Study on the Impact of Housing Price on the Heterogeneous Labor Force

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Abstract: The talents have become a key engine to promote the economic development in the new economic era. The 20th National Congress of the Communist Party of China also pointed out that China should rely on talents to build a strong country. Regarding talent attraction and aggregation in cities, housing price is an important factor. In order to study the impacts of housing price, from the heterogeneous labor perspective, this paper uses data of National 1% Population Sampling Survey 2005-2015, and the National Census 2010 for empirical analysis, discussing the relationship between housing price and the heterogeneity of the labor force. The study finds that: (1) The housing price does not reduce skilled and labor force accumulation; (2) The housing price has an inverted U-shaped relationship with skilled labor and ordinary labor. When the housing price exceeds a certain critical value, the uncertainty brought by the rising housing price and the pressure of rising cost play a dominant role and hinder the accumulation of the two types of labor; (3) Compared with small and medium-sized cities, the impact of rising housing price in big cities on the accumulation of the labor force is still significant, and the impact on the ordinary labor force is more obvious. The conclusion of this paper is of great significance to the implementation of the talent country and the proper strategies to deal with the relationship between housing price and labor force in the new era.

Keywords: Housing Price, Skilled Labour Force, General Labour Force Accumulation

1. Introduction

The continued rise of housing price has raised social concerns about its impact on talent mobility. The report of the 20th National Congress pointed out that more active, open and effective talent policies should be implemented, emphasizing the reliance on talents to strengthen the country's development. Local governments have also attached great importance to the introduction of talent and have used specific policies to attract talents, including the provision of talent housing with preferential policies, in effect hoping to attract talents by reducing their housing consumption burden. The reform of urban housing system of commercialization, marketization and socialization has greatly promoted urban housing construction and fundamentally ensured the continuous improvement of urban residents' housing level, but at the same time, there has been a long-term significant increase in housing price. The nominal sales price of residential commercial housing nationwide was 2,092 yuan/m^2 in 2002, rising to 2,937 yuan/m^2 in 2005 and increasing to 9,980 yuan/m^2 in 2020, the average annual rate of increase in housing price reaching over 9%. The housing price of central cities (Beijing, Shanghai, Guangzhou and Shenzhen) rose much more than non-central cities. In 2002, residential commodity house nominal sales price of the four central cities were 4467 yuan / m^2, 4007 yuan / m^2, 3995 yuan / m^2, 5267 yuan / m^2, reaching 42684 yuan /m^2, 36741 yuan / m^2, 27112 yuan/m^2, 56844 yuan/m^2 in 2020, the average annual rising more than 10%. Housing consumption expenditure is an important part in consumer spending, and the rise in housing price will cause the growth of housing consumption expenditure, so some people believe that the rise in housing price in a city will result in a "drive away talent" effect.

The existing literature concentrates on the relationships between housing price and human capital, and little research notices the relationships between housing price and heterogeneous labor. In order the fill the research gap, in this paper, we try to answer the research questions: (1)What is the impact of rising housing price on talent accumulation?(2)What are the effects on different types of labor? In this paper, according to their education levels, we divide the labor force into the skilled labor force and ordinary labor force and respectively discuss the impacts of housing price on them.

This paper is innovative and significant in terms of its originality of modelling and constructing the housing price, the ordinary labor force and the skilled labor force   from the perspective of labor supply and demand, and the inner logic of housing price on heterogeneous labor mobility decisions is clarified. The practical contributions can be made through the in-depth analysis on the effects of housing price and the policy suggestions for the realization of the development strategy of a strong talent country and a strong talent province.

The remainder of the paper is structured as follows: the second section compares the relevant research literature on the effect of housing price on labor mobility; the third describes the mechanism of the effect of housing price on labor mobility; the fourth introduces the model setting and data sources; the fifth empirically tests the effects of housing price on heterogeneous labor accumulation and explains the reasons; the final section puts forward relevant policy reflections.

2. Literature Review

Since the new economic geography theory was proposed, many scholars have started to pay attention to the labor mobility issue, and there is an increasing amount of literature studying the factors influencing labor mobility. Some scholars believe that economic factors significantly affect the labor mobility. Fu (2017) argues that the location choice of labor mobility is a complex issue, and rural labor mobility is more influenced by the macroeconomic and social environment such as village environment, local economic development level and the proportion of non-agricultural industries in the location choice[1]. With the lens of income difference between urban and rural areas, Liu and Feng (2014) find that the income of urban residents in the moving-in area is an important reason to attract population inflow, and the income of the moving-out area, science and technology and culture level and rural income in the place of migration are negatively related to the rate of migration[2]. Similarly, Pissarides (1990) argues that there is a strong correlation between labor mobility and wages and unemployment rate, and he believes that labor mobility is mostly in pursuit of higher wages and more employment opportunities[3]. In addition, some scholars have also argued that with economic development and residents' living standards improvement, non-economic factors, such as public service, taxes, education and etc., have gradually become to affect labor mobility decisions. Dahlberg et al. (2012) using micro data from Sweden showed that public services and taxes are important factors influencing labor mobility decisions[4]. Xia and Lu (2015) show that labor mobility is influenced by wage levels and employment rates, but also find the important role of public services such as basic education and medical services[5]. Li Chao et al. (2018) specifically point out that education has an important influence on labor force mobility decisions, and that the introduction of balanced policies for the education of accompanying children will attract more labor force inflows, and that the stronger the reform, the lower the threshold requirements for accompanying children to enroll in school, and the less restrictive the conditions for further education, the more attractive it will be to the labor force [6].

On the other hand, the continuously rising housing price has an impact on the national economy and people's life (Color and Zhu, 2013)[7]. At the macro level, existing studies have focused on the effects of housing price on industrial structure, resource allocation, and economic growth (Han and Lu, 2017; Chen et al., 2015; Binkai, et al., 2015)[8][9][10]. On the micro side, a large number of studies have discussed the wealth effects and the house slave effect caused by the increase of housing price (Color, 2013)[11]. Some scholars have studied the effect of housing price on labor mobility. Helpman (1998) points out that excessive housing price reduces the relative utility of workers, thus inhibiting labor concentration[12]. Murphy et al. (2006) argue that high housing price can discourage labor inflow, to some extent, but expected housing capital gains and income growth can offset this impact[13]; According to an empirical analysis of 35 large and medium-sized cities in China , Gao, Bo et al. (2012) use a dynamic panel data from 2000 to 2009 and argue that regional differences of housing price lead to labor mobility and induces industrial shifts. The empirical results suggest that the relative increase in housing price among cities leads to a decrease in the relative employment and induces the industrial value chain to climb up to the higher end. That also promotes industrial upgrading, and indicates that regional differences of housing price are an important factor in industrial transfer and industrial upgrading in the east, central and western regions[14].

There are various factors affecting labor mobility, but it is a complex issue when scholars try to investigate which kind of impact of housing price takes place in labor mobility. On one hand, housing price affects labor mobility not only from the consumption side, but also from the investment side, and by nature, the two aspects may or may not be consistent; for another, the impact of housing price on different types of labor mobility may be different, because different types of labor mobility may be

equally or differently sensitive to economic versus non-economic factors and different economic and non-economic factors. Therefore, it is arbitrary to assert that high housing price will lead to brain drain or attract talent. This paper uses a theoretical model from the perspective of heterogeneous labor force to reveal the inner logic of housing price affecting labor force structure and empirically analyzes the relationship between the two based on national census data.

3. Methodology

3.1 Settings

3.1.1 Labor supply

Foollowing Moretti (2011)[15] , assume that firms within city v produce only a single product y and set its price to 1. There are two types of labor within the city, the skilled labor force and ordinary labor force, and both types of labor and firms are free to move. Assuming that the labor market is perfectly competitive and that each labor force provides units of labor, the labor supply then depends only on its residence decision, and the indirect utility function of g labor in city v can be expressed as:

$$U_g^v = w_g^v - x^v + A^v + e_{ig}^v \quad v \in \{1,2\} \quad g \in \{h,n\} \tag{1}$$

w_g^v is the wage of g labor in city v, h is the skilled labor force, n is the ordinary labor force; x^v is the cost of living; A^v measures the comfort level of the city; e_{ig}^v measures the stickiness of city v to the labor force, when given the wage and comfort level, a larger e_{ig}^v indicates that the location of city v is more adsorptive to the labor force. It has been shown that the costs involved in switching workplaces, such as transaction costs, search costs, psychological costs, and sunk costs, will increase the adsorption of cities to the labor force[16][17] . Assuming that the preference of labor force i for city 1 is greater than that of city 2 satisfying:

$$e_{ig}^1 - e_{ig}^2 \sim U[-\lambda, \lambda] \quad g \in \{h,n\} \tag{2}$$

The parameter λ characterizes the labor force's particular preference for city location. Larger λ indicates that the labor force places more importance on the location of the city and that wages and urban comfort have limited appeal to the labor force.

Assume that the number of skilled and ordinary labor force in the city is h^v and n^v, the total population of city v is N^v which satisfies the following conditions:

$$N_h = h^1 + h^2 \tag{3}$$

$$N_n = n^1 + n^2 \tag{4}$$

$$N^v = h^v + n^v \tag{5}$$

For simple analysis, we assume that the quantity of total labor force in city v and the quantity of both types of the labor force are fixed, which means the two types of labor markets are independent and separate from each other.

From our simplified model, it is clear that the labor force's residential decision is influenced by a combination of wages, costs of living, urban comfort and location preferences. Labor l chooses city 1 if and only if $e_{ig}^1 - e_{ig}^2 > (w_g^2 - w_g^1) + (x^1 - x^2) + (A^2 - A^1)$, further solving, the supply equation of the two types of the labor force in equilibrium is as follows:

$$w_g^1 - w_g^2 = (x^1 - x^2) + (A^2 - A^1) + \frac{\lambda}{N_g}(g^1 - g^2) \tag{6}$$

The costs of living of the labor force depend on housing expenses, transportation costs, congestion, consumer spending, and other elements [18]. In reality, housing costs have become a major component of the cost of living for the labor force. We approximate the living cost as consisting mainly of two

types of costs, housing costs and other consumption costs. Assuming that the consumption cost depends on the quantity of the population and is positively correlated with it, therefore, the living cost has the following linear functional form:

$$x^v = j^v + f^v hp^v + m^v N^v \qquad\qquad m > 0 \quad f > 0 \qquad (7)$$

In addition, to simplify the analysis, it is assumed that the initial conditions are the same for both types of cities.

3.1.2. Labor demand

The production function for firms in the city is Cobb–Douglas with constant returns to scale, so that:

$$InY = \alpha InK + (1-\alpha)InL \qquad (8)$$

Where K is capital, L is labor, and α is the output elasticity. It is assumed that the housing price is a simple linear function of capital K, $K = \gamma_0 + \gamma_1 hp$. Based on the previous assumption that the market is perfectly competitive, it follows that firms are price takers and labor is paid for the marginal product so that the labor demand in city v can be written as:

$$w_g^v = \gamma_g + \beta_g hp^v - \beta_g g^v \quad v \in \{1,2\} \ \ g \in \{h, n\} \qquad (9)$$

The ability of skilled labor force to demand wage increases is higher than that of ordinary labor force, which means $\beta_h > \beta_n$.

3.2. The impact of housing price on a heterogeneous workforce

The housing decision of heterogeneous labor force should be different due to rising housing price. Equilibrium will be reached when labor g obtains the same level of utility in both cities, at this time, according to the model, the relationship between the two types of labor quantity in city 2 at equilibrium can be obtained as follows:

3.2.1. Skilled labor force

Where C is a constant greater than zero, and from equation (10), it is clear that the metric is greater than 0 overall. It indicates that rising housing price does not hinder the accumulation of skilled labor force, but rather facilitate the accumulation of the skilled labor force. This conclusion is consistent with the reality that cities with high housing price tend to be cities with a high concentration of talents, as well as cities with high development speed and high development level. Combined with equation (10), we analyze the reasons as follwos: first, although rising housing price increases the burden of home ownership, they are also a signal of urban development, signaling that premium returns (material rewards and economic opportunities) will be generated; second, cities with higher housing price are also cities with faster and higher levels of development, and these cities, in addition to bringing higher economic returns, can also provide irreplaceable resources, such as high-quality public infrastructure and human environment, and a highly educated labor force possesses a higher pursuit of urban comforts [19]; third, cities with higher housing price also have higher migration costs, which are sufficient to compensate for the losses caused by the increased cost of home ownership.

3.2.2. General labor force

$$\frac{\partial n^2}{\partial hp^2} = [\{-f^2(\beta_h - \beta_n) + \beta_h[2\beta_h\beta_n + (\beta_n - \beta_h)(m^1 + m^2) + \frac{2\lambda\beta_n}{N_h}]\}/C] > < 0 \qquad (10)$$

From equation (11), the positive and negative signs of the equation cannot be determined, that is, the change in the number of general labor force due to the increase in housing price is uncertain. From equation (11), the positive and negative signs of the equation cannot be determined, that is, the change in the number of general labor force due to the increase in housing price is uncertain, depending on the "pull" of the expected premium gain from the increase in housing price compared with the "resistance" from the increase in the costs of living, and therefore it needs to be further demonstrated empirically.

3.3. Model

To test the effects of housing price on the skilled and ordinary labor force, the empirical model is

designed as follows:

$$Inskill_{it} = \alpha + \varphi_1 hp_{it} + \varphi_2 X_{it} + \varphi_3 P_{it} + v_i + w_t + \varepsilon_{it} \qquad (11)$$

$$Innormal_{it} = \alpha + \varphi_1 hp_{it} + \varphi_2 X_{it} + \varphi_3 P_{it} + v_i + w_t + \varepsilon_{it} \qquad (12)$$

Models (12) and (13) are used to test the effects of housing price on the skilled labor force and the ordinary labor force, respectively. i and t denote city and year, respectively, v_i and w_t denote city fixed effects and year fixed effects, and ε_{it} denotes the random disturbance term. The explanatory variable $skill_{it}$ and $normal_{it}$ denote the number of the skilled labor force and the number of the ordinary labor force in the city, respectively, and in line with numerous scholars[20][21] , we define labor force with college education and above as skilled labor force and workers with less than college education as ordinary labor force.

The explanatory variable denotes the housing price of a city, which is expressed as relative housing price following Gao, Bo et al. (2012)[22]. Relative housing price = housing price in a given city/average housing price in the rest of the sample cities, and housing price in a given city = residential commercial housing sales in that city/residential commercial housing sales area. The best way to measure housing price is to use the weighted average price of commodity housing price and secondary housing price, but because of the lack of statistics on secondary housing price, and the fact that the trends of commodity housing price and secondary housing price are basically the same, we choose to measure housing price by commodity housing price. The commodity housing price is calculated by dividing the sales of commodity housing by the sales area of commodity housing.

Table 1: Descriptive statistics of the main variables

variable	Mean	SD	Min	Max
Number of skilled labor force (10,000)	8.06	1.45	4.99	12.77
Number of ordinary labor force (10,000)	9.34	1.46	6.12	13.32
Housing price	1.08	0.74	0.37	7.66
GDP per capita (yuan)	10.26	0.72	8.46	12.24
Industry structure	0.85	0.43	0.13	4.03
Number of household registration population (million)	5.91	0.67	3.76	8.12
Fixed asset investment (million yuan)	15.73	1.09	12.59	18.85
Medical (pcs/million)	0.02	0.02	0.00	0.12
Education (pcs/million)	38.43	16.97	8.14	136.99
Recreation (books, pieces / 10,000 people)	53.00	79.24	2.10	924.57
Unemployment rate (%)	99.78	0.0017	97.76	99.99
Whether provincial capital (yes=1, no=0)	0.11	0.32	1	0
Whether eastern region (yes=1, no=0)	0.40	0.49	1	0

X_i represents the city characteristics variables, including economic and non-economic factors. Among them, the economic factors mainly include: (1) Level of economic development. The level of economic development is the most important factor in attracting the labor force, which is measured by using the logarithm of per capita gross regional product of cities. (2) Industrial structure. We use the ratio of the output value of the tertiary industry to the output value of the secondary industry. The secondary industry and tertiary industry have different employment absorption capacity, and different industrial structures have different effects on labor flow. (3) Economic agglomeration level. We use the logarithm of the number of household population at the end of the year. Economic agglomeration can bring scale effect and spillover effect. The higher the agglomeration level of a city, the stronger the agglomeration effect is, and the more it can improve the utility of labor force through learning, sharing, matching and other channels directly or indirectly. (4) Investment in fixed assets. We use the logarithm of total social fixed asset investment to express. Investment growth will promote economic growth, which will increase the demand for labor force. The higher the amount of fixed asset investment means the relatively larger the scale of investment, the larger the scale of labor demand will be. (5)

Unemployment rate. This paper uses the proportion of the number of registered unemployed persons in urban areas at the end of the year to the number of employed persons in units at the end of the year. Non-economic factors mainly include: (1) Basic education. In this paper, the number of schools of higher education per 10,000 people is used. (2) Basic medical care. The number of hospital and health center beds per 10,000 people is used. (3) Recreation. The number of books (volumes and pieces) in public libraries per 100 people is chosen to represent urban entertainment. Table 1 reports the descriptive statistics of the main variables in this paper.

3.4. Data source

The labor force data used in this paper are obtained from National 1% Population Sample Survey 2005-2015 and National Census 2010, the skilled labor force and ordinary labor force variables are constructed based on the education level of the employed population in the population survey data; relevant data about housing price are obtained from the EPS database, and other city-level data are obtained from the China City Statistical Yearbook.

4. Regression result

4.1. Basic regression results

Table 2: Basic regression results

	(1)	(2)	(3)	(4)	(5)	(6)
	skilled labor force			ordinary labor force		
Housing price	0.7595***	1.0592***	0.2919***	0.6575***	0.7981***	0.2857***
	(10.7389)	(19.0170)	(5.1101)	(9.0532)	(14.3522)	(4.0191)
GDP per capita			0.4218***			0.2737**
			(4.7055)			(2.4736)
Industry structure			0.1385*			-0.1517*
			(1.9587)			(-1.7196)
Population size			0.7411***			0.7622***
			(10.7188)			(8.9286)
Fixed Asset Investment			0.1441**			0.0827
			(2.1946)			(1.0207)
Education			5.7668***			0.4948
			(4.2836)			(0.2949)
Medical			0.0224***			0.0196***
			(9.4420)			(6.6818)
Recreation			-0.0001			0.0002
			(-0.2045)			(0.2846)
Unemployment rate			32.7869**			9.3753
			(2.4422)			(0.5576)
Intercept	7.2270***	5.8634***	-37.5689***	8.5894***	7.3899***	-10.1378
	(78.9147)	(12.1008)	(-2.8093)	(91.6621)	(15.2328)	(-0.6054)
Provincial Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	Yes	Yes	No	Yes	Yes
N	677	677	654	687	687	664
Adj.R^2	0.1447	0.7495	0.9038	0.1056	0.7523	0.8535

*< 0.1; **< 0.05; ***< 0.0

Based on model (12) that tests the effect of housing price on skilled labor force, Table 2 reports the results of the basic tests. The first three columns of which are regression results. Column (1) shows the results of the OLS regression with only the core variable of the housing price. The regression coefficient of housing price, which is our concern, is positive and passes the statistical test of significance level of 1%, which is consistent with the expectation of the theoretical model, indicating that housing price is positively related to the number of the skilled labor force. In other words, high housing price does not prevent the accumulation of the skilled labor force, and the signal from the

increase of housing price generates more pull than resistance to the skilled labor force. Column (2) is the estimated results of controlling for the province effect and year effect based on column (1), and column (3) is the regression result of further controlling for other control variables, showing that the regression result is unchanged and the regression coefficient of housing price is significantly positive. The latter three columns in the table show the regression results of the effect of housing price on the ordinary labor force based on the test of the model (13). Column (4) shows the OLS regression results with only housing price included, column (5) shows the estimated results controlling for the province effect and year effect based on column (4), and column (6) shows the regression results further controlling for other control variables. The regression results show that the regression coefficients of housing price are all significantly positive, indicating that among the ordinary labor force, the increase of inhalation and stickiness effects of housing price is greater than the crowding-out effects. Comparing column (3) and column (6) of Table 2, it can be found that the positive effect of rising housing price on the accumulation of skilled labor force is greater than that of general labor force.

4.2 Robustness check

4.2.1 Test for replacement variables

Table 3: Robustness tests

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Substitution of explanatory variables				Substitution of explanatory variables			
	skilled	ordinary	skilled	normal	skilled	normal	skilled	normal
Housing price	0.2466***	0.2234***	0.7223***	0.5463***	0.3278***	0.2768***	0.2943***	0.2896***
	(3.8235)	(2.6539)	(5.2381)	(3.1507)	(5.4417)	(4.0494)	(5.1408)	(4.1257)
Intercept	-35.9649***	-9.2544	-39.4415***	-11.0969	-42.4182***	-12.6561	-35.4409***	-5.3226
	(-2.6651)	(-0.5227)	(-2.9501)	(-0.6589)	(-3.0081)	(-0.7863)	(-2.6445)	(-0.3238)
Control variables	control	control	control	control	control	control	control	control
Provincial Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	667	677	654	664	654	664	654	668
Adj.R^2	0.9003	0.8349	0.9040	0.8520	0.9054	0.8619	0.9041	0.8563

*< 0.1; **< 0.05; ***< 0.0

Replace the explanatory variables: (1) In the previous section, we used commodity residential sales price to construct a relative housing price indicator to measure the level of housing price, and here we used commodity housing sales price to reconstruct the relative housing price indicator. (2) The relative housing price is directly replaced by the sales price of commodity houses. The first four columns of Table 3 show the estimation results, and it can be seen that after replacing the indicators, the regression results are basically consistent with the baseline regression results, and the regression coefficients of housing price are all significantly positive at the 1% level, which further proves the robustness of the regression results.

Replacing the explanatory variables: (1) In this paper, the labor force with a college education and above is defined as skilled labor force in the benchmark regression, and in this part, we defined the skilled labor force as college undergraduate and above, otherwise as normal labor force. (2) Drawing on some classical literature, the average years of education is used to measure the structure of the labor force. According to Xing et al. (2013)[23] , we assign years of education to each education level, where the corresponding years of education for different education levels of no school, elementary school, junior high school, high school, college specialist, college undergraduate and graduate are 0, 6, 9, 12, 15, 16 and 19 years, respectively. The size of the skilled labor force and the ordinary labor force are obtained by multiplying the share of employed persons with different levels of education by the corresponding average years of education and accumulating them. The last four columns of Table 3 show the specific test results, from which it can be seen that the increase in housing price promotes the accumulation of skilled and normal labor force, which is consistent with the results of the basic regression.

4.2.2. Endogeneity test

Thirdly, on one hand, housing price affects labor force accumulation, while labor force also pushes up housing price by increasing housing demand, thus causing a two-way causal relationship between labor force and housing price; on the other hand, the random error term may contain factors such as institutional and cultural aspects that affect both labor force accumulation and housing price, thus creating the omitted variable problem. In order to solve the endogeneity problem caused by the above

factors, we select lagged one-period housing price as the instrumental variable and use the 2SLS method for regression analysis. There are two reasons for choosing lagged one-period housing price as the instrumental variable: first, due to the stickiness of price, there is a strong correlation between lagged one-period housing price and current housing price; second, lagged one-period housing price does not directly affect labor force accumulation in the current period. Table 4 reports the estimation results, the signs and significance of the estimated coefficients of the main explanatory variables are not significantly different from the basic regression result.   The regression results of the instrumental variables indicate that the basic regression results are very robust.

Table 4: Instrumental variable regression results

	(1)	(2)
	skilled labor force	**normal labor force**
Housing price	0.4233***	0.4475***
	(4.2026)	(3.3747)
Intercept	-43.8090***	-16.8811
	(-3.0805)	(-0.8957)
Control variables	control	control
Provincial Effect	Yes	Yes
Time Effect	Yes	Yes
N	563	566
Adj.R^2	0.9035	0.8513

*< 0.1; **< 0.05; ***< 0.0

4.3. Scalability Analysis

4.3.1. Consider the inverted U-shaped effect of housing price on heterogeneous labor force

Table 5: Non-linear relationship test

	(1)	(2)
	skilled labor force	**normal labor force**
Housing price	0.5779***	0.5010***
	(4.4089)	(3.0754)
House price square item	-0.0479**	-0.0362
	(-2.4220)	(-1.4683)
Intercept	-37.8911***	-10.6412
	(-2.8445)	(-0.6359)
Control variables	control	control
Provincial Effect	Yes	Yes
Time Effect	Yes	Yes
N	654	664
Adj.R^2	0.9046	0.8537

*< 0.1; **< 0.05; ***< 0.0

It has been shown that housing price and labor mobility have an inverted U-shaped relationship. When housing price is low, housing price rises and labor flows in, but after housing price reaches a certain level (the inflection point), the rising costs of living and increased expectations of uncertainty about future earnings caused by continued increasing housing price will discourage labor force accumulation. We introduce the quadratic term of housing price into the regression equation to test whether there is a nonlinear relationship between housing price and the skilled and ordinary labor force. The regression results are shown in Table 5. The results indicate that there is a significant inverted U-shaped relationship between housing price and skilled labor force, and within a certain range, rising housing price positively promotes the accumulation of skilled labor force, which means before the inflection point, the combined gains gained by skilled labor force in the city are greater than the economic losses from rising housing price, but when housing price continues to rise beyond the inflection point, the excessive cost of living makes housing price more of a drag on the labor force than a pull, a finding that is also consistent with reality.

For the normal labor force, the quadratic coefficient of housing price is not significant and does not

show a significant nonlinear relationship, which probably caused by their renting forms including collective dormitory provided by enterprises, peasant houses in village-in-city and group-oriented leasing. Different from buying houses, the normal labor force chooses lower costs housing and then their solutions to housing problems offsets the effects of the increase of housing price. In addition, the household registration system in big cities and the bundled policy of enrollment qualification also weaken the ability of the normal labor force to purchase houses, which makes the correlation between the normal labor force and house purchase even lower.

4.3.2. Heterogeneity of the city

The impact of housing price on labor mobility decisions can be influenced by city heterogeneity. Different cities have different development spaces and growth cycles. In ordinary, the larger the city, the larger the development space and platform; conversely, the smaller the city, the smaller the development space and platform. In this paper, we categorize provincial capitals and municipalities directly under the central government as the group of large cities and other cities as the group of small and medium cities, and regress separately. The regression results are shown in Table 6. Columns (1) and (2) of Table 6 show the regression results for the small and medium-sized cities group. Comparing the regression results in columns (1) and (2) of Table 6, it can be seen that the estimated coefficients of the core explanatory variables, housing price, are both positive at the 1% level of significance, indicating that in small and medium-sized cities, the increase in housing price promotes the accumulation of both skilled and normal labor force, and the increase in housing price promotes the accumulation of skilled labor force more than normal labor force. Columns (3) and (4) of Table 6 show the regression results for the large city group. The regression results show that neither of the estimated coefficients of housing price is significant, implying that rising housing price has little effect on the accumulation of skilled labor force and normal labor force. It maybe that housing price in large cities is at a higher level, and both skilled and normal labor force are normally more sensitive to changes of housing price. Compared with small and medium-sized cities, the push of housing price increases on labor is larger enough to offset the pull, which in turn shows that housing price increases have no effect on the accumulation of both types of labor, and the smaller regression coefficients corroborate this, while the regression coefficients in column (3) is significantly larger than that of column (4), indicating that the thrust caused by rising housing price is greater for the normal labor force. Certainly, the insignificance of the regression coefficients may also be caused by the small number of provincial capitals and municipalities directly under the central government and the small sample size.

5. Conclusions and Policy Recommendations

This paper examines the relationship between housing price and heterogeneous labor force accumulation using data of 2005 and 2015 National 1% Population Sample Survey and 2010 National Population Census, as well as the China Urban Statistical Yearbook. The theoretical model suggests that rising housing price increases the costs of living for labor force on the one hand, and rising housing price also as a signal of urban development, potential of stable and higher returns to physical capital. In addition, urban comfort, urban stickiness, are also the pull generated by the rise in housing prices. Since the skilled labor force has higher wages bargaining power, which means higher returns to physical capital, and urban non-economic factors are more sticky to it. Rising housing price promotes an increase in the size of skilled labor force and result in uncertainty about the size of the normal labor. The empirical results show that rising housing price promotes the accumulation of both skilled and normal labor force sizes, and that rising housing price contributes more to the accumulation of skilled labor force compared to the normal labor force. This relationship holds even when the measurement is changed, and endogeneity is also taken into account. Besides, housing price has an inverted U-shaped relationship with skilled labor force and normal labor force. When housing price is below the inflection point, the pull of rising housing price on both types of labor is greater than the push, and when housing price exceeds a certain threshold, the uncertainty and upward cost pressure brought by rising housing price dominate, which is not conducive to the accumulation of both types of labor force. Also, in small cities, rising housing price will promote the accumulation of both types of labor, while in large cities, the thrust of rising housing price on the labor force is larger enough to offset the pull, and it causes more thrust on the normal labor force.

Based on the findings of this paper, the following policy recommendations are put forward: First, based on the findings of this paper, the rise in housing price will promote accumulation of skilled labor force and normal labor force. The promotion of the accumulation of skilled labor force is much greater than that of normal labor force, so government departments need to avoid the change of labor supply

structure caused by the rise in housing price when regulating housing price, which will affect the operation of cities. Government should further improve urban infrastructure construction and urban quality, optimize urban environment and increase the happiness index of labor. A good working and living environment for labor force is necessary and urgent. Secondly, for small and medium-sized cities, it is necessary to strengthen the information disclosure system of the real estate market, which can help to disclose relevant information in a timely manner, to correctly guide market expectations and investors' emotions, to avoid the false prosperity of real estate market caused by false information, and to prevent small and medium-sized cities from further aggravating the real estate bubble. Third, the government should actively adjust the industrial structure, accelerate the transformation and upgrading of the industrial structure, reasonably absorb the labor supply, and provide sufficient job market for the labor force, especially in big cities, through optimizing the industrial structure, especially to provide sufficient development platform for the skilled labor force. Fourth, according to the needs of urban development, the housing supply system should be further imrpoved, and a multi-level housing security system should also be built. The proportion of low-cost housing, public housing, rent-protected housing and shared property rights housing should be reasonably allocated to maximize the housing rights of the labor force, and government departments can appropriately cooperate with housing subsidies, tax concessions and other means.

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