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Land market, land development and urban spatial structure in Beijing

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ABSTRACT

The paper first examines urban spatial patterns of the gradients of housing and land prices and land development intensity, and then tests the relationship between the land price gradient and housing price gradient. Urban theory predicts the former is steeper than the latter based on the notion of derived demand for land from the provision of housing services. Finally the paper examines the impact of the property of housing production function on urban spatial structure. For the property of housing production function, we are particularly interested in the elasticity of capital-land substitution. The paper concludes (1) market influences over spatial structure, (2) the derived demand for land, and (3) it is the actual (or expected) housing price increases that cause skyrocketing land prices, not the other way around.

Introduction

A functioning land market is of great importance in achieving land use efficiency through optimizing land allocation among competing uses. A functioning land market also plays a critical role in the formation and development of efficient urban spatial patterns and structures. An efficient urban spatial pattern features minimized external effects among incompatible land uses, maximized agglomerative economies, and produces orderly spatial traffic flows that can be better serviced by mass transit systems (Bertaud and Malpezzi, 2003; Bertaud, 2002; Ding, 2009; Fogarty and Garofalo, 1988; Rosenthal and Strange, 2003).

The spatial structure of a city is not only complex in that it can be measured in different ways, but more importantly in the outcome of collective decisions of different interest groups such as planners, real estate developers and investors, businessmen, and policy makers over the years.[1] In addition to market influences, it is also affected by factors such as topography and infrastructure. Costly land redevelopment and the irreversibility of land development decisions make spatial structure and urban form an important subject of study since its consequences and impacts (positive and/or negative) are long lasting. However, this important subject becomes less favored to study mainly because the rate at which spatial structure reshapes, largely, is slow.

Urban spatial growth can be impressive during periods of rapid urbanization, as it is the case in China. The urbanization rate in 1978, which was the year China adopted its famous open-door policy, was only 17.9 percent. It grew gradually to 19.4 percent in 1980 and then to 26.4 percent in 1990, suggesting that China's urbanization rate increased annually by about 0.7 percentage points between 1978 and 1990. The rate of urbanization jumped to 36.22 percent in 2000 and then to 49.68 percent, implying that it increased annually by nearly 1 and 1.3 percentage points in the 1990s and 2010s, respectively. The rate of growth in the 2010s was nearly twice as high as that in the 1980s.[2] The rapid rate of urbanization has driven many Chinese cities to spatial expansion at unprecedented speeds. The built-up areas in cities and towns increased from 7438 km^2 in 1981 to 25,927.6 km^2 in 2002.[3] This translates to a remarkable annual growth rate of 1.06 percent. Some cities expand even more remarkably. For instance, Shenzhen grew from a small village of less than 3 km^2 in 1979 to a modern city of more than 140 km^2 in 1990. In Beijing, the urbanized areas increased nearly 30 percent in the 1990s, and per capita construction space rose by two-thirds. Guangzhou expanded by approximately 7–8 km^2 per year in the second half of the 1990s. Hangzhou increased its built-up areas from 430 km^2 in 1987 to 683 km^2 in 1997 (Ding, 2007).

In addition to the rapid spatial expansion of urban built-up areas of Chinese cities, Chinese cities are also significantly restructuring its urban spatial forms. This restructuring includes (1) rising

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[1] There are few cities in the world that successfully emerge from virtually nowhere to become megacities. Shenzhen is one of them. Its population was at about 30,000 in the early 1980s but grew to a megacity of more than 15 million by 2011.

[2] Data sources: China City Statistics Yearbooks (1991, 2001, 2005, and 2011), National Statistics Bureau.

[3] Source: http://tjsj.baidu.com/pages/jxyd/26/72/a26bcebda9a261a9ef5f9a72c926a326_0.html.

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land use density; (2) high-value added activities in high land value areas; (3) emerging development gradients, such as land and housing prices, and land use intensity (floor area ratio); and (4) the relocation of low-value added activities (warehouse and industrial establishments) from central locations to city outskirts. Those changes are attributed to emerging land markets that influence land use and development decisions (Ding, 2004).

We believe that the combination of rapid urban spatial expansion and radical land institutional reforms in China offers a great opportunity to examine the interaction between policy reforms and urban spatial form. Specifically, we are interested in the following two questions: (1) do emerging land markets matter regarding land resource allocation and land development? and (2) is spatial structure influenced by emerging market forces? These two questions are related. The first is focused on a micro picture of urban spatial structure through site development, whereas the second is focused on a macro level of urban spatial development. We address the first question by examining the gradients of land and housing prices and the relationship between land prices and land development intensity measured by FAR (floor area ratio). We address the second question by examining the relationship between land price and housing price gradients, and the impacts of the housing production function on urban spatial structure. The housing production function that we are interested in is the elasticity of capital-land substitution that affects capital density or constructed space. We conduct both numerical simulations and regression analyses.

The paper is organized as follows: Section "Theory on urban spatial structure" reviews the theory of spatial structure. Section "Land market and land development in Beijing" describes land development and markets in Beijing. Section "Urban spatial structure and land markets" examines the impacts of emerging land markets on land development and urban spatial structure. Final remarks and conclusions are presented in Section "Conclusions and final remark".

Theory on urban spatial structure

Based on the assumptions of derived land demand and the competitiveness of markets, Brueckner (1987) shows that a monocentric city has the following properties (1) negative price gradients for land and housing prices; (2) both land and housing price gradients become flattened as transport costs fall and/or incomes rise; and (3) land prices fall more quickly than housing prices, indicating a steeper land price gradient than housing price gradient.

Price gradients are captured by negative r_x and p_x, where r and p are unit land and housing price, respectively, and x denotes the distance to the city center.[4] The relative slope of the land price gradient and housing price gradient is captured by $\lambda = ((\partial r/\partial x)/(r/x))/(\partial p/\partial x)/(p/x) > 1$, which represents the ratio of the distance elasticity of land price $((\partial r/\partial x)/(r/x))$ over the distance elasticity of housing price $((\partial p/\partial x)/(p/x))$.[5] Brueckner (1987) shows that $\lambda > 1$, that is to say that land prices decline faster than housing prices over distance. The relation of $\lambda > 1$ can also be interpreted as that a one percent change in housing prices will cause more than a one percent change in land prices.

There are plenty of empirical studies on spatial gradients on housing and land prices. Coulson (1991) presented evidence that housing prices decline with distance to the CBD, and more importantly at a rate approximately equal to the increase of transportation costs. This negative slope of the housing price gradient was also found in Yinger's study (1979). Mills (1969) estimated the land price gradient and found that (1) land value declined by 5–50 percent per mile from the CBD, depending on the time period, by using data on the city of Chicago in the period between 1838 and 1930 and (2) the land price gradient flattened as the explanatory power of distance to the CBD eroded over time. The negative gradient of land values was also found to be significant in Chicago by McDonald and McMillen (1990). They concluded that land values declined 16 percent per mile with distance to the CBD and the effect decreased over time. Atack and Margo (1998) estimated the price gradient of vacant land in New York City between 1835 and 1900. They confirmed the flattening land price gradients, which were significantly negative in 1835, 1845, 1860, 1875, 1880, 1895, and 1900 (insignificant in 1870 and 1885).[6] Ding (2004) conducted a land price gradient study in Beijing and concluded that the coefficient of distance to the CBD ranged from −0.16 to −0.22, suggesting a one-percent change in distance (which was equivalent to 100 m at the mean value) would decrease the per square meter land price by 40–60 RMB, which was converted to one to three-percent change in per square meter land price.

It should be noted that there are studies that show positive or not-significantly negative rent gradients (Heikkila et al., 1989; Yiu and Tam, 2004).[7] This could be due to the following reasons: first, the data used to estimate rent gradients did not at all conform to the assumptions used in a monocentric framework. One of the assumptions is related to job decentralization that creates sub-centers of employment, particularly after WWII. Each sub-center may have its own rent gradients, not only creating a confounding effect on any estimate of rent gradient to the city CBD, but also producing a complicated map of a negative gradient function for housing prices. It is possible that each sub-center has its own distinctive submarkets, along with its own rent gradient, fitting well with what is predicted by the monocentric model, but a negative rent gradient may not be found for the metropolitan area as a whole (Coulson, 1991; Dubin and Sung, 1987).

Second, it is speculated that neighborhood effects cause positive rent gradients (Richardson, 1977). If omitted neighborhood variables are positively correlated with distance, empirical estimation will produce a positive rent gradient due to a model specification error. This may often be the case since neighborhood quality can hardly fully be represented due to data limitations. Finally, if the overall effects of an increase in urban negative externalities such as pollution, traffic jams and noise level as moving toward the CBD may not be completely offset by savings in transport costs, a positive rent gradient is likely obtained (Richardson, 1977).

Rapid urban spatial development in China has drawn attention among urban researchers on similar questions to ours in this paper (Bertaud, 2004; Ding, 2004; Wang, 2009). Ding (2004) shows that, by using data on Beijing land transactions, land prices were affecting by distances and land use types, while Wang (2009) draws similar conclusions with regard to land price gradients using benchmark land prices for the cities of Beijing and Tianjin, and a few others. Population density curves across Chinese cities decline even in pre-reform periods and skylines of buildings appear to be flat

[4] Subscript denotes partial derivative.

[5] The concept of the distance elasticity of land price is similar to the price elasticity of demand.

[6] Other studies confirming negative land price gradients include Kau and Sirmans (1981), McDonald and Bowman (1979), and Yeates (1965). The literature provides overwhelming support for a downward-sloped population density function; we do not review them for space-saving purposes.

[7] The urban model predicts a negative gradient for unit price, not total value/price for land or housing properties. Since unit price is hardly observed, one should be cautious to conclude a positive price/rent gradient.