THE HOUSING SUPPLY ELASTICITY AND ITS DETERMINANTS: EVIDENCE FROM CHINA

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Abstract

Using panel data for 35 cities in China from 1992 to 2009, this article estimates the flow model and the stock adjustment model based on the work by Malpezzi and Maclennan (2001). The flow model represents an implied housing supply elasticity varying from -0.004 to 0.819. In contrast, the stock adjustment model yields a slightly lower estimation ranging from -0.002 to 0.419. A further examination of the determinants of housing supply elasticity suggests that housing supply is not only significantly influenced by housing prices, but also by land-use regulations as well as the lagged housing stock.

Keywords: Housing supply elasticity, housing stock, land regulations
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I. INTRODUCTION

Housing constructions play a critical role not only in economic development, but also in affecting the household welfare. Given the importance of housing constructions, additional efforts in this field are thus justified. The vital importance of housing supply for market analysis and policy making has been stressed several times. For example, as Malpezzi and Maclennan (2001) argued, '…most housing models and policy analysis hinge on explicit or implicit estimates of the price elasticity of housing supply, does the market respond to demand side shocks with more supply or higher prices?' In fact, the Chinese housing market has experienced rapid growth since the housing system reform, which was implemented in 1998. As a result, the demand of housing was enormously stimulated. Afterwards, housing prices jumped from 1,854 RMB (the Chinese Yuan) per square meter in the year 1998 to 4,725 RMB per square meter in 2010 (with an average annual growth rate of nearly 12%), and caused a genuine concern in recent years. Consequently, a series of regulations have been implemented by the Chinese government to intervene in the housing market and to avoid overheating and possible bubbles. The interventions include interest rates adjustments, reducing and exempting real estate taxes and fees, and reducing land rents. An evaluation on pros and cons of policies requires a thorough understanding of both sides of housing demand and housing supply. However, while there are already extensive studies, which focus on the housing demand, few attentions have been paid to the housing supply.

This article focuses on the supply side. The reduced-form approach is used to estimate housing supply elasticity. It also examines the housing supply determinants in the Chinese housing market. Several questions will be explored. First, how elastic is housing supply in China? Second, do the flow model and the stock-adjustment model report the same housing supply elasticity? Finally, does land regulation play a crucial role in affecting housing supply elasticity?

The following section summarizes the existing literature. Section 3 discusses the methodology. Section 4 shows the estimated results. The final section discusses the main findings.

II. LITERATURE REVIEW

A comprehensive review of the previous studies can be found in DiPasquale (1999), who provides an excellent summary of the issues on the supply of housing. However, this study discusses current studies on the latest developments in economics of housing supply. It pays particular attention to the most-recent studies, which focus on the supply of housing in China. In particular, its main focus is on the following disquieting issues. What is known concerning the approaches of housing supply research? What is the appropriate functional form for housing supply equations? What is known concerning determinants of housing supply? What appear to be the major determinants of the estimated housing supply elasticity in the previous studies?

One of the major continuing questions concerning housing supply is just how sensitive supply is to changes in prices. A perfectly elastic housing supply is supported by the earlier studies of Muth (1960), Follain (1979) and Stover (1986). Muth (1960) is generally cited as the first empirical research on the relationship between housing prices and housing supply. Using a regression model and the national data, he attempts to examine the relationship between new housing outputs and housing prices in the United States, but finds no statistically significant relationship. Alternatively, Follain (1979) applies Muth's model to a longer and more recent period with full consideration of serial correlation or the possibility of simultaneity bias between prices and quantity of new constructions. He got a similar finding to Muth (1960). Afterwards, Stover (1986) and Olsen (1987) present a compelling argument on the method and data used in Follain (1979) and Muth (1960). Stover stresses that there might be aggregation bias existed when national data is used and consequently, and estimates price elasticity using cross-section data from 61 metropolitan areas of the United States. However, he still does not find any significant relationships between new housing supply and housing price. The result can be treated as evidence to support a perfect elasticity housing supply in the United States. Further, Olson (1987) points out that there might be some misspecifications in Muth's (1960) and Follain's (1979) studies. He argues that if the relationship between housing price and input costs (capital cost, land cost, and labor cost) is correctly specified, then the coefficient on quantity is zero regardless of the elasticity of supply. As a result, the supply function with price as the dependent variable should have either input costs or housing output on the right-hand side, but not both. Since the goal of the analysis is to examine the relationship between long-run supply price and housing construction, input costs should not be included in their estimation. Input costs mean capital costs, construction costs, land costs and labor costs. Generally, input's costs fluctuate under the regulation of the government. Unfortunately, he fails to provide empirical evidence. In general, most of the above researches use a reduced-form model to examine the relationship between housing supply and housing price. The price elasticity of housing is derived from the coefficients on supply and demand shifters in the reduced form regression. Although various approaches have been utilized in previous studies, the reduced-form model is frequently employed. Two recent studies by Mayo and Sheppard (1996) and Malpezzi and Maclennan (2001) also apply such approaches to comparative studies between countries.

However, one unusual characteristic of housing supply is that the short to medium supply curve for housing embeds a fundamental asymmetry and can be probably best be viewed as kinked. When housing demand falls, the market cannot easily adjust the supply of housing downward because housing is so durable. On the other hand, under absent constraints on land supply, the market should be able to absorb increases in demand. Of course, it has been the case recently that the strong national market for new construction has led to material and labor shortages that have, in turn, driven up prices of materials and labor. This suggests that housing supply is not perfectly elastic in the face of increased demand, at least in the short run. Furthermore, due to a long construction period and the relatively small effect of annual construction on the total stock of housing, housing supply responds on partially to cyclical movement in demand (Arnott, 1987). Unlike the earlier studies, Poterba (1984), Topel and Rosen (1988), and Dipasquale and Wheaton (1994) employ the structural approach to estimate housing supply elasticity directly and finally provide evidence to support a less than perfectly elastic housing supply. In an effort to make a good comparison, later research by Blackely (1999) estimates the alternative models mentioned above using the annual aggregate data with a longer time span from the United States.

On the other hand, the urban growth model takes full consideration of the role of land, which is superior to other models based on investment theory. Capozza and Helsley (1989) originally develop a simple model in which capital is durable and landowners have perfect foresights, and show that land price has four additive components: the value of agricultural land rent, the cost of conversion, the value of accessibility, and the value of expected future rent increases. As an extension of Capozza and Helsely (1989), Mayer and Somerville (2000) develop an urban growth model to estimate housing supply in the U.S. using the data from the year 1976 to

1987. Furthermore, they argue that new construction should be a function of changes in housing prices and construction costs rather than their levels. Their estimates suggest a fairly moderate response of supply to house price changes. The results reveal that a 10% rise in real house prices leads to a 0.8% increase in the housing stock. Green et al. (2005) estimate separate supply elasticity for 45 metropolitan areas of the United States following a model based on a theory of urban form suggested by the work of Capozza and Helsley (1989), and Mayer and Somerville (2000). They find housing supply elasticity to vary substantially from place to place due to different degrees of regulations. Table 1 shows the estimated results of previous studies on housing supply elasticity.

Table 1. A wide Range of the Estimated Housing Supply Elasticity

Argument	Studies	Study area	Data used	Estimates
I. Perfectly elastic housing supply	Muth (1960), Follain (1979)	The United States	National level time-series data	Infinite
	Stover (1986)	The United States	Cross-sectional data	Infinite
II. Less perfectly elastic housing supply	Poterba (1984)	The United States	Quarterly time-series data for 1964:1-1982:2	0.5-2.3 for new construction; -0.9-1.8
	Topel and Rosen (1988)	The United States	Quarterly time-series data for 1963:1-1983:4	1.2-1.4 (myopic); 1.7-2.8 (cost adjustment)
	DiPasquale and Wheaton (1990)	The United States	Aggregate annual data for 1963-1990	1.0-1.2
Comparative studies across countries	Mayo and Sheppard (1996)	Malaysia, Thailand, Korea and the U.S.	Annual time-series data for 1970-1986	Malaysia: 0.0-0.35; Thailand: infinite; Korea: 0.0-0.17; the U.S.: 12.59-19.88
	Malpazzi and Maclennan (2001)	The United States and the United Kingdom	Annual time-series data for 1985-1995 for the U.K. while 1889-1994 for the U.S.	The United States: 4.0-13; the United Kingdom: 0-6.0

Source: summarized by the author.

Meanwhile, a large body of literature explores the determinants in affecting housing supply elasticity. As a durable good, the supply of housing is determined not only by decisions of new construction developers, but also by the decisions of existing home owners. In addition, there are two sources to increase housing availability: construction and renovation or repair of existing housing. Since data on the latter are not available, most existing studies only focus on new construction. Figure 1 illustrates the key factors and their inter-relationships in the housing market. An increase in population as well as households' income generally gives rise to increase in the housing demand. Meanwhile, housing supply is basically affected by housing prices, housing stock, and input costs. The government regulates housing market mainly through adjusting interest rates and controlling land supply for construction use to affect housing supply in order to eventually stabilize housing prices. The effect of these regulations on housing supply depends on the response of housing developers.

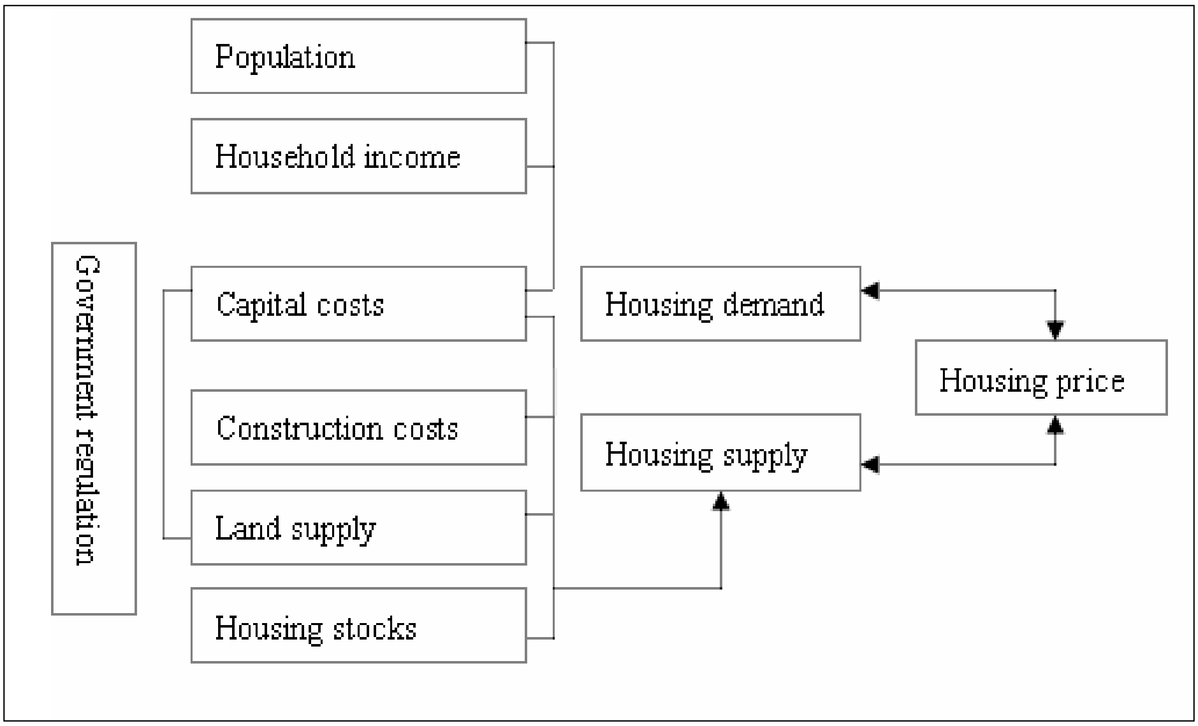

Figure 1. The Key Factor in the Housing Market

Table 2 reports the previous studies on the estimated coefficient of explanatory variables such as construction costs, the housing stock and the vacancy rate. Most of them report a positive sign for the real interest rate and a negative sign for the vacancy rate, while there is no agreement on the coefficients of construction costs and the housing stocks.

Table 2. Alternative Explanatory Variables for Housing Supply Elasticity

Explanatory variables	Estimates of Coefficient signs	Studies
Real interest rates	Nine papers: "-" Only one paper: "Not significant"	Follain (1979); Topel and Rosen (1988); DiPasquale and Wheaton (1994); Mayer and Somerville (2000); Hwang and Quigley (2006)
Construction costs	Five papers: "-"; Five papers: "+";	Follain (1979); DiPasquale and Wheaton (1994); Somerville (1999); Mayer and

	Two papers: "Not significant"	Somerville (2000);
Stock of housing	Only one paper: "+"; Two papers: "-"; Four papers: "Not significant"	Muth (1960); Follain (1979); DiPasquale and Wheaton (1994); Blackley (1999); Mayer and Somerville (2000)
Vacancy rate	Four papers: "-"; Only one paper: "Not significant"	de-Leeuw and Ekanem (1971); DiPasquale and Wheaton (1992); Quigley (1999)

Note: Summarized by the author.

An overview of the existing studies focus on the Chinese housing market reveals that most researchers concentrate on the housing demand, while they overlook the housing supply. Using data for 35 cities, Gao and Wang (2008) investigate the elasticity of housing demand. They find an inelastic housing demand in China, and their finding also suggests a significant regional difference in housing demand elasticity across cities. Similarly, Chow and Niu (2010) estimate the housing demand elasticity using time-series data for years of 1987-2006. They report that the income elasticity of housing demand is 0.904, while the price elasticity of supply is 0.831. More recent work by Wang et al. (2012) make several improvements in exploring the housing supply elasticity and its determinants in China. Using the data for 35 cities from the year 1998 to 2009, they find a less elastic housing supply. They use an indicator of the developable land ratio to measure land-use regulations in each city. The results suggest that there is a significant relationship between the availability of developable land and housing supply elasticity. Further, the results indicate that geographical constraint, the average built-up area, the rate of population growth and regulatory restrictions on land use matter in determining housing supply elasticity. Especially, as there are no published data on housing stock in China, their study measures housing stock by per-capita floor area multiplied by the urban population in 1999. Their results may be better convinced if they employed a more precise measure of the housing stock. Alternatively, Fu et al. (2011) explain housing supply elasticity across the Chinese cities, and obtain several interesting findings. Their results show the supply elasticity increases with fixed investments and urban area expansion in a city. Although, holding investment and urban area expansion constant, the supply elasticity is independent of urban size and density.

This article extends the existing literature in several ways: 1) an update panel data for 35 cities from the year 1999 to 2010 is used to avoid the aggregation bias of employing aggregated time-series data, 2) both the flow model and stock-adjustment model is used to examine, and 3) it incorporates the impact of land-use regulation into the model.

III. RESEARCH METHOD

Our analysis follows the work by Malpezzi and Maclennan (2001). As they criticized, the Muth-Follain test cannot differentiate between perfectly elastic and perfectly inelastic. Based on their work, this study first conducts its analysis to explain sources of the housing supply elasticity considering the effect of land regulation on developing new constructions.

3.1. Price Elasticity of Housing Supply

A flow model of housing market consists of the following three equations:

$$\ln Q_d = \alpha^d + \varepsilon_y^d \cdot \ln Y + \varepsilon_p^d \cdot \ln P + \varepsilon_D^d \cdot \ln D \quad (1)$$

$$\ln Q_s = \alpha^s + \varepsilon_p^s \cdot \ln P \quad (2)$$

$$\ln Q_d = \ln Q_s \quad (3)$$

where the parameters of ε_y^d and ε_p^d is the income and price elasticity of demand for housing respectively, and ε_p^s is the price elasticity of supply for housing. In equation (1) housing demand, Q_d, is treated as a function of household income (Y), housing price (P), and number of population (D). In equation (2) housing supply (Q_s), is assumed to be determined by the housing price only. Hence, combining the three equations yields a reduced-form equation, which can be described as follows:

$$\ln P = \pi_0 + \pi_1 \ln Y + \pi_2 \ln D + \varepsilon, \quad (4)$$

where the parameter π_1 is given by:

$$\pi_1 = \frac{\varepsilon_y^d}{\varepsilon_p^s - \varepsilon_p^d}. \quad (5)$$

Thus, the price elasticity of housing supply can be estimated by:

$$\varepsilon_p^s = \varepsilon_p^d + \frac{\varepsilon_y^d}{\pi_1}. \quad (6)$$

To begin with, we discuss briefly the relationship between these parameters. The equation (6) implies that if ε_y^d equals to 0, the price elasticity of housing supply will equal to the price elasticity of housing demand on condition that, $\pi_1 \neq 0$. Otherwise, if $\pi_1 = 0$, the price elasticity of housing supply must be infinite. Given the value of π_1 obtained by estimating the equation (4), and a range of assumptions about ε_p^d and ε_y^d, we can calculate the value of ε_p^s . Then the regression coefficient π_1 will be transformed into the price elasticity of supply ε_p^s (for given value of ε_p^d and ε_y^d).

Following the work by Malpezzi and Maclennan (2001), this study also applies the stock adjustment model

$$\ln Q_d = d\,(\ln K_t^* - \ln K_{t-1}), \quad (7)$$

where d is a parameter indicating the portion of the gap closed in period t and ranges from 0 to 1, and K_{t-1} is the actual stock in period $t-1$.

K^*, the equilibrium demand for housing stock, which is determined by

$$\ln K^* = \beta_0 + \beta_1 \ln P_t + \beta_2 \ln Y_t + \beta_3 \ln D_t. \quad (8)$$

Combining the equation (7) and (8) to solve for the housing price (P), which leads to the equation (9). The demand function is

$$\ln P_t = \pi_0 + \pi_1 \ln Y_t + \pi_2 \ln D_t + \pi_3 \ln K_{t-1} + \varepsilon, \quad (9)$$

hereby, the price elasticity of housing can be obtained from

$$\varepsilon_p^s = d\varepsilon_p^d + \frac{d\varepsilon_y^d}{\pi_1}. \quad (10)$$

Following Muth (1960) and Malpazzi and Maclennan (2001), we use 0.3 and 0.6 as an estimation of parameter d.

3.2. Housing Supply Determinants

The quantity of housing that developers provide is sensitive to price and cost, and depends also on available land for construction. Follain (1979) points out that the purchasing price of a new house essentially consists of two components, the price of the structure and the price of the land. Studies by Peng and Wheaton (1994) and Wang et al. (2012) suggest that there is a positive relationship between land supply and housing supply in Hong Kong and on the Chinese mainland cities. Moreover, the finding of Wang et al. (2009) indicates that an increase in land price has little influence on housing supply, while the land supply increase is an effective stimulator to housing supply. This study performs a cross-sectional regression, where housing construction is a dependent variable. The existing studies present two alternative measures for housing construction. One is the real value of residential construction, and the other is either starts or completions. This study measures housing output by new completions. By including dependent variables of housing price, housing stock, demographic characteristics and land variable, this study attempts to explore the determinants of housing supply elasticity using an improved measure of the housing stock and land regulations.

IV. ANALYSIS AND DISCUSSION

4.1. Data

Data for estimation come from the 35 Chinese cities in the period of 1999 to 2010. The total sample size is 420. The descriptive statistics for variables of empirical analysis are given in Table 3.

Table 3. Statistics of Housing Price and Independent Variables

Variable	Definition	Mean	Min.	Max.	Std. Dev	Obs.
P	Housing price (RMB/sq.m)	3,568.2	1,077.0	18,954.0	2,562.3	420
Y	Annual per capita disposable household income (RMB)	12,947.4	4,764.9	32,380.9	6,092.1	420
D	Non-agricultural population (10 000)	280.9	1.0	1,192.2	227.8	420
K	Housing stock (10 000 sq.m)	6,698.3	980.0	35,377.7	5,877.5	420

Q	Housing completion (10 000 sq.m)	526.7	19.9	3,380.1	522.0	420
LP	Land price(RMB/sq.m)	3,639.7	345.0	22,827.0	4,282.6	385
LS	Land purchased by developers in one year (10 000 sq.m)	397.0	2,092.5	13.9	358.0	385

Source: China Statistical Yearbook, 2010; China City Statistical Yearbook, 2000-2010; China land price information dynamic publishing platform.
Note: Data on land price and land supply are only available for 2000-2010.

Unlike the studies on developed countries, the data time period of this study is limited because the Chinese housing commercialization system was merely implemented in 1998. Especially, data on housing stock are only available for 1999. Using the data for 1999 as a benchmark, this study obtains its own time series of housing stock. In Kuang and Zhou (2010) and Wang et al. (2012) housing stock is estimated by per-capita floor area multiplied by the number of population. Alternatively, Chow and Niu (2010) use the indicator per capita floor area separately to measure housing stock. This study measures the movement of housing price using the average sales price of residential buildings. Household income is measured by per capita annual disposable income of urban households. The data mainly come from the Statistical Yearbook for each city. Data on population are the number of non-agricultural population. Most of the above data come from the China Statistical Yearbook released by the National Statistical Bureau of China (NBS). In addition, our study uses two instrumental measures of land regulation, land price and land space purchased by the developers. The data on land price are the land dynamic monitoring system data released by the Chinese land price information dynamic publishing platform.

4.2 Estimated Price Elasticity of Housing Supply

This study conducted regressions based on the equation (4) and (9), and obtained the estimated coefficients on income elasticity of demand, π_1. Hence, given the estimated of price elasticity of demand, ε_p^d, and the income elasticity of demand, ε_y^d, the implied price elasticity of housing supply can be finally obtained. Table 4 represents the regression results.

Table 4. Estimation Results for Income Elasticity of Housing Supply

Variable	Case 1	Case 2	Case 3	Case 4
log*Y*	1.061***	1.088***	0.900***	0.951***
	(0.026)	(0.057)	(0.038)	(0.077)
log *D*	0.024	0.006	-0.009	-0.007
	(0.033)	(0.031)	(0.035)	(0.032)
$\log K_{t-1}$			0.227***	0.209***
			(0.039)	(0.073)

AR(1)		0.765***		0.737***
		(0.032)		(0.037)
Constant	-2.056***	-2.232	-2.302	-2.650***
	(0.168)	(0.539)	(0.191)	(0.561)
R^2	0.79	0.947	0.805	0.922
DW	0.696	1.998	0.727	2.036
Observations	420	385	385	350

Note: The dependent variable is housing price in logarithm. Standard errors are in parenthesis.* indicates significant at 10% level, ** indicates significance at 5% level, and *** indicates significance at 1% level.

The dependent variable is housing price in natural logarithm, while the independent variables include household income, population and the lagged housing stock. The first two cases are the estimation for the flow model, while Case 3 and Case 4 describe the estimated results for the adjusted stock model. Further, Case 1 and Case 3 is the direct estimation for equation (4) and (9) respectively. Case 2 and Case 4 are adjusted for autocorrelation by including an item of AR (1). As demonstrated in Table 4, the estimated coefficient on household income is significantly greater than zero in all cases indicating a less perfectly elastic housing supply in China. On the other hand, the coefficient on demographic characteristics measured by the non-agricultural population is not significant in all cases. A correction for autocorrelation makes little difference in coefficients of household income. Similar to other studies, the stock-adjusted model yields a slightly lower elasticity compared to the flow model.

To estimate the price elasticity of housing supply, this study uses the estimates of these two parameters on ε_p^d and ε_y^d as summarized by Malpezzi and Mayo (1987) and Malpezzi and Maclennan (2001). Using these estimated parameters, this study calculates the implied price elasticity of supply with a combination of the estimates of income elasticity and price elasticity of demand. Some representative calculations are reported in Table 5.

Table 5. Price Elasticity of Housing Supply

ε_p^d : -0.1~-0.5 **ε_y^d : 0.5~1.0**	**Flow model** **(π_1 =1.088)**	**Stock-adjustment model** **(π_1 =0.951)**	
		d =0.3	**d =0.6**
ε_p^d =-0.5, ε_y^d =1.0	0.419	0.126	0.251
ε_p^d =-0.1, ε_y^d =1.0	0.819	0.246	0.491
ε_p^d =-0.5, ε_y^d =0.5	-0.004	-0.001	-0.002

ε_p^d =-0.1, ε_y^d =0.5	0.360	0.108	0.216
Malpezzi and Maclennan (2001)	US: 4.4~12.7 UK: 0.0~4.3	US: 1.2~2.8 UK: 0.0~0.3	US: 2.4~5.6 UK: 0.0~0.5

Note: ε_p^d is the price elasticity of demand; ε_y^d is the income elasticity of demand. The price elasticity of housing supply can be calculated by

$$\varepsilon_p^s = d\left(\varepsilon_p^d + \frac{\varepsilon_y^d}{\pi_1}\right).$$

As noted in Table 5, the implied price elasticity of supply, based on the estimated results of the flow, models fall in an interval between -0.004 to 0.819. In contrast, the stock adjustment elasticity is much lower ranging from -0.002 to 0.491. The similar approach was used in Malpezzi and Maclennan (2001), Mayo and Sheppard (1996). The former research chooses the value between -0.2 and -0.5 for price elasticity and the value between 0.5 and 1.0 for income elasticity. The latter one chooses the value between -0.1 and -0.5 for income elasticity and the same range as the former for price elasticity. Similarly, this study chooses the estimated price elasticity of demand between -0.1 and 0.5, so that the estimated income elasticity of demand is between 0.5 and 1.0. Moreover, the baseline of the adjustment parameters is 0.3 and 0.6. However, as Malpezzi and Maclennan (2001) argued, the estimated elasticity of housing supply we obtained is only a range.

Other studies obtained similar magnitude of housing supply elasticity represented by Chow and Niu (2010) and Fu et al. (2011). Using the yearly national data of China, the former one obtained a price elasticity of supply of 0.831, although their focus is on the demand elasticity. The latter calculates an elasticity of housing supply in cities of China varying from 0.62 to 1.46. In contrast, Wang et al. (2012) obtained an average elasticity ranging from 2.82 to 5.64, which is larger than our study and other studies. Their estimated housing supply elasticity was derived from the average estimated housing supply of the 35 cities. In general, most of the studies on the housing supply in China obtained a lower elasticity of supply.

4.3. The Alternative Determinants of Housing Supply

This study further conducts regressions on housing construction Q . As an independent variable, Q is measured by housing completions in the corresponding year. Independent variables include housing price (P), lagged housing stock (K_{-1}), land price (LP), and land supply (LS). The regression result is as follow:

$$\log(Q) = -4.175 + 0.100\log(P) - 0.271\log(LP) + 0.241\log(LS) - 2.075\log(K(-1))$$

S.E. = (0.374) (0.056) (0.071) (0.022) (0.295)

Number of observations = 385, R^2 =0.821

This study obtained expected coefficients. The estimated coefficients on land price are significantly negative indicating that an increase in land price will enormously decrease the housing output. Meanwhile, an increase in land supplies associates with an increase in housing output. In addition, a significantly positive relationship between housing output and housing price was found using housing completions as a dependent variable. The result can be treated as evidence to reject the Muth-Follain test, which means that housing supply in China is less elastic. Although an ignorance of other inputs such as capital cost and labor cost may slightly reduce the explanatory power, our specification can explain about 80 percent of the variation in housing output. Overall, the results are supportive of the importance of land-use regulations in affecting housing outputs.

V. CONCLUSION

This study conducted regressions on new housing constructions using cross-sectional data for 35 cities during the period 1999-2010. The estimated results of both the flow model and the stock adjustment model are represented. The estimated results based on the flow model suggest that the elasticity of housing supply ranges from -0.004 to 0.819. But the stock adjustment model yielded a lower elasticity varying from -0.002 to 0.491. These findings reveal that housing supply in China is less elastic compared to developed countries. The lower estimated housing supply elasticity implies that developers in China cannot respond quickly by releasing more houses to a shock from the demand side. Moreover, the results of this study confirmed that land-use regulation has a significant effect on housing supply. Housing supply elasticity in China is not only determined by the housing price, but also influenced by land-use regulations as well as the lagged housing stock.

However, there are still several researchers, who argue that supply conditions of housing may vary from place to place even in the same country. Future work is required to investigate the housing supply variations across regions in China.

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