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Title: Public Services, Real Estate Taxes & Fees, and Housing Prices in China: A Study Based on Chinese-style Decentralization

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Public Services, Real Estate Taxes & Fees, and Housing Prices in China: A Study Based on Chinese-style Decentralization [☆]

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ABSTRACT

In this research, we extend the work of Stadelmann and Billon (2012) by incorporating Chinese-style decentralization variables. We do this to explore the characteristics of tax capitalization and the capitalization of public services under the city governances in China. As an indicator of Chinese-style decentralization, the city-level administrative hierarchy leads to city-level differentiation of fiscal resources and public services. We argue that this further causes a huge disparity in housing prices among China's 35 major cities. Meanwhile, the land transferring fee is a factor driving the increase in urban housing prices.

The main contributions of this research are fourfold. One, we provide a reasonable explanation for the structural intercity housing price differences in China's 35 major cities. Two, we use the method of principal component analysis (PCA) to calculate the 35 major cities' public services indexes. Three, we use measures of land-related taxes and land transferring fees to check the effects of tax capitalization. Four, we use the number of city-level government officials at the deputy bureau chief and above levels for the first time as an instrumental variable and an indicator for Chinese-style city-level decentralization to help mitigate the endogeneity in the panel data analysis.

Keywords: Chinese-style decentralization; Public services capitalization; Tax capitalization; Intercity housing price differences; Administrative levels; Principal component analysis

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Public Services, Real Estate Taxes & Fees, and Housing Prices in China: A Study Based on Chinese-style Decentralization

1. Introduction

Chinese-style decentralization, which is characterized by a combination of political centralization and fiscal decentralization, has been regarded as one of the fundamental institutional factors propelling China's rapid economic development (Xu, 2011). In the process of China's rapid urbanization, multilevel city governments have gradually come to replace multilevel regional governments.⁵ Consequently, the Chinese-style city governance structure with its feature of a multi-level administrative hierarchical system has been formed.⁶

City governments at various administrative levels compete with each other in the fiscal decentralization process, and city governments with higher administrative levels play dominant roles in city-level horizontal and vertical competitions. Our argument is that the higher land prices (implicit taxes) are impounded into the house prices (capitalization) and that each city gives a costly signal about their provision of services and job opportunities via their administrative structure. As Hilber (2017) suggests capitalization is most prevalent in "locations with strict regulatory and geographic supply constraints."

Administrative levels therefore, which to a great extent indicate a city's capability to obtain political and fiscal resources, become the key factor of city level Chinese-style decentralization featured by the combination of vertical political control and

⁵ Prefectural level cities were created in 1983, and by March 2017, there were 293 prefectural level cities in 334 prefectural administrative divisions in China.

⁶ In the year of 2017, there are four-tier cities including province-level cities (municipalities), sub-province level cities, prefecture level cities and county level cities. The predecessors of sub-province level cities were *Cities Specifically Designated in the State Plan*, which were listed separately in the five-year and annual state plans. These cities were on the same level as the provinces and national ministries in the 1980s, making them economically independent of their provincial governments. On February 25th, 1994, the original *Cities Specifically Designated in the State Plan* were renamed as sub-provincial cities by the *Central Organization Committee of the CPC*. In the year of 2017, there are 15 sub-provincial cities, most of which are capital cities of the provinces in which they are located.

horizontal economic competition, and in general, a city with a higher administrative level could have better public services. We believe that these administrative levels in China effectively communicate regulatory and general government power. This process also is effective because it is a costly signal that other cities cannot mimic.

We view that the administrative structures and resources signal the quality of the city from a provision of services point of view. This signaling is a well-studied phenomena. Michael Spence (1973), Kenneth Arrow (1973)), Joseph Stiglitz (1975), Thomas Schelling (1980), and Edmund Philips (1972) made key contributions to this idea. The key idea is that sometimes we are not able to directly measure and action of event, but we can have a good signal⁷. A good signal however requires a cost—thus a signal is good only when it is hard to fake.

In recent years, although the Chinese government has implemented a series of macro-control policies and measures on real estate markets, housing prices in most of China's 35 major cities have increased substantially. And importantly, the housing price differentiation among different administrative level cities has grown (Yu & Huang, 2016), and a city with a higher administrative level could have higher housing prices, *ceteris paribus*.

Another unique phenomenon is the heavy dependence of local public finance on real estate taxes & fees which are broadly defined as land-related or property-related taxes & fees⁸(Du, 2009; Guo, 2011; Zhao, 2011). Although residential property tax trials have been imposed since January 28, 2011 only in Shanghai and Chongqing, various types of real estate taxes & fees are still prevalent in China. Chinese land-related or property-related taxes mainly cover (commercial) housing property taxes,⁹ residential property taxes (limited to the Shanghai and Chongqing municipality trials),

⁷ Much of the work on signaling was applied to education and the labor market and to discrimination, but the theory fits many other areas of society.

⁸ Chinese scholars often use the term real estate tax in a broad sense, since pilot programs of residential property taxes with this narrow definition exist only in Shanghai and Chongqing.

⁹ Prior to 2009, there were two kinds of property taxes in China: urban real estate taxes and (commercial) housing property taxes. But, urban real estate taxes were merged into the (commercial) housing property tax category on January 1, 2009. Today, (commercial) housing property taxes are paid by property owners. The taxpayers are commercial homeowners, housing operational and managerial units, mortgagees, custodians and renters.

farmland occupation taxes,¹⁰ contract taxes,¹¹ business taxes & surcharges in real estate development,¹² and project settlement taxes & surcharges¹³ (Du, 2009; Guo, 2011; Zhao, 2011).

Meanwhile, land transferring fees, which are fees assessed for transferring land usage rights, could be regarded as a real estate tax to some extent, since these are the present discounted values of future annual rent flows charged to households (Zhao, 2011). Thus, if we agree that these land transfer fees give revenue to the cities and that the cities control the supply of land, we have a situation that fits Hilber's expectation that more strongly controlled supplies of land will experience more capitalization (price increases).

The rapid urbanization and development of China's real estate market has led to a sharp increase in the proportion of real estate taxes & fees collected as local fiscal revenues (Zheng, Wang & Cao, 2014, Pan, Zhang, Zhu & Wójcik, 2016). This so-called land financing facilitates regional economic development and the provision of public goods. What are the impacts of real estate taxes and fees on urban housing prices? What is the relationship between housing prices and land-based local public financing? These issues are worth studying.

Tiebout (1956) and Oates (1969) develop the capitalization of tax and public services hypothesis that residents would prefer to pay higher residential home prices in order to live in a community with better public services (or the same public services at a lower tax rate). The Tiebout-Oates model is based on a local governance structure under the institutional environment of United States, which is characterized by horizontal competition of local governments, free mobility among different areas, public- services-oriented property taxes and the voter guided officials' selection system.

However, there are huge institutional differences between China and United States.

¹⁰ Farmland occupation taxes are imposed on entities and individuals who use arable land to build houses or for other non-agricultural construction purposes, and are assessed based on the area of the arable land used.

¹¹ Contract taxes are imposed on property rights transfers. The taxpayers are the buyers or receivers of the land and housing properties.

¹² Business taxes & surcharges include the business taxes imposed on the income of main business, city maintenance and construction taxes, and educational surcharges. The taxpayers are real estate developers. In 2016, the reform program replaced the real estate business tax with a value-added tax.

¹³ Project settlement taxes & surcharges include the business taxes imposed on project construction income, city maintenance and construction taxes, and educational surcharges. The taxpayers are construction enterprises.

In China, cities are classified into different categories according to administrative levels, and local fiscal revenues rely mainly on land-transferring fees due to the imperfect local tax system. It is also important that in the Chinese hierarchical urban governance structure, governments in upper-level cities can make decisions on the appointment and promotion of officials in lower-level cities, so officials in lower-level cities prefer to be responsible for upper-governments rather than local residents. These significant institutional differences affect the taxation and public services capitalization process in China. While there are large differences in the USA and China in terms of housing markets, we'd expect that any costly signal would still be useful in explaining price differences across city areas.

Would the mechanism of tax capitalization and the capitalization of public services still exist in China's transition period in spite of these institutional differences with the original assumptions of Tiebout-Oates model? If yes, which characteristic does the mechanism of both kinds of capitalization process under the local governance of Chinese-style decentralization? Can a city-level administrative hierarchy, which is an indicator of Chinese-style decentralization, be seen as an important factor for housing price differentiation? Our research in this paper aims to address these questions. We expect that the control of land and the costly construction of administrative levels signals a level of services that explains capitalization and thus high prices across these administrative cities.

The remainder of this paper is organized as follows. In the next section, we present our literature review. Section 3 expands the Tiebout-Oates model by introducing Chinese-style decentralization factors to theoretically analyze the impact of public services, and real estate taxes & fees on city-level housing prices. Model specifications and data descriptions are introduced in Sections 4 and 5, respectively. The sixth section of this paper employs our empirical analysis to examine the relationship among China's real estate taxes and fees, the provision of public services, and housing prices in the context of China. The final section concludes and discusses some policy suggestions.

2. Literature review

2.1. Chinese-style decentralization

Chinese-style decentralization has unique institutional features. Many studies have focused on *Market-Preserving Federalism, Chinese Style* (Weingast, 1995; Qian & Weingast, 1996; Qian & Roland, 1998), *personnel control* (Blanchard & Shleifer, 2001; Zhou, 2007), and the combination of *Market-Preserving Federalism, Chinese Style* and vertical *personnel control* (Xu, 2011; Wang & Ma, 2014; He, Zhou, & Huang, 2015). Meanwhile, in China's rapid urbanization process, multilevel city governments came to replace multilevel regional governments, and the multi-level administrative hierarchy is a typical characteristic of China's city government system. Consequently, Chinese-style decentralization, which manifests as an administrative level for each city in the city government system, could become an important variable in explaining urban intergovernmental relations.

On the one hand, more and more cities experience high economic growth as a consequence of both *economic incentives* induced by fiscal decentralization and *promotion incentives* caused by political centralization (Zhang & Zou, 1998; Feltensteina & Iwata, 2005). Therefore, intergovernmental horizontal competition, which is described as a *promotion tournament* (Jia & Guo, 2014; Chen, 2017), prevails in local urban governance. On the other hand, in the hierarchical governance structure under political centralization, a city with a higher administrative level could capture numerous resources within its jurisdiction. This might lead to unfair competition among cities with different administrative levels (Li, Wei, Liao, & Huang, 2015; Cartier, 2016).

There has been little research on whether and how a city's administrative level as the indicator of Chinese-style decentralization affects the city-level provision of public services, housing prices and other economic variables. Another issue that needs to be studied, is the measurement of Chinese-style decentralization. Many scholars assess the degree of decentralization by introducing a fiscal decentralization index proxy (Zhang & Zou, 2001; Jia, Guo, & Zhang, 2014), but this indicator cannot reflect the unfair vertical competition that exists among cities with different administrative hierarchical

levels. Furthermore, no matter what kind of fiscal decentralization index, it is difficult for empirical studies to eliminate endogeneity.

2.2. Tax capitalization and public services capitalization

After Tiebout (1956) and Oates (1969) proposed the hypotheses of tax capitalization and the capitalization of public services, more and more studies focus on this topic. More recently, Fredrik (2009), Richard (2011), David (2012), Charlot (2013), Batista (2016), and Wirth, Hardt, and Lehmann (2016) conduct empirical studies on the Tiebout-Oates hypotheses and provide evidence of the existence of tax capitalization and public services capitalization using the communities or states data of Norway, Georgia, Switzerland, France, Brazil and Germany, respectively.

In the literature on China's tax capitalization and the capitalization of its public services, some scholars limit their examination to the relationship between real estate taxes and housing prices (Kuang, 2009; Luo & Wu, 2012), while others focus their analysis on the relationship between public services and housing prices (Liang, 2008; Shao & Yuan, 2010; Feng & Lu, 2010).

Studies that comprehensively analyze both tax capitalization and public services capitalization are relatively scarce. Only Du, Huang and Wu (2009) find the negative effect of real estate taxes and the positive effect of local public expenditures on housing prices, which can be regarded as empirical evidence of the Tiebout-Oates effect in China. However, almost all of the related studies ignore the possible impacts of Chinese-style decentralization on these two kinds of capitalization. Moreover, it is difficult to incorporate China's specific institutional variables into an empirical study of tax and public services capitalization, since China's decentralization apparently does not satisfy the assumptions of the traditional Tiebout-Oates model.

In terms of empirical methodology, most of the related studies are based on the hedonic price approach, which provides a theoretical framework for the relationship between housing prices and the characteristics of houses, including public services (Oates, 1969, 1973; Black, 1999; Li & Fu, 2010; Wen et al., 2017). However, the

disadvantage of this approach is that it is difficult to add variables related to real estate taxes into the model. In addition, other studies conduct empirical analyses using the capitalization approach (Yinger, Bloom, Borsch-Supan, & Ladd, 1988; Palmon & Smith, 1998). Although this approach introduces real estate taxes into the model, it is not capable of clearly explaining the formation mechanism of housing prices, especially the impact of public services on housing prices. It is therefore difficult to achieve reasonable results through either a hedonic or capitalization approach.

Apart from the two approaches noted above, Stadelmann and Billon (2012) construct a basic theoretical model under partial equilibrium of the housing market from the perspective of a consumer's utility maximization, and directly illustrate the impacts of taxes and public services on housing prices. Based on the theoretical model of Stadelmann and Billon (2012), Zheng, Sun and Wang (2014) conduct an empirical study of the capitalization process in China, but Chinese-style decentralization factors are not included in their study.

Apart from the existing literature, this paper expands the traditional Tiebout-Oates hypothesis by introducing an institutional variable representing Chinese-style decentralization into Stadelmann and Billon's (2012) model. Then, we conduct a corresponding empirical analysis to check the influences of real estate taxes and fees, and public services on housing prices in China's 35 major cities.

The main contributions of this paper include three aspects. Firstly, it provides a reasonable explanation for soaring housing prices and the structural differences in China's 35 major cities from the perspective of Chinese-style decentralization. Secondly, the number of city-level government officials of deputy bureau chief and above is used, for the first time, as both an instrumental variable and an indicator for Chinese-style city-level decentralization to eliminate the endogeneity that is prevalent in existing studies. Thirdly, it extends Stadelmann and Billon's (2012) model by introducing Chinese-style decentralization variables to examine the effects of both tax capitalization and the capitalization of public services under China's institutional background.

3. Theoretical model

In China, the higher the administrative level a city has, the stronger its ability to obtain administrative and fiscal resources. Therefore, cities with high administrative levels can obtain more additional fiscal revenues to provide public services to their cities. Considering the context of Chinese-style decentralization and the framework of Stadelmann and Billion (2012), we improve the traditional Tiebout-Oates model by adding city administrative level factors.

We assume a metropolitan area composed of several cities and inhabited by N_t residents who have identical preferences at time t . Let T_{it} and G_{it} denote its own fiscal revenues and the public services increment of city i at time t , respectively. The ratio of public service spending relative to its own fiscal revenue, G_{it}/T_{it} , can be represented as θ_i . The original Tiebout-Oates model is based on the institutional background of the local governance structure and federalism in United States, namely, that cities and communities are self-governing. It is assumed that each city's public services spending comes only from its own revenues, that is to say, $\theta_i = 1$. Denoting G_{it}^* as the public services increment when $\theta_i = 1$, we can get $G_{it} = \theta_i T_{it} = \theta_i G_{it}^*$. Therefore, the total public services increment during t period is $G_{it}' = \sum_{d=1}^t G_{id}' = \sum_{d=1}^t \theta_i G_{id}^* = \theta_i G_{it}^*$. However, in the background of Chinese-style decentralization, cities have different administrative levels, and higher-level authorities could use their control power to dominate the allocation of fiscal resources. In other words, cities with higher administrative level can receive more additional fiscal revenue for public services provision, that is to say, $\theta_{high} > 1$. Conversely, cities with lower administrative levels are forced to lose part of their own fiscal revenues, that is to say, $\theta_{low} < 1$. Therefore, after considering the differences of administrative levels caused by

Chinese-style decentralization, the theoretical model of Stadelmann and Billon (2012) can be revised as follows.

It is assumed that the annual income of a representative resident in city i at year t is y_{it} , and his or her consumption could be classified into two categories: housing consumption h_{it} and non-housing consumption c_{it} . In order to simplify the model, we denote housing prices as p_{it} and the price of non-housing consumption goods as $p_{c_{it}} = 1$. Residents are obliged to pay taxes $tax_{it}y_{it}$. In return, they enjoy the corresponding public services in city i . Therefore, the disposable income of a representative resident in city i is $y_{it}^d = (1 - tax_{it})y_{it}$.

The indirect utility function of a representative resident is

$$U = v(y_{it}^d, p_{it}, G_{it}') = v(y_{it}^d, p_{it}, \theta_i G_{it}^{*'}) \quad (1)$$

and the budget of a representative resident is constrained to

$$st. \quad y_{it}^d = (1 - tax_{it})y_{it} = c_{it} + h_{it}p_{it} \quad (2)$$

In China's metropolitan area, there are two kinds of cities: cities with high administrative levels and those with low administrative levels. In the process of rapid urbanization, residential relocation or migration among Chinese cities is very common, so we assume that residents of the two types of cities can move freely.¹⁴ The equilibrium condition among cities in the metropolitan area is that the utility level of residents living in any city is equal. Therefore, the equilibrium condition can be written as:

$$v(y_{it}^d, p_{it}, G_{it}') = v(y_{it}^d, p_{it}, \theta_i G_{it}^{*'}) = v(y_{jt}^d, p_{jt}, \theta_j G_{jt}^{*'}) = v(y_{jt}^d, p_{jt}, G_{jt}') \quad (i \neq j) \quad (3)$$

We assume city i has n_{it} inhabitants at year t , and that the housing demand of a representative resident is $h_{it}(p_{it})$. The aggregate demand is then $n_{it}h_{it}(p_{it})$.

¹⁴ Although affected by China's household registration system, residents typically have to bear the costs of moving from low administrative level cities to higher administrative level cities. These costs however, do not seem to have deterred the large number of people flocking to higher administrative level cities every year. Of course, residents can also move from a high administrative level city to a lower administrative level city. Therefore, in the process of rapid urbanization, a large number of residents' migration among Chinese cities is prevalent.

Meanwhile, the aggregate housing supply is S_{it} . According to the partial equilibrium condition of the housing market, we get:

$$n_{it}h_{it}(p_{it})=S_{it} \quad (4)$$

Then, we have

$$\sum \frac{S_{it}(p_{it})}{h_{it}(p_{it})} = N_t \quad (5)$$

Differentiating formula (3) with respect to G_{it}^* , we obtain:

$$\frac{\partial v}{\partial p_{it}} \frac{\partial p_{it}}{\partial G_{it}^*} + \theta_i \frac{\partial v}{\partial G_{it}^*} - \frac{\partial v}{\partial p_{jt}} \frac{\partial p_{jt}}{\partial G_{it}^*} = 0 \quad (6)$$

The two sides of formula (6) can be divided by $\frac{\partial v}{\partial y_{it}^d}$, since

$h_{it} = \frac{\partial v}{\partial p_{it}} \bigg/ \frac{\partial v}{\partial y_{it}^d}$, $h_{jt} = \frac{\partial v}{\partial p_{jt}} \bigg/ \frac{\partial v}{\partial y_{it}^d}$, then we get:

$$h_{it} \frac{\partial p_{it}}{\partial G_{it}^*} - h_{jt} \frac{\partial p_{jt}}{\partial G_{it}^*} = -\theta_i \frac{\partial v}{\partial G_{it}^*} \bigg/ \frac{\partial v}{\partial y_{it}^d} \quad (7)$$

Where $MRS_{it} = -\frac{\partial v}{\partial G_{it}^*} \bigg/ \frac{\partial v}{\partial y_{it}^d}$ the marginal rate of substitution of public services

and the disposable income of a representative resident. Obviously, $MRS_{it} > 0$, then formula (7) can be rewritten as:

$$h_{it} \frac{\partial p_{it}}{\partial G_{it}^*} - h_{jt} \frac{\partial p_{jt}}{\partial G_{it}^*} = \theta_i MRS_{it} \quad (8)$$

We differentiate formula (5) with respect to G_{it}^* :

$$\frac{1}{h_{it}} \frac{\partial S_{it}}{\partial p_{it}} \frac{\partial p_{it}}{\partial G_{it}^*} - \frac{S_{it}}{h_{it}^2} \frac{\partial p_{it}}{\partial G_{it}^*} \frac{\partial h_{it}}{\partial p_{it}} + \sum_{i \neq j} \left[\frac{1}{h_{jt}} \frac{\partial S_{jt}}{\partial p_{jt}} \frac{\partial p_{jt}}{\partial G_{it}^*} - \frac{S_{jt}}{h_{jt}^2} \frac{\partial p_{jt}}{\partial G_{it}^*} \frac{\partial h_{jt}}{\partial p_{jt}} \right] = 0 \quad (9)$$

The price elasticity of housing supply is defined as

$$\alpha_{it} = \frac{p_{it}}{S_{it}} \frac{\partial S_{it}}{\partial p_{it}} \quad (10)$$

and the price elasticity of housing demand is defined as

$$\beta_{it} = \frac{p_{it}}{h_{it}} \frac{\partial h_{it}}{\partial p_{it}} \quad (11)$$

Substituting formula (10) and (11) into formula (9), we can obtain:

$$\frac{n_{it}}{p_{it}} (\alpha_{it} - \beta_{it}) \frac{\partial p_{it}}{\partial G_{it}^{**}} + \sum_{i \neq j} \frac{n_{jt}}{p_{jt}} (\alpha_{it} - \beta_{it}) \frac{\partial p_{jt}}{\partial G_{it}^{**}} = 0 \quad (12)$$

Combining formula (8) with formula (12), we can get:

$$\frac{\partial p_{it}}{\partial G_{it}^{**}} = \theta_i \frac{E \cdot MRS_{it}}{\frac{n_{it}}{p_{it}} (\alpha_{it} - \beta_{it}) h_{it} + E} \quad (13)$$

where $E = \sum_{i \neq j} \frac{n_{jt}}{p_{jt}} (\alpha_{jt} - \beta_{jt}) h_{jt} > 0$. Since $MRS_{it} > 0$, $\alpha_{it} > 0$, $\beta_{it} < 0$, therefore

$\frac{\partial p_{it}}{\partial G_{it}^{**}} > 0$, which indicates that public services are positively capitalized into housing

prices. However, θ_i would distort the effect of public services capitalization in China, compared with Stadelmann and Billon's (2012) original model.

As shown in formula (13), the capitalization effect could be amplified in high administrative level cities as $\theta_{high} > 1$. Conversely, the public services offered in cities with lower administrative levels could be less capitalized into housing prices due to $\theta_{low} < 1$. We can then put forward Proposition 1 as follows.

Proposition 1: In China, housing prices could increase along with the improvement of public services, and the capitalization process of public services definitely exists. Furthermore, the Chinese-style decentralization factor, which can be measured by a city's administrative level, would significantly distort the capitalization effect. *Ceteris paribus*, the higher the administrative level is, the larger the public services capitalization degree would be. As a result, housing prices could grow faster and *vice versa*.

Derivation of the tax capitalization effect is similar to the case of public services capitalization. We can obtain:

$$\frac{\partial p_{it}}{\partial tax_{it}} = -\frac{E \cdot y_{it}}{\frac{n_{it}}{p_{it}}(\alpha_{it} - \beta_{it})h_{jt} + E} \quad (14)$$

Obviously, $\frac{\partial p_{it}}{\partial tax_{it}} < 0$. According to formula (14), we can get Proposition 2.

Proposition 2: *Ceteris paribus*, a rise in the tax rate could decrease housing prices.

That is to say, tax rate changes could lead to a negative capitalization effect.

4. Model specification

4.1. Variable selection

Housing prices (*HP*) is the dependent variable in our empirical study. The public services comprehensive evaluation index (*PS*), real estate taxes and fees (*LCP*) and the fiscal expenditure decentralization index (*FD*) are the main independent variables. All of the variables are panel data from China's 35 major cities and the sample interval is from 2006 to 2011.

The *PS* represents the level of public services. Based on the definition of basic public services in *China's Twelfth Five-year Plan for the National Basic Public Services System*,¹⁵ six categories including 15 sub-indicators are chosen, which are presented in detail in Table 1. We use principal component analysis (*PCA*) to calculate each city's public services index.

Table 1

An evaluation system of the public services index.

Classification	Index Layer	Unit
Culture & Education	Number of Full-Time Teachers of Primary and Junior Secondary schools per 10,000 Persons (A1)	person
	Number of Institutions of Higher Education per million Persons (A2)	unit
	Collections of Public Libraries Owned per Person (A3)	copy
Health Care	Number of Licensed (Assistant) Doctors per 10,000 Persons (A4)	person
	Number of Beds of Medical Institutions per 10,000 Persons (A5)	bed

¹⁵ In this official document, basic public services are defined as the public services provided mainly by governments, and aimed at guaranteeing the basic survival and development of citizens. Meanwhile, the provision of basic public services should be adapted to China's social and economic development on the basis of public consensus.

Public Management	Number of Public Administration and Social Organization Staff (A6)	1,000 persons
Infrastructure	Area of Paved Roads per 10,000 Persons (A7)	square meter
	Number of Public Transportation Vehicles per 10,000 Persons (A8)	unit
	Number of Post Offices (at year-end) (A9)	unit
	Annual Per Capita Electricity Supply (A10)	Kilowatt-hour
	Annual Per Capita Tap Water supply (A11)	ton
Environment	Green Coverage Rate (A12)	%
	Per Capita Area of Parks and Green Land (A13)	square meter
	Attainment Rate of Waste Water Discharge (A14)	%
	Comprehensive Utilization Rate of Solid Waste (A15)	%

Although many kinds of taxes & fees on land and housing are imposed in the land & housing transactions process, residential property taxes are not generally imposed in China, except in Shanghai and Chongqing.¹⁶ Therefore, although different opinions exist in the literature, many scholars use substitution variables to try to measure residential property taxes in China's real estate market. Based on Kuang (2012), Du (2009), Guo (2011) and Zhao (2011), we construct two substitution variables. The first one, which is designated as LCP_1 , is the summation of (commercial) property taxes, farmland occupation taxes, contract taxes, business taxes, real estate development surcharges, and project settlement taxes and surcharges. The second one, which is designated as LCP_2 , is the variable for land transferring fees.

There are three main Chinese-style fiscal decentralization indicators: the fiscal expenditure decentralization index, fiscal revenue decentralization index and local fiscal autonomy (Guo & Jia, 2008). Since we emphasize, in this paper, the influence of fiscal decentralization on the provision of public services, we incline toward selecting the fiscal expenditure decentralization index, which is designated by FD ¹⁷. However,

¹⁶ Although residential property tax trials began being formally carried out in Shanghai and Chongqing on January 28, 2011, residential property taxes have not been legislatively imposed. In this sense, there is no residential property tax in China. Meanwhile, the residential property tax in Shanghai is not applied to an individual's primary residence but rather targets solely each second and above homes purchased, while the residential property tax in Chongqing is levied mainly on high-end homes. So, the residential property tax trials have little effect on our empirical analysis based on the panel data from 2006 to 2011. Therefore, the residential property tax trails in Shanghai and Chongqing are not included in this study.

¹⁷ We calculate the FD in China's 35 major cities based on the method of Guo and Jia (2008).

when introducing FD into the house pricing model, there is an intractable problem in that fiscal expenditures and housing prices are highly endogenous, especially in a city with high proportion of land transferring fees in local fiscal revenue. In order to decrease the influence of endogeneity, we count the number of government officials with a deputy bureau chief and above¹⁸ which is designated as OFF , in each of China's 35 major cities, and take this as a proxy of FD . It is obvious that OFF is positively correlated with a city's capabilities to obtain fiscal resources while it has no correlation with housing prices.

Disposable income per capita (PIN), foreign direct investment (FDI), living space per capita ($PLIV$) and real estate development investment ($REINV$) are chosen as control variables in our regression analysis, as all of these variables affect housing prices from either the demand-side or supply-side of housing markets, according to the standard housing price model widely used in the literature (Liang & Gao, 2007). Disposable income per capita (PIN) determines a resident's capability to purchase a home, while FDI , as a vital factor that propels economic growth, would indirectly increase housing demand or even directly transfer into funds for real estate development or housing purchases (Yu, 2010). For this reason, it is plausible to assume that according to consumption theory, PIN and FDI could be positively correlated with housing prices. Living space per capita ($PLIV$) and real estate development investment ($REINV$), which are the supply-side housing market variables, would be negatively related with housing prices.

4.2. Model construction

The following four regression formulas are specified based on the above

¹⁸ According to Article 16 in Chapter III of the *Civil Servant Law of the People's Republic of China* effective January 1, 2006, there are ten-tiers of civil servants in China, which from top to bottom consist of: (1) *chiefs at the state level*, (2) *deputies at the state level*, (3) *chiefs at the provincial and ministerial levels*, (4) *deputies at the provincial and ministerial levels*, (5) *chiefs at the department and bureau levels*, (6) *deputies at the department and bureau levels*, (7) *chiefs at the county and section levels*, (8) *deputies at the county and section levels*, (9) *chiefs at the township and sub-division levels*, and (10) *deputies at the township and sub-division levels*. Since this study focuses on China's 35 major cities we calculated the number of officials beginning by the tie of prefecture level cities' *Deputy Mayor* corresponding to *deputies at the department and bureau levels* (i.e., deputy bureau chief). The number of these officials is significantly different among municipalities, sub-provincial cities and prefecture level cities in China's hierarchical city governance structure, and in general, the higher a city's administrative level, the more officials at the deputy bureau level and above.

theoretical analysis and variable selections.

$$LnHP_{it} = \alpha_0 + \alpha_1 PS_{it} + \alpha_2 LnLCP_{it} + \sum_{i=1}^4 \beta_i X_i + \lambda_i + \eta_t + \varepsilon_{it} \quad (15)$$

$$LnHP_{it} = \alpha_0 + \alpha_1 PS_{it} + \alpha_2 LnLCP_{it} + \sum_{i=1}^4 \beta_i X_i + \lambda_1 D_i + \lambda_i + \eta_t + \varepsilon_{it} \quad (16)$$

$$LnHP_{it} = \alpha_0 + \alpha_1 PS_{it} + \alpha_2 LnLCP_{it} + \sum_{i=1}^4 \beta_i X_i + \lambda_1 LnFD_{it} + \lambda_i + \eta_t + \varepsilon_{it} \quad (17)$$

$$LnHP_{it} = \alpha_0 + \alpha_1 PS_{it} + \alpha_2 LnOFF_{it} + \alpha_3 LnOFF_{it} \times PS_{it} + \alpha_4 LnLCP_{it} + \sum_{i=1}^4 \beta_i X_i + \lambda_i + \eta_t + \varepsilon_{it} \quad (18)$$

Model (15) is established to verify Tiebout-Oates's hypothesis of tax capitalization and the capitalization of public services in China. The variables with subscript i and t vary with location i , in different cities and at time t .

In order to explore the differences in housing prices of the varied administrative level cities, we add a dummy D_i that represents a city's administrative level in model (16) based on model (15). If the city we choose is one of the municipalities or sub-province cities, we set $D_i=1$, otherwise, $D_i=0$.

We construct model (17) through the introduction of FD_{it} into model (15) in order to determine how fiscal decentralization in varied administrative level cities impacts housing prices.

Next, we replace the PS_{it} in model (15) with the interaction term $LnOFF_{it} * PS_{it}$. In all of the models above, we then take the logarithm of all of the variables except PS_{it} and D_i to release heteroscedasticity.

5. Data

Our empirical analysis in this paper is based on the panel data of China's 35 major cities from 2006 to 2011.¹⁹ China's Statistical Yearbook and the China Real Estate

¹⁹ The period 2006-2011 is the end phase of the Hu Jin-tao Administration in China, and as such, the city governance structure is relatively stable. China's current Xi Jin-ping Administration began in 2012, and accompanied by administrative system reforms, China's central-local relationship is in transition. Therefore, our sample is chosen for the period 2006 to 2011 to eliminate any variation due to the influence of city governance structures.

Statistical Yearbook have provided the *HP* data in the sample interval. The *PS* index of each city is calculated based on data from the China Economic Net's annual database using *PCA* with the public services index evaluation system demonstrated in Table 1. It is worth mentioning that data normalization is applied during the *PCA* process so that the *PS* index figures vary between 0 and 1.

The (commercial) housing property tax, farmland occupation tax, contract tax, business tax & surcharge on real estate development, the project settlement tax & surcharge data, and all of the control variables above are drawn from the applicable China City Statistical Yearbooks. The land transferring fees data are obtained from the applicable China Land and Resources Statistical Yearbooks. The numbers of government officials with deputy bureau chief and above (*OFF* numbers are accessed from public information on government websites in China's major cities.

In addition, the 1996 *CPI* is assumed as the base point ($CPI_{1996}=100$) and all of the nominal variables are deflated by the corresponding years *CPI* values to obtain the real terms. Table 2 reflects the descriptive statistics of the main variables.

Table 2
Descriptive statistics of the data.

		Obs.	Mean	Std.	Min	Max
<i>LnHP</i>	Overall	N=210	8.523	0.509	7.570	9.954
	Between	n=35		0.445	7.902	9.571
	Within	T=6		0.256	7.948	9.053
<i>PS</i>	Overall	N=210	0.971	0.645	0.248	4.414
	Between	n=35		0.622	0.373	4.134
	Within	T=6		0.196	0.553	1.379
<i>LnLCP₁</i>	Overall	N=210	13.661	1.041	10.741	16.276
	Between	n=35		0.914	11.738	15.473
	Within	T=6		0.521	12.456	15.544
<i>LnFD</i>	Overall	N=210	0.798	0.150	0.377	0.980
	Between	n=35		0.149	0.451	0.976
	Within	T=6		0.028	0.623	0.897
<i>LnOFF</i>	Overall	N=210	3.623	1.344	1.946	6.509
	Between	n=35		1.362	1.946	6.509
	Within	T=6		0.000	3.623	3.623

Table 2 demonstrates that the mean values and standard deviations of *LnHP*,

$LnLCP$ and $LnOFF$ are larger than those of PS and $LnFD$. It is noteworthy that the fluctuation of the $LnOFF$ is larger than the other variables, even though it has a relatively small mean value. This indicates that the administrative resources are obviously differentiated among China's 35 major cities.

6. Empirical results

6.1. Using LCP_1 to represent real estate taxes & fees

First, when LCP_1 is used as the substitution variable of real estate taxes & fees, models (15) through (18) can be estimated through the use of panel data regressions. The corresponding results are provided in Table 3.

In Table 3, columns 1a and 1b are the OLS regressions and random-effect regression results for estimating model (15), respectively.²⁰ Column 1a indicates that the variable PS has a positive effect on $LnHP$, which means that positive public services capitalization could exist in China. Although the coefficient of $LnLCP_1$ is negative, it is not significant at 10% confidence level. That is to say, the existence of a tax capitalization could not be confirmed in China. However, this result could be related to the regression method we use in our analysis. And the estimation of OLS, considering the influence of individual effects such as geographical factors and other shocks, may be biased. Therefore, the random-effect regression is used to estimate model (15). In contrast to column 1a, the information listed in column 1b shows that $LnLCP_1$ has a significantly negative impact on $LnHP$, and the confidence interval has expanded from 90% to 95%. This is the consequence of controlling the individual and time effects, and real estate taxes & fees, which could have a depressant effect on housing prices. In conclusion, public services capitalization as the first part of Proposition 1, and tax capitalization from Proposition 2 can be confirmed.

Column 2 lists the regression results of model (16). By introducing a dummy D_i ,

²⁰ In fact, both the fixed-effect regression and random-effect regression are used to estimate model (15). However, the random-effect regression is ultimately chosen because of the consequence of the Hausman test, which is provided in Table 3.

we find that both tax capitalization and public services capitalization could be affected by a city's administrative levels, since the dummy D_i is significant at the 1% confidence level. According to the result of Hausman Test, we firstly choose the random-effect regression to estimate model (17). The results in column 3a indicate that the impact of FD on housing prices is not significant. Considering the potential endogeneity, which has been mentioned above, $LnOFF$, an instrumental variable of FD , is introduced into the 2SLS model to further estimate formula (17).²¹ Column 3b shows that fiscal decentralization in China exerts a remarkable influence on the differentiation of city-level housing prices, since the coefficient of FD is significant when the confidence interval equals 95%. It is beneficial therefore, for those cities with higher administrative levels to obtain more fiscal resources in the background of Chinese fiscal decentralization. The more fiscal resources a city possesses, the higher its housing prices are and *vice versa*.

This finding is further illustrated when we use the random-effect regression to estimate model (18). Column 4 indicates that when we add an interaction item $PS*LnOFF$ to the regression model, the fitness of the model, which is reflected by R^2 , is higher than Column 1b. At the same time, both of PS and $LnOFF$ exert a positive influence on housing price significantly, and $PS*LnOFF$ also has positive impact at 5%. This result indicates that the accessibility of fiscal resources would produce moderating effect on the influence of public services capitalization. Therefore, in the context of Chinese-style decentralization, the unfair distribution of fiscal resources has a significant impact on the disparity of housing prices among China's 35 major cities. The degree of public services capitalization would be larger in cities with higher administrative levels, which means that the growth rates of housing prices are larger in these cities. Proposition 1 can be totally confirmed.

In addition, $LnPIN$, as one of the control variables, has a significant impact on housing prices in all of our regression results, which confirms the positive effect of disposable income on housing consumption. The remaining control variables are

²¹ Since only one instrumental variable is used, no excessive identification test is required.

significant in some regression results, but insignificant in others. Therefore, it can be concluded that the influences of those variables on housing prices are not stable. Moreover, this also verifies the effect of public services capitalization from another angle, *i.e.*, the unbalanced distribution of fiscal resources and discrepancy in the provision of public services could be the main reasons for both rising housing prices in high administrative level cities and the differentiation of housing prices in cities with different administrative levels.

6.2. Using LCP_2 to represent real estate taxes & fees

Although the empirical results of Table 3 demonstrate the existence of a tax capitalization and capitalization of public services in China, some scholars point out that China's land transferring fees have the attributes of real estate taxes & fees (Zhao, 2011). In order to check the impact of land transferring fees on housing prices, as well as to achieve stable empirical results, LCP_2 , which denotes the land transferring fees, is used as the substitute variable for real estate taxes & fees in models (15) through (18). The corresponding empirical results are shown in Table 4.

As can be seen in Table 4, the signs of most of the coefficients are roughly the same as those shown in Table 3, except that the coefficient sign of $LnLCP_2$ is the opposite to that of the $LnLCP_1$. These results could confirm, to a certain extent, the reasonability and robustness of the previous empirical analysis. The reason for the positive coefficient of $LnLCP_2$ is related to the unique character of China's land transferring fees. According to Zhao (2011), China's land transferring fees can be regarded as the present discounted values of future annual rent flows, which would be further incorporated into housing costs and ultimately be charged to each household. Therefore, in contrast to the LCP_1 , land transferring fees could exert a positive effect on housing prices in China. *Ceteris paribus*, greater land transferring fees means higher housing prices.

Furthermore, when the core independent variable change from $LnLCP_1$ to $LnLCP_2$, the moderating effect of fiscal decentralization stays still significant. We have confirmed Proposition 1 once more.

Table 3 Regression results using LCP_t to represent real estate taxes & fees.

Dependent : $LnHP_{it}$						
	1a (ols)	1b (re)	2 (ols)	3a (re)	3b (2sls)	4 (re)
<i>CONS</i>	-3.538(0.000)***	-2.490(0.000)***	-3.513(0.000)***	-2.509(0.000)***	-2.546(0.000)**	-2.683(0.000)***
<i>PS</i>	0.146(0.000)***	0.125(0.000)***	0.148(0.000)***	0.123(0.004)***	0.118(0.000)***	0.104(0.000)***
<i>PS*LnOFF</i>						0.028(0.036)**
<i>LnOFF</i>						0.013(0.067)*
<i>LnLCP₁</i>	-0.024(0.171)	-0.015(0.011)**	-0.024(0.037)**	-0.015(0.012)**	-0.016(0.032)**	-0.015(0.055)*
<i>LnPIN</i>	1.295(0.000)***	1.024(0.000)***	1.298(0.000)***	1.024(0.000)***	1.021(0.000)***	1.042(0.000)***
<i>LnFDI</i>	-0.046(0.012)***	-0.036(0.156)	-0.046(0.011)**	-0.036(0.162)	-0.035(0.118)	-0.028(0.274)
<i>LnINVEST</i>	-0.015(0.714)	0.096(0.037)**	-0.020(0.765)	0.095 (0.055)*	-0.093(0.032)**	0.078(0.086)*
<i>LnPLIV</i>	-0.139(0.109)	-0.017(0.601)	-0.135 (0.108)	-0.015(0.635)	-0.012(0.807)	-0.013(0.759)
<i>FD</i>				0.053(0.785)	0.156(0.016)**	
<i>D</i>			0.128(0.001)***			
R^2	0.856	0.861	0.856	0.835	0.833	0.878
<i>Individual effect</i>	control	/	control	/	control	/
<i>Time effect</i>	control	/	control	/	control	/
<i>Hausman test</i>		0.224		0.276		0.136

(1) *P*-Values are reported in parentheses. (2) ***: significant at the 1% level; **: significant at the 5% level; *: significant at the 10% level. (3) *D* is a dummy variable representing a city's administrative level. If the city is one of the municipalities or sub-province cities, we set $D = 1$, otherwise $D = 0$.

Table 4 Regression results using LCP_2 to represent real estate taxes & fees.

Dependent : $LnHP_{it}$						
	1a (ols)	1b (re)	2 (ols)	3a (re)	3b (2sls)	4 (re)
<i>CONS</i>	-1.669(0.015)**	-1.623(0.000)***	-1.424(0.034)**	-1.609(0.000)***	-1.540(0.025)**	-1.643(0.000)***
<i>PS</i>	0.204(0.000)***	0.152(0.000)***	0.193(0.000)***	0.153(0.000)***	0.178(0.000)***	0.167(0.000)***
<i>PS*LnOFF</i>						0.019(0.038)**
<i>LnOFF</i>						0.026(0.021)**
<i>LnLCP₂</i>	0.070(0.013)**	0.037(0.016)**	0.053(0.046)**	0.037(0.016)**	0.043(0.147)**	0.036(0.029)**
<i>LnPIN</i>	1.040(0.000)***	0.869(0.000)***	1.063(0.000)***	0.867(0.000)***	1.057(0.000)***	0.732(0.000)***
<i>LnFDI</i>	-0.046(0.000)***	-0.030(0.177)	-0.047(0.000)***	-0.030(0.180)	-0.047(0.000)***	0.011(0.877)
<i>LnINVEST</i>	-0.013(0.699)	0.081(0.030)**	-0.041(0.206)	0.082(0.029)**	-0.043(0.211)	0.140(0.023)**
<i>LnPLIV</i>	-0.177(0.011)**	-0.000(0.992)	-0.137(0.016)**	-0.001(0.987)	-0.132(0.019)**	-0.128(0.831)
<i>FD</i>				-0.035(0.846)	0.521(0.014)**	
<i>D</i>			0.128(0.000)***			
R^2	0.839	0.883	0.842	0.823	0.829	0.886
<i>Individual effect</i>	control	Control	control	control	control	control
<i>Time effect</i>	control	Control	control	control	control	control
<i>Hausman test</i>		0.224		0.273		0.114

(1) *P*-Values are reported in parentheses. (2) ***: significant at the 1% level; **: significant at the 5% level; *: significant at the 10% level. (3) *D* is a dummy variable representing a city's administrative level. If the city is one of the municipalities or sub-province cities, we set $D=1$, otherwise $D=0$.

7. Conclusions and policy suggestions

This paper expands the model of Stadelmann and Billon (2012) by incorporating Chinese-style decentralization variables. The effects of both tax capitalization and public services capitalization are examined based on panel data of China's 35 major cities from 2006 to 2011. The empirical results indicate that the mechanism of tax capitalization and the capitalization of public services could exist in China's decentralization and urbanization process, although the country's institutional environment does not fully satisfy the original Tiebout-Oates model's assumptions.

Meanwhile, we can conclude that the land transferring fee is a factor driving the increase in city-level housing prices. As an indicator of Chinese-style decentralization, the city-level administrative hierarchy could lead to city-level differentiation of fiscal resources and public services, which could further result in a huge disparity of housing prices in China's 35 major cities.

Therefore, the skyrocketing housing prices evidenced in most of municipalities and sub-province level cities in China's 35 major cities is in accordance with their more favorable political and economic status under Chinese-style decentralization. This pattern is consistent with Hilber's (2017) view that capitalization occurs most prevalent where there are strong supply and regulatory constraints.

According to our empirical results and our expectations, some policy implications for China's housing price regulations can be derived. First, China should reform its city-level hierarchical administration system in order to promote fair competition among cities and improve its urban governance. Secondly, public services should be equalized among cities with different administrative levels. Thirdly, introducing a residential property tax could be a useful instrument to prevent housing prices from further skyrocketing in China's first-tier cities and some second-tier cities. Finally, the promotion of balanced development through metropolitan area planning for cities with different administrative levels is necessary in China.

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