Is It A Compensation? The Causal Effect of Housing Prices on Wages

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Outline

Research Question

Will companies in cities that face **higher housing prices** pay their worker more salaries as **compensation**?

- The causal impact of housing prices on workers' wages
- From the perspective of companies

Outline

Main Variables of Interest

- Housing prices
  - Source: CEIC database
  - City-year-level, covering 284 cities and ranging from 2011 to 2013
- Wages
  - The database of China's industrial enterprises
  - Wages is the average wage paid by the company

$$\text{Average Wage} = \frac{\text{Employee Compensation Payable}}{\text{Number of Employees}}$$

  - Firm-year-level, covering 339701 firms, 284 cities and ranging from 2011 to 2013
  - First winsoring: $< 1\%$, $> 97\%$

Company Controls

Firm-year-level, covering 339701 firms, 284 cities and ranging from 2011 to 2013.

- Company Controls
  - Variables: Firms' total assets, total debt, operating income, operating cost as well as operating revenue
  - Source: The database of China's industrial enterprises

Cities Characteristics

City-year-level, covering 284 cities and ranging from 2011 to 2013.

- Cities' Features
  - **Nighttime light**: a proxy for local economic development
    - Source: Defense Meteorological Satellite Progam, DMSP
    - Measurement: the weighted average of each city
  - **College**: cities with more educated people may have higher wages due to the high skills while it also tends to correlate with housing prices, thus a potential confounder.[1]
  - **Industry Structure**: People has a stereotype that the service industry has higher wage compared to the manufacturing industry, thus a potential confounder.[1]

[1] Source of College & Industry Structure: CEIC database

Instrument Variables Setting

City-year-level, covering 284 cities and ranging from 2011 to 2013.

- **Land: construction land supply**
  - Source: CEIC database
  - Measurement: use the lag term of log land construction land supply of each city

Summary Statistics

Variable	N	Mean	SD	Min	Max	Label
year	876183	2012.04	0.82	2011	2013	
TotalWage	874180	13755.71	1.31e+05	-2.07e+04	2.41e+07	Total Wage Paid to Workers
TotalWorkers	846949	371.50	1264.99	0.00	2.23e+05	
hp	873681	51689.68	59568.18	168.68	3.53e+05	housing prices
			Company Controls			
TotalAsset	876023	2.30e+05	2.78e+06	-1.16e+05	9.50e+08	
TotalDebt	873345	1.34e+05	1.67e+06	-4.59e+06	5.63e+08	
ComIncome	876026	2.89e+05	2.32e+06	0.00	5.15e+08	Operating Income
ComCost	875980	2.45e+05	1.98e+06	-324.00	4.08e+08	Operating Cost
ComRev	873217	20116.38	3.05e+05	-9.57e+06	9.36e+07	Operating Revenue
			City Features			
nlc	8855070	4.27	5.17	0.01	22.61	Night Light, City Level
college	854001	15.08	19.85	1.00	91.00	Number of College
second	864767	195.58	162.90	3.62	695.31	
third	864767	187.04	229.72	3.84	1680.65	

Outline

Baseline Regression

$$lnw_{ict} = \beta_0 + \beta_1 lnhp_{ct} + \gamma X_c + \upsilon \Gamma_i + \omega_i + \delta_t + \epsilon_{ict} \quad (1)$$

- lnw_{ict}: the logarithm of average wages for company i, city c in year t
- $lnhp_{ct}$: the logarithm of housing prices
- X_c: a rich set of control variables for city
- Γ_i: a rich set of control variables for company
- ω_i: firm fixed effect
- δ_t: time fixed effect
- ϵ_{ict}: the error term

OLS Results

	(1) lnwage	(2) lnwage	(3) lnwage	(4) lnwage	(5) lnwage
lnhp	0.107***	0.113***	0.123***	0.0486*	0.0619**
	(0.0239)	(0.0240)	(0.0288)	(0.0257)	(0.0261)
nlc	0.00559	0.00635	-0.00793	-0.00406	-0.00172
	(0.00685)	(0.00695)	(0.00535)	(0.00439)	(0.00489)
college	-0.00438***	-0.00486***	0.0115	0.000323	0.00374
	(0.00159)	(0.00156)	(0.00733)	(0.00679)	(0.00654)
indstr	0.166***	0.175***	0.503***	-0.164	0.129
	(0.0492)	(0.0493)	(0.135)	(0.125)	(0.114)
_cons	-1.578***	-1.689***	0.367	2.541***	1.847***
	(0.244)	(0.246)	(0.304)	(0.295)	(0.345)
Company_Controls	Yes	Yes	Yes		Yes
Year_Fixed_Effect		Yes		Yes	Yes
Firm_Fixed_Effect			Yes	Yes	Yes
N	723129	723129	652808	765305	652808
r2	0.409	0.413	0.885	0.796	0.885

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Endogeneity Issue

- Hypothesis: Companies in areas with high housing prices tend to offer higher prices as compensation to workers compared to regions with low housing prices.
- Reverse Causality: Cities with higher average wages attract more labors, thus increasing the demand of housing and pushing up the housing prices.
- Instrument Variable Approach
  - Construction Land Supply (Liang et al., 2016; Glaeser, Gyourko, and Saks, 2005; Glaeser, Gyourko, and Saks, 2005)

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IV Analysis

Instrument Variable: Construction Land Supply

- First-Stage Correlation
  - Land is a main input to constructing housing. Areas with limited land supply tend to have higher housing prices given the same demand, thus satisfying the first-stage correlation assumption.
- Exclusion Restrictions
  - Since 2003, the central government has limited the land supply quota of Eastern regions and stipulated to protect rural land. Therefore, the land supply couldn't be easily adjusted by the local government.
- Controls that strengthen the exclusion restriction
  - Economic Development - nightlight

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Two Stage Regression Equation

First Stage:

$$lnhp_{ct} = \alpha_0 + \alpha_1 lag\_log\_land_{ct} + \gamma' X_c + \delta_t + \mu_{ct} \quad (2)$$

Second Stage:

$$lnw_{ict} = \beta_0 + \beta_1 lnhp_{ct} + \gamma X_c + \upsilon \Gamma_i + \omega_i + \delta_t + \epsilon_{ict} \quad (3)$$

IV Results

	(1) OLS, robust	(2) OLS, cluster	(3) IV, robust	(4) IV, cluster
lnhp	0.0619***	0.0619**	0.210***	0.210
	(0.00409)	(0.0261)	(0.0475)	(0.478)
nlc	-0.00172***	-0.00172	-0.00296***	-0.00296
	(0.000567)	(0.00489)	(0.000822)	(0.00767)
college	0.00374***	0.00374	0.00333***	0.00333
	(0.000996)	(0.00654)	(0.00100)	(0.00714)
indstr	0.129***	0.129	0.0971***	0.0971
	(0.0177)	(0.114)	(0.0189)	(0.131)
Company_Controls	Yes	Yes	Yes	Yes
Year_Fixed_Effect	Yes	Yes	Yes	Yes
Firm_Fixed_Effect	Yes	Yes	Yes	Yes
N	652808	652808	644367	644367
F	12065.9	2004.2	11915.3	1886.5

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

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Conclusion

- Companies in areas with higher housing prices indeed offer higher prices as compensation to workers compared to regions with low housing prices

Glaeser, E. L., Gyourko, J., & Saks, R. (2005).Why is manhattan so expensive? regulation and the rise in housing prices [Publisher: [The University of Chicago Press, The Booth School of Business, University of Chicago, The University of Chicago Law School]]. *The Journal of Law & Economics*, *48*(2), 331–369. https://doi.org/10.1086/429979

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