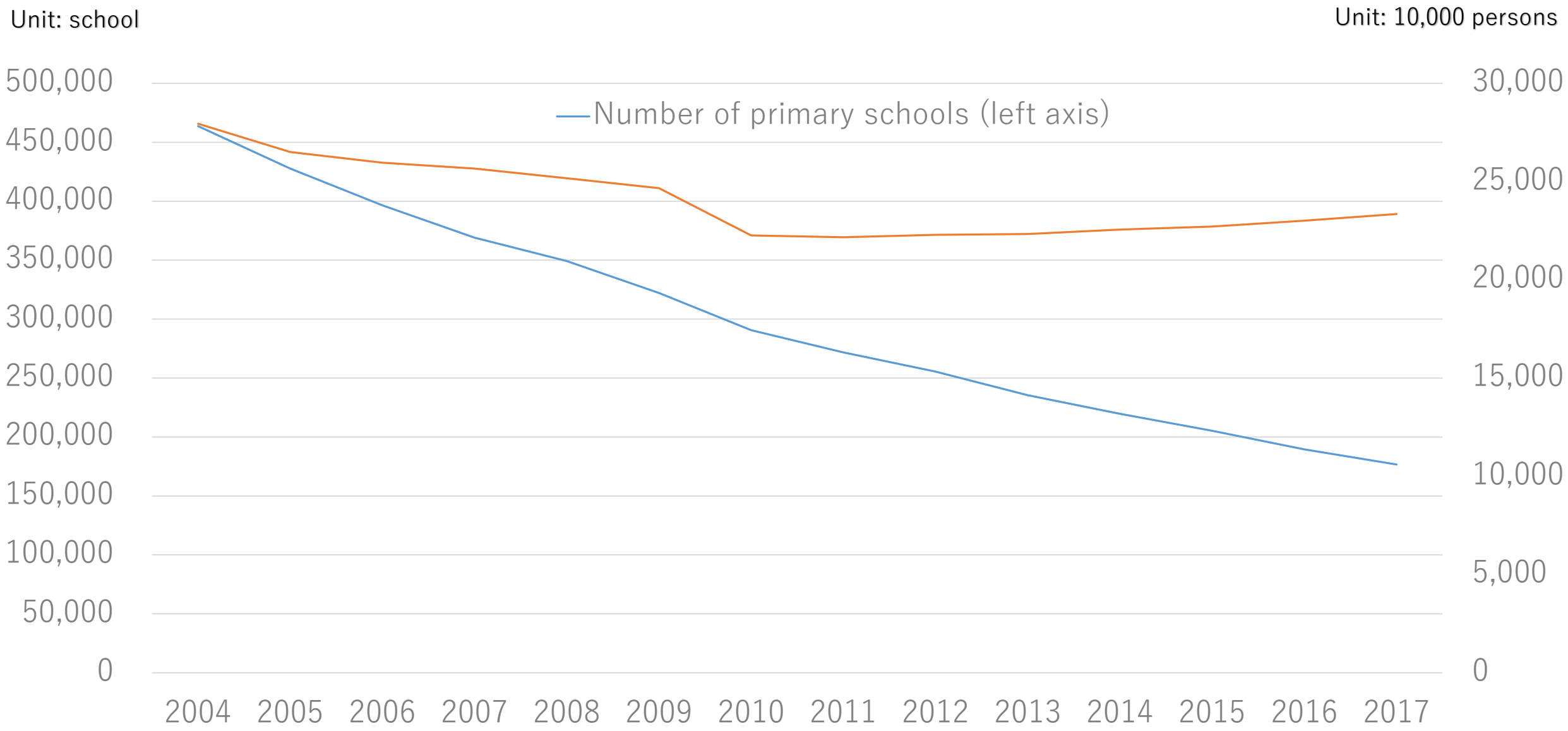
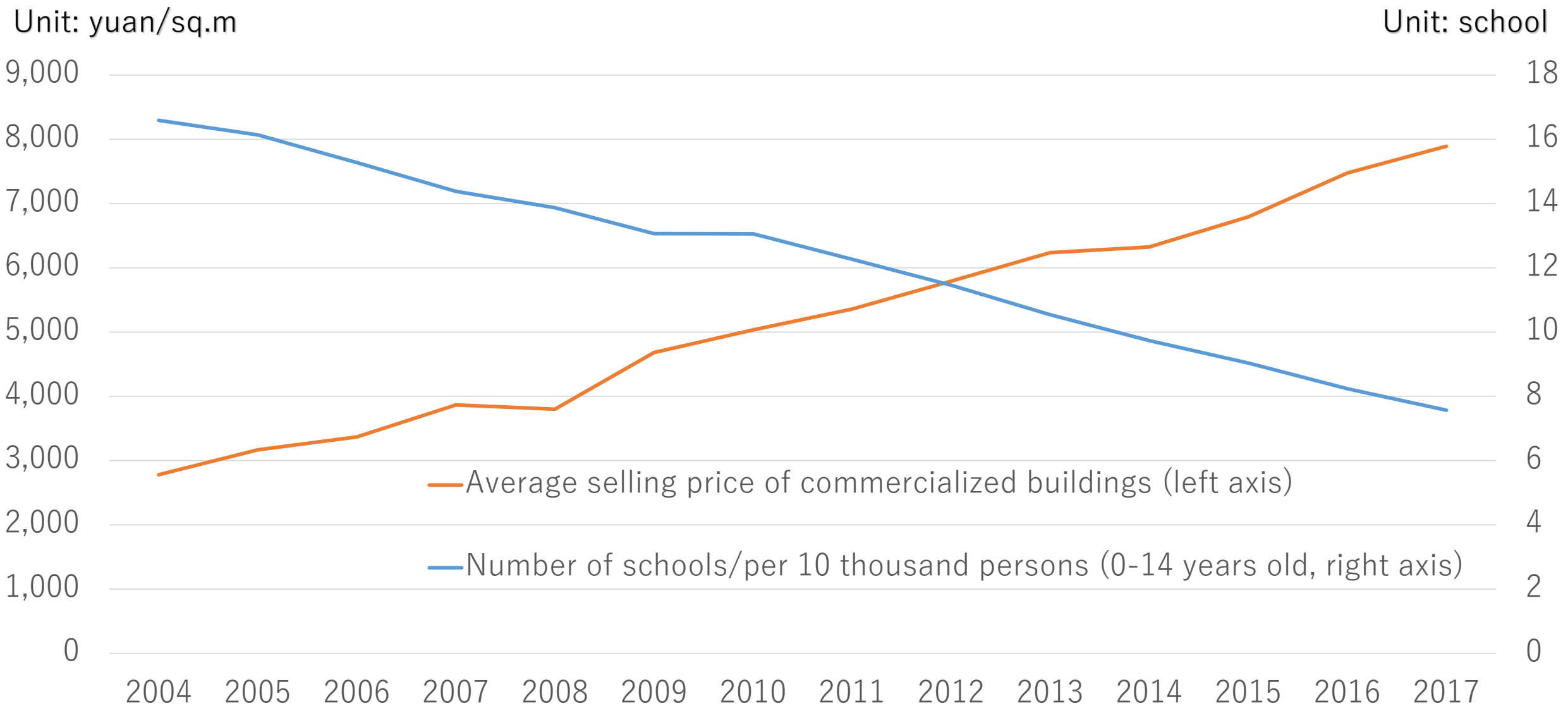


Figure 6: Number of primary education schools vs. population (0-14 years old)



Source: Data from the China Statistical Yearbook from 2005 to 2018.

Figure 7: Average selling price of commercialized buildings vs. number of schools/per 10 thousand persons (0-14 years old)



Source: Data from the China Statistical Yearbook from 2005 to 2018.

Table1: Industrial sector cross-references, 2004-2016

Industry	Number
First industry	
Agriculture, forestry, animal husbandry and fishery	
Secondary industry	II
Mining	II(1)
Manufacturing	II(2)
Production and supply of electricity, heat, gas and water	II(3)
Construction	II(4)
Third industry	III
Transport, storage and post	III(1)
Information transmission, software and information technology	III(2)
Wholesale and retail trades	III(3)
Hotels and catering services	III(4)
Financial intermediation	III(5)
Real estate	III(6)
Leasing and business services	III(7)
Scientific research and technical services	III(8)
Management of water conservancy, environment and public facilities	III(9)
Services to households, repair and other Services	III(10)
Education	III(11)
Health and social service	III(12)
Culture, sports and entertainment	III(13)
Public management, social security and social organizations	III(14)

Source: China Statistical Yearbook, 2005-2017.

Table 2: Correlation matrix for the variables

	ln_housing price	ln_education	ln_health	ln_water	ln_public	ln_entertainment	ln_construction	ln_mining	ln_real estate
ln_housing price	1								
ln_education	-0.0287	1							
	(0.5820)								
ln_health	-0.0614	0.3730 ***	1						
	(0.2370)	(0.0000)							
ln_water	-0.0079	0.2280 ***	0.1430 ***	1					
	(0.8800)	(0.0000)	(0.0057)						
ln_public	0.0199	0.0769	0.1820 ***	0.0099	1				
	(0.7030)	(0.1390)	(0.0004)	(0.8490)					
ln_entertainment	-0.0442	0.1710 ***	0.2170 ***	0.1270 **	0.2680 ***	1			
	(0.3950)	(0.0009)	(0.0000)	(0.0146)	0.0000				
ln_construction	0.0987 *	0.0312	0.0980 *	-0.0176	0.1930 ***	-0.0439	1		
	(0.0592)	(0.5510)	(0.0611)	(0.7370)	(0.0002)	(0.4020)			
ln_mining	-0.1240 **	0.0126	0.0285	0.1160 **	-0.0052	0.0322	-0.0072	1	
	(0.0168)	(0.8090)	(0.5840)	(0.0257)	(0.9210)	(0.5350)	(0.8910)		
ln_real estate	0.1370 ***	0.1130 **	0.0787	0.1520 ***	-0.0242	0.0229	0.0442	0.0601	1
	(0.0081)	(0.0293)	(0.1300)	(0.0034)	(0.6420)	(-0.6590)	(0.3990)	(0.2470)	

Note: P-values are in parentheses; *, **, ***, representing 10%, 5% and 1% significance level, respectively.

Table 3: Summary statistics of investment by sector and housing prices (logarithm value), 2004-2016

Variable	Obs	Median	Mean	Std. Dev.	Min	Max
ln_education	403	4.6299	4.5226	0.9686	1.3346	6.6123
ln_health	403	3.8822	3.7440	1.1907	-0.0546	6.3205
ln_edu_heah	403	4.9846	4.9202	1.0225	1.6549	7.1625
ln_over	399	7.5146	7.3018	1.2235	2.5878	9.3896
ln_mining	403	5.1862	4.7206	1.7752	-2.4950	7.4396
ln_construction	399	3.2158	3.2632	1.5668	-0.5850	7.0330
ln_realestate	403	7.2775	7.0392	1.3515	2.2039	9.3726
ln_price1	403	8.3301	8.3153	0.5659	7.1892	10.2218
year	403	2010	2010	3.7463	2004	2016

Table 4: Determinants of investment in education sector, 2004-2016
(Panel estimation with fixed effect (2SLS))

Independent Variables	Dependent Variable = ln_education (2SLS)			
ln_over	-0.5215 **			
	(0.2276)			
ln_mining		-0.394 *		
		(0.2075)		
ln_construction			-0.2047 **	
			(0.0896)	
ln_realestate				-0.5356 **
				(0.2496)
year	0.2551 ***	0.2095 ***	0.1772 ***	0.2653 ***
	(0.0481)	(0.0337)	(0.0147)	(0.0556)
Constant	-504.3958 ***	-414.6714 ***	-350.9689 ***	-524.9819 ***
	(94.9454)	(66.7807)	(29.3324)	(110.0749)
Observations	399	403	399	403
Number of id	31	31	31	31

Note: Endogenous variables: ln_over, ln_mining, ln_construction, ln_realestate; instrumental variable: ln_housing_price; standard errors in parentheses (2SLS); *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Determinants of investment in health and social service sector, 2004-2016 (Panel estimation with fixed effect (2SLS))

Independent Variables	Dependent Variable = ln_health (2SLS)			
ln_over	-0.0467			
	(0.1795)			
ln_mining		-0.0335		
		(0.1400)		
ln_construction			-0.0183	
			(0.0699)	
ln_realestate				-0.0455
				(0.1900)
year	0.2267 ***	0.2218 ***	0.2197 ***	0.2266 ***
	(0.0379)	(0.0227)	(0.0115)	(0.0424)
Constant	-451.5846 ***	-441.9601 ***	-437.8415 ***	-451.326 ***
	(74.8865)	(45.0672)	(22.8723)	(83.8101)
Observations	399	403	399	403
Number of id	31	31	31	31

Note: Endogenous variables: ln_over, ln_mining, ln_construction, ln_realestate; instrumental variable: ln_housing_price; standard errors in parentheses (2SLS); *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Determinants of investments in both education and health and social services, 2004-2016 (Panel estimation with fixed effect (2SLS))

Independent Variables	Dependent Variable = ln_edu_health (2SLS)			
ln_over	-0.3826 **			
	(0.1951)			
ln_mining		-0.2887 *		
		(0.1705)		
ln_construction			-0.1502 **	
			(0.0757)	
ln_realestate				-0.3924 *
				(0.2119)
year	0.2481 ***	0.2144 ***	0.1909 ***	0.2553 ***
	(0.0412)	(0.0277)	(0.0124)	(0.0472)
Constant	-490.8914 ***	-424.7407 ***	-378.3176 ***	-505.5693 ***
	(81.3956)	(54.8940)	(24.7836)	(93.4475)
Observations	399	403	399	403
Number of id	31	31	31	31

Note: Endogenous variables: ln_over, ln_mining, ln_construction, ln_realestate; instrumental variable: ln_housing_price; standard errors in parentheses (2SLS); *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Granger causality tests for investment in education sector and investment in real estate sector by province, 2004-2016

Province or city		H_0: real estate does not Granger cause education			H_0: education does not Granger cause real estate		
	lags	statistical value	p-value		statistical value	p-value	
Beijing	1	11.24	0.0008	***	0.25	0.6183	
Tianjin	1	7.04	0.0080	***	5.16	0.0231	**
Hebei	1	4.77	0.0289	**	2.25	0.1332	
Shanxi	1	3.16	0.0757	*	2.79	0.0946	*
Inner Mongolia	1	1.56	0.2123		0.76	0.3847	
Liaoning	1	5.11	0.0238	**	13.70	0.0002	***
Jilin	1	2.79	0.0951	*	0.12	0.7280	
Heilongjiang	1	4.87	0.0273	**	4.80	0.0285	**
Shanghai	1	2.13	0.1448		2.79	0.0948	*
Jiangsu	1	19.27	0.0000	***	3.67	0.0555	*
Zhejiang	1	55.18	0.0000	***	22.01	0.0000	***
Anhui	1	9.32	0.0023	***	3.71	0.0541	*
Fujian	1	2.46	0.1165		0.65	0.4215	
Jiangxi	1	8.94	0.0028	***	1.05	0.3047	
Shandong	1	0.75	0.3861		9.97	0.0016	***
Henan	1	2.50	0.1140		0.38	0.5380	
Hubei	1	3.98	0.0461	**	3.62	0.0571	*
Hunan	1	2.04	0.1532		0.18	0.6705	
Guangdon	1	12.72	0.0004	***	1.15	0.2836	
Guangxi	1	1.18	0.2779		0.11	0.7449	
Hainan	1	12.45	0.0004	***	0.36	0.5502	
Chongqing	1	3.60	0.0578	*	1.88	0.1703	
Sichuan	1	6.37	0.0116	**	0.72	0.3966	
Guizhou	1	12.27	0.0005	***	15.38	0.0001	***
Yunnan	1	5.11	0.0238	**	0.13	0.7159	
Xizang	1	3.29	0.0698	*	3.91	0.0479	**
Shaanxi	1	0.92	0.3378		0.00	0.9459	
Gansu	1	2.39	0.1224		0.28	0.5943	
Qinghai	1	4.62	0.0317	**	0.04	0.8446	
Ningxia	1	2.22	0.1360		5.75	0.0165	**
Xinjiang	1	9.53	0.0020	***	0.00	0.9474	

*, **, ***, represents significance levels of 10%, 5% and 1%, respectively.