

Migration, Housing Constraints, and Inequality: A Quantitative Analysis of China

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(As calculated from Urban Statistics Yearbooks of China 2010, massive (≈ 150 million) workers migrated from less developed cities to these more developed cities while construction land supply increased disproportionately slow in these more developed cities.)

Research Questions

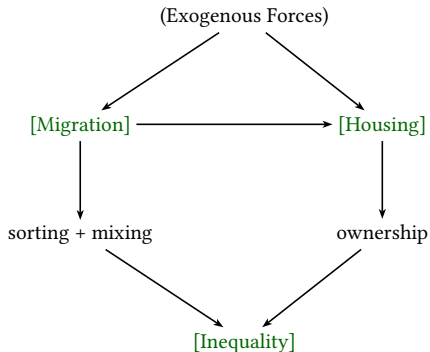
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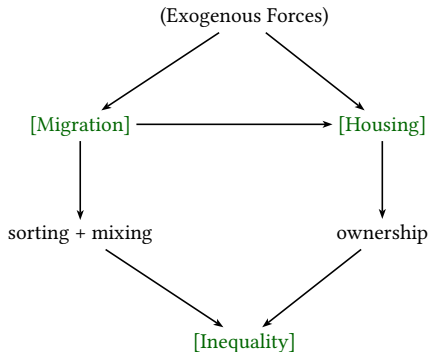
Our Story



Exogenous Forces:

1. Migration Cost ↓ (universally)
2. Productivity ↑ (unevenly)
3. Land Supply (unevenly)

Our Story



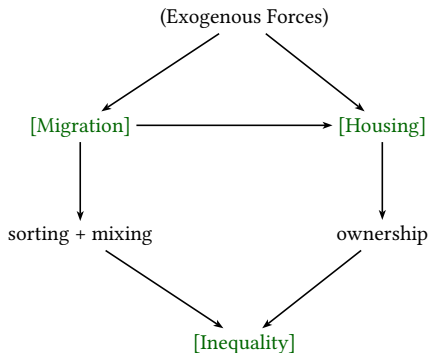
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Migration: low-prod → high-prod
Housing: high-prod city ↑

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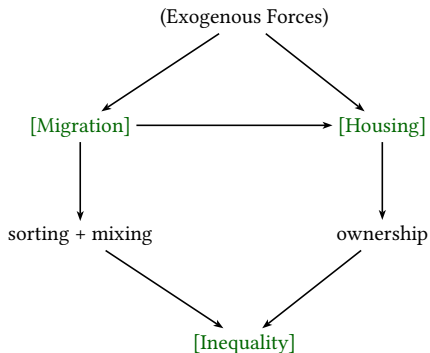
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House wealth income in high-prod city ↑

Sorting & mixing in high-prod city ↑

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House wealth income in high-prod city ↑

Sorting & mixing in high-prod city ↑

Inequality within high-prod city ↑

What we do in this paper

1. Document these spatial characteristics using comprehensive data;
2. Build a spatial GE model to match the data facts and quantify the exogenous forces;
3. Conduct counterfactuals to reduce inequality.

Preview to Our Answers

Q1. Could the massive migration inflow and the tightening housing constraints in more developed cities explain the rapidly rising income inequality in China?

Yes, migration inflows and tightening local housing constraints increases housing values which actually enlarges the inequality between housing owners and migrants.

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Q2. If the answer to Q1 is true, then, are there any policies we could implement to alleviate this rapidly rising income inequality in China?

Both a reform in land supply policy (loosening housing constraints) and a property tax policy (only redistribution) could help to reduce inequality.

Outline

1. Data and Stylized Facts
2. A Spatial GE Model of Migration and Housing
3. Solving the Model
4. Quantitative Results of the Model
5. Counterfactual with Land Supply Reform (Property Tax)
6. Conclusion

Data & Stylized Facts

Population Census of China in 2005 & 2010:

- ▶ Household & Individual Survey (we have 0.2% in 2005, and 0.35% in 2010);
- ▶ Hukou, Location, Employment, Education, Wage(2005), Rent, Housing, ...

Statistic Yearbook of each city & Urban Statistic Yearbook in 2005 & 2010:

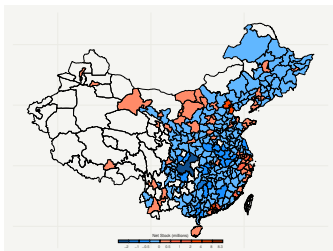
- ▶ Annual wage income by 19 sectors in 246-287 cities;
- ▶ Total construction land supply in each city above.

Stylized Facts: An Overview

1. Migrant workers are highly & increasingly concentrated in certain cities;
2. Housing costs increase drastically with net stock of migrant workers and across time;
3. Income inequality within cities are positively correlated with net stock of migrant workers;
 - ▶ Wage inequality within cities are not correlated with net stock of migrant workers;
 - ▶ Cities with higher net stock of migrant workers contribute more to the national income inequality.

Fact 1: Migrant workers are highly & increasingly concentrated in certain cities

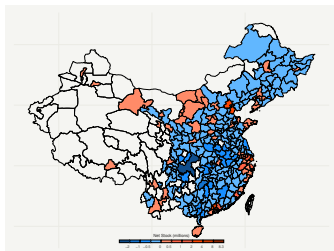
Figure: Net Stock of Migrant Workers by City in China



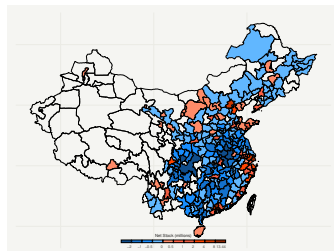
(a) Net Stock of Migrant Workers in 2005

Fact 1: Migrant workers are highly & increasingly concentrated in certain cities

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(a) Net Stock of Migrant Workers in 2005



(b) Net Stock of Migrant Workers in 2010

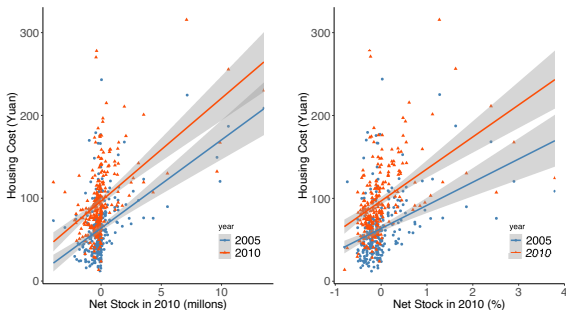
► Maps in Net Stock (Percentage)

► Tables for Map

► Correlation Overtime

Fact 2: Housing costs increase drastically with net stock of migrants and across time

Figure: Net Stock of Migrants and Housing Cost



► Quality-adjusted Housing Rents and Migration

► Additional Results from CHIP

Definition Preparation for Fact 3

Income Measure: (between major groups: hukou city i, working city j, skill level s)

- ▶ By Income: $x_{ij}^s = \text{wage}_j^s + \text{Imputed rent income}_i^s$;
- ▶ Imputed rent income = self-consumed space + actual rent income
- ▶ Imputed rent income is potentially a lower bound for asset income

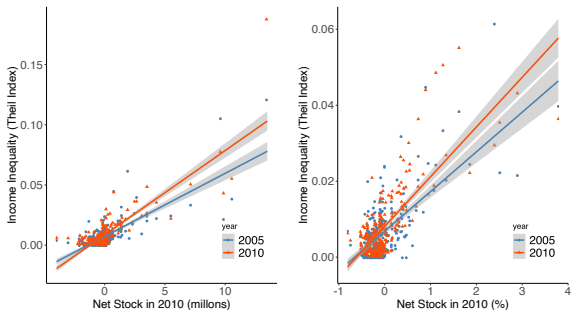
Inequality Measure: Theil Index

- ▶ Calculate Theil Index for each city
- ▶ Calculate National Theil Index and each city's share of contribution

Limitations: "Inequality" documented here is only between major groups

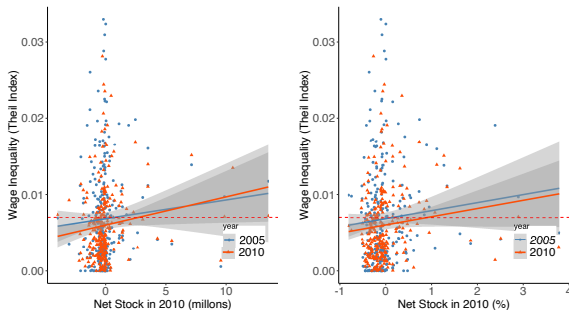
Fact 3: Income inequality within cities are positively correlated with net stock

Figure: Net Stock of Migrants and Income Inequality



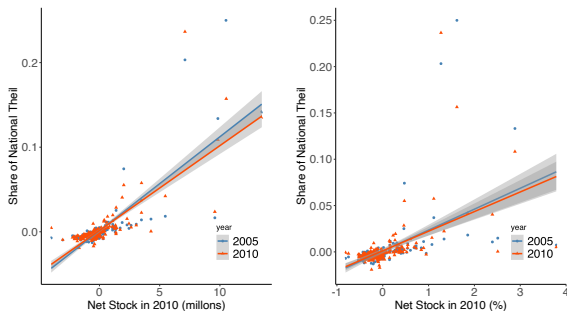
Supplement for Fact 3: Wage inequality within cities are not correlated with net stock

Figure: Net Stock of Migrants and Wage Inequality



Supplement for Fact 3: high net stock cities contribute more to national inequality

Figure: Net Stock of Migrants and Share of Contribution to National Inequality



Takeaway of the Stylized Facts

1. Migration, Housing Constraints, and Inequality are highly correlated;
2. Cities with more migrant workers have higher housing costs and higher inequality;
3. The inequality pattern is mainly explained by housing inequality (not wage inequality);

A Spatial GE Model of Migration and Housing

Model: Overview

Eaton-Kortum(2002) Framework for migration with H/L-skill workers

- ▶ Location choices s.t. preferences, income, migration costs;
- ▶ Local production combining H/L-skill workers.

Ahlfeldt et al.(2015) Framework for floor space market

- ▶ Floor space construction using fixed land supply;
- ▶ Endogenous floor space price due to both residential demand;
- ▶ Local residents gain all the returns from floor space market.

Model I: Worker Preferences

- ▶ Worker's Utility:

$$U_{ijo} = \frac{z_{ijo}}{\tau_{ij}^s} \left(\frac{c_{ijo}}{\beta} \right)^\beta \left(\frac{s_{ijo}}{1 - \beta} \right)^{1 - \beta} \quad (1)$$

- ▶ Shock (z_{ijo}) follows Frechet Distribution: $F(z_{ijo}) = e^{-z_{ijo}^{-\epsilon}}$
- ▶ FOCs: $c_{ijo} = \beta v_{ij}^s$, $s_{ijo} = (1 - \beta) \frac{v_{ij}^s}{Q_j}$

- ▶ Indirect Utility:

$$U = \frac{z_{ijo} v_{ij}^s Q_j^{\beta - 1}}{\tau_{ij}^s} \quad (2)$$

Model I: Frechet Distribution of Utility

- ▶ Origin-Destination-Skill Pair:

$$G_{ij}^s(u) = \Pr[U \leq u] = F\left(\frac{u\tau_{ij}^s Q_j^{1-\beta}}{v_{ij}^s}\right) \quad (3)$$

$$G_{ij}^s(u) = e^{-\Phi_{ij}^s u^{-\epsilon}}, \quad \Phi_{ij}^s = (\tau_{ij}^s Q_j^{1-\beta})^{-\epsilon} (v_{ij}^s)^\epsilon \quad (4)$$

- ▶ Origin-Skill Pair:

$$1 - G_i^s(u) = 1 - \prod_{k=1}^K e^{-\Phi_{ik}^s u^{-\epsilon}} \quad (5)$$

$$G_i^s(u) = e^{-\Phi_i^s u^{-\epsilon}}, \quad \Phi_i^s = \sum_{k=1}^K \Phi_{ik}^s \quad (6)$$

Model I: Migration Flows and Income

- Gravity Equation of Migration Flow:

$$\pi_{ij}^s = \frac{(\tau_{ij}^s Q_j^{1-\beta})^{-\epsilon} (v_{ij}^s)^\epsilon}{\sum_{k=1}^K (\tau_{ik}^s Q_k^{1-\beta})^{-\epsilon} (v_{ik}^s)^\epsilon} = \frac{\Phi_{ij}^s}{\Phi_i^s} \quad (7)$$

- Income: (wage + rent)

$$v_{ij}^s = w_j^s + \frac{Q_i S_i}{H_i^R} \quad (8)$$

Model II: Production

- ▶ City Production:

$$X_j = [(A_j^h H_j^h)^{\frac{\sigma-1}{\sigma}} + (A_j^l H_j^l)^{\frac{\sigma-1}{\sigma}}]^{\frac{\sigma}{\sigma-1}}$$

- ▶ First Order Conditions:

$$w_j^l = A_j^l{}^{\frac{\sigma-1}{\sigma}} X_j^{\frac{1}{\sigma}} H_j^{l-\frac{1}{\sigma}}$$

$$w_j^h = A_j^h{}^{\frac{\sigma-1}{\sigma}} X_j^{\frac{1}{\sigma}} H_j^{h-\frac{1}{\sigma}}$$

- ▶ Skill Premium:

$$\omega_j = \frac{w_j^h}{w_j^l} = \left(\frac{A_j^h}{A_j^l} \right)^{\frac{\sigma-1}{\sigma}} \left(\frac{H_j^h}{H_j^l} \right)^{-\frac{1}{\sigma}}$$

Model III: Floor Space Market Clearing

- ▶ Floor Space Production:

$$S_j = \phi_j L_j$$

- ▶ Floor Space Market Clearing:

$$S_j = E[s_j]H_j = (1 - \beta) \frac{E[v_j]H_j}{Q_j}$$

Solving the Model

Model IV: Equilibrium and Estimation

► Spatial General Equilibrium Conditions:

(1).Worker Optimization; (2).Firm Optimization; (3).Labor Market Clearing for each j ; and
(4).Floor Space Market Clearing for each j .

► Estimation of Parameters:

Table: Estimated Parameters

Parameter	Description	Value
β	share of consumption in utility	0.77
σ	elasticity of substitution between H/L-skills	1.40
ϵ	migration elasticity	1.90

► Equilibrium Conditions

► Estimation

► Estimation Results

Model V: Solving the Model (Productivity)

This model has a very nice accounting property: it can be solved directly from data (Data in Blue and Unknown in Red)

A.Productivity

From production function and FOC $A_j^h = A_j^l(H_j^h/H_j^l)^{1/(\sigma-1)}(w_j^h/w_j^l)^{\sigma/(\sigma-1)}$, we have:

$$X_j = A_j^l H_j^l \left[\frac{w_j^h H_j^h + w_j^l H_j^l}{w_j^l H_j^l} \right]^{\frac{\sigma}{\sigma-1}} = w_j^h H_j^h + w_j^l H_j^l$$

Defining $\Xi_j^l = \frac{w_j^l H_j^l}{w_j^h H_j^h + w_j^l H_j^l}$ as the share of labor income of low-skill workers, we can then calculate the productivities for both skill types as follows:

$$A_j^l = w_j^l (\Xi_j^l)^{\frac{1}{\sigma-1}} \quad (9)$$

$$A_j^h = w_j^h (1 - \Xi_j^l)^{\frac{1}{\sigma-1}} \quad (10)$$

Takeaway: higher wage and higher share of skill s in city j reflects of higher A_j^s .

Model V: Solving the Model (Floor Space)

B.Floor Space

$$\begin{aligned} S_j &= E[s_j]H_j = (1 - \beta) \frac{E[v_j]H_j}{Q_j} \\ &= \frac{1 - \beta}{Q_j} [w_j^l H_j^l + w_j^h H_j^h] + (1 - \beta)S_j \\ &= \frac{1 - \beta}{\beta} \cdot \frac{w_j^l H_j^l + w_j^h H_j^h}{Q_j} \end{aligned}$$

and then back out the construction intensity ϕ_j by dividing the land supply data:

$$\phi_j = S_j / L_j$$

Takeaway: higher wage and larger population reflects larger floor space, while higher price reflects smaller floor space.

Model V: Solving the Model (Migration Costs)

C. Migration Costs

$$\Phi_i^s = \sum_{k=1}^K (\tau_{ik}^s Q_k^{1-\beta})^{-\epsilon} (v_{ik}^s)^\epsilon = \frac{(Q_j^{1-\beta})^{-\epsilon} (v_{ij}^s)^\epsilon}{\pi_{ii}^s}$$

Inserting Φ_i^s into the original gravity equation, we have the migration cost as follows:

$$\tau_{ij}^s = \frac{v_{ij}^s}{Q_j^{1-\beta} (\pi_{ij}^s \Phi_i^s)^{1/\epsilon}}, \text{ for } i \neq j$$

Takeaway: migration cost from i to j for skill s is reflected in income v_{ij}^s , Q_j , π_{ij}^s , and Π_{is} .

Quantitative Results of the Model

Quantitative I: Unobserved Variables across Cities & Change Overtime

- ▶ Migration Costs (τ_{ij}^s):
Annually drop of migration costs is 8.8%;
- ▶ Productivity (A_j^s):
1. Annually growth of productivity is 13% (high-skill) & 14% (low-skill);
2. Productivity in larger cities is much higher, especially for high-skill;
- ▶ Floor Space (S_j):
Floor space per worker growth is much lower in more developed cities.

▶ Average Migration Costs

▶ Average Productivity Growth

▶ Construction Land Supply and Floor Space

Quantitative II: Within-city Theil Index

1. Wage Theil is similar across cities, but Income Theil is way different;
2. Wage Theil doesn't change much, but Income Theil increases fast in larger cities;

Table: Within-city Theil Index

Net Migrant Range(2010)	No. of City	Wage Theil Index			Income Theil Index		
		2005	2010	Relative	2005	2010	Relative
Average	233	0.0072	0.0070	97%	0.0100	0.0184	184%
(6,13)	5	0.0087	0.0097	111%	0.0442	0.0908	205%
(1,6)	19	0.0065	0.0079	122%	0.0092	0.0223	242%
(0, 1)	45	0.0075	0.0083	111%	0.0060	0.0092	153%
(-1,0)	134	0.0071	0.0058	82%	0.0049	0.0052	106%
(-4,-1)	30	0.0072	0.0058	80%	0.0054	0.0062	115%

Quantitative II: Share of Contribution to National Theil Index

1. National Theil Indexes drop overtime;

2. More developed cities' share of national inequality remains unchanged;

Table: Share of Contribution to National Theil Index

Net Migrant Range(2010)	No. of City	Share of Wage Theil			Share of Income Theil		
		2005	2010	Relative	2005	2010	Relative
National Theil	233	0.0985	0.0622	64%	0.1156	0.0921	80%
(6,13)	5	+1.49	+1.41	97%	+1.43	+1.27	89%
(1,6)	19	+0.58	+0.83	143%	+0.53	+0.70	132%
(0, 1)	45	+0.22	+0.26	118%	+0.19	+0.20	105%
(-1,0)	134	-0.92	-1.00	108%	-0.81	-0.78	96%
(-4,-1)	30	-0.37	-0.49	132%	-0.35	-0.39	111%

Quantitative II: Skill Premium & Housing Premium

1.Skill Premium does not change much;

2.Housing Premium accounts for the majority of the inequality changes;

Table: Skill Premium and Housing Premium

Net Migrant Range(2010)	No. of Cities	Skill Premium			Housing Premium		
		2005	2010	Relative	2005	2010	Relative
Average	233	1.47	1.40	95%	0.36	0.49	136%
(6,13)	5	1.35	1.39	103%	0.93	1.89	203%
(1,6)	19	1.40	1.40	100%	0.39	0.56	144%
(0, 1)	45	1.42	1.39	97%	0.31	0.35	113%
(-1,0)	134	1.50	1.40	93%	0.27	0.25	93%
(-4,-1)	30	1.58	1.45	92%	0.24	0.31	129%

Takeaways from Quantitative Analysis

I. What Unobserved Variables are driving the observed stylized facts?

- ▶ National reduction of Migration Costs (τ_{ij}^s);
- ▶ Uneven (growth) of Productivity (A_j^s) in larger cities;

II. Inequality Measures across cities & change overtime

- ▶ Wage Inequality doesn't change much, but Income Inequality spikes;
- ▶ Larger City's Contribution to national Wage/Income Theil Index is higher;
- ▶ Skill Premium remains the same, but Housing Premium spikes.

Counterfactual with Land Supply Reform

Counterfactual I: A Migration-based Land Supply Policy Reform

- 1.Redistributing the total land supply increment from 2005 to 2010 by net inflow;
- 2.Subtracting land income from the additional land allocated to land-gaining cities and compensate land-losing cities for their losses for redistribution.

Table: Counterfactual Construction Land Supply

Net Inflow Range(2010)	No. of Cities	Land Supply (Data)				Counterfactual		
		2005	2010	Relative	Changes	2010	Relative	Changes
National	233	24,277	31,705	131%	+7,428	31,705	131%	+7,428
(6,13)	5	5,135	5,648	110%	+513	7,762	151%	+2,627
(1,6)	19	3,801	5,912	155%	+2,111	7,131	188%	+3,330
(0, 1)	45	5,555	7,250	131%	+1,695	6,829	123%	+1,274
(-1,0)	134	7,950	10,363	130%	+2,413	7,988	100.5%	+38
(-4,-1)	30	1,836	2,532	138%	+696	1,836	100%	+0

Counterfactual I Results: Migration Flow & Housing Cost

- 1.The reform motivates more migration into more developed cities;
- 2.It also lowers housing costs more developed cities;

Table: Migration Flow and Housing Cost: Land Supply Reform

Net Migrant Range(2010)	No. of Cities	Net Migrant			Housing Cost		
		2010	$\widehat{2010}$	Relative	2010	$\widehat{2010}$	Relative
Overall	233	96m	112m	117%	114	119	104%
(6,13)	5	+45m	+55m	122%	226	158	70%
(1,6)	19	+38m	+44m	116%	136	102	75%
(0, 1)	45	+13m	+13m	100%	118	132	112%
(-1,0)	134	-48m	-48m	100%	87	115	132%
(-4,-1)	30	-48m	-65m	135%	80	105	131%

Counterfactual I Results: Within-city Theil Index

The reform lowers income inequality but not much on wage inequality;

Table: Within-city Theil Index: Land Supply Reform

Net Migrant Range(2010)	No. of Cities	Wage Theil Index			Income Theil Index		
		2010	$\widehat{2010}$	Relative	2010	$\widehat{2010}$	Relative
Average	233	0.0070	0.0072	103%	0.0184	0.0121	66%
(6,13)	5	0.0097	0.0093	97%	0.0908	0.0428	47%
(1,6)	19	0.0079	0.0089	113%	0.0223	0.0139	62%
(0, 1)	45	0.0083	0.0082	99%	0.0092	0.0098	106%
(-1,0)	134	0.0058	0.0059	101%	0.0052	0.0045	86%
(-4,-1)	30	0.0058	0.0056	97%	0.0062	0.0051	82%

Counterfactual I Results: Share of national Theil Index

1. The reform further lowers national income inequality;
2. It, however, does not affect city's share of national inequality much;

Table: Share of National Theil Index: Land Supply Reform

Net Migrant Range(2010)	No. of Cities	Share of Wage Theil			Share of Income Theil		
		2010	$\widehat{2010}$	Relative	2010	$\widehat{2010}$	Relative
National Theil	233	0.062	0.062	100%	0.092	0.074	80%
(6,13)	5	+1.41	+1.46	104%	+1.27	+1.28	101%
(1,6)	19	+0.83	+0.84	101%	+0.70	+0.66	94%
(0, 1)	45	+0.26	+0.23	88%	+0.20	+0.30	150%
(-1,0)	134	-1.00	-0.95	95%	-0.78	-0.73	94%
(-4,-1)	30	-0.49	-0.58	118%	-0.39	-0.50	128%

Counterfactual Results: Skill Premium & Housing Premium

The reform mainly works through the Housing Premium;

Table: Skill Premium and Housing Premium: Land Supply Reform

Net Migrant Range(2010)	No. of Cities	Skill Premium			Housing Premium		
		2010	$\widehat{2010}$	Relative	2010	$\widehat{2010}$	Relative
Average	233	1.40	1.40	100%	0.49	0.45	92%
(6,13)	5	1.39	1.39	100%	1.89	1.12	59%
(1,6)	19	1.40	1.43	102%	0.56	0.41	73%
(0, 1)	45	1.39	1.38	99%	0.35	0.40	114%
(-1,0)	134	1.40	1.39	99%	0.25	0.33	132%
(-4,-1)	30	1.45	1.43	98%	0.31	0.26	84%

Takeaways from Counterfactual I

A Land Supply Redistribution according to worker flows would:

- ▶ Motivate more workers moving to higher productive cities;
- ▶ Lower the Housing Premium in the larger cities;
- ▶ Lower the Within-city Income Inequality in larger cities;
- ▶ Lower the share of national Income Inequality of the larger cities;

We also show (Counterfactual II) property tax and redistribution would also lower Income Inequality with similar magnitudes, however, it does not improve much on national productivity.

▶ Property Tax I

▶ Property Tax II

▶ Property Tax III

Conclusion

Conclusion

Migration and Housing Constraints in China:

- ▶ Generate high housing costs in larger cities;
- ▶ Generate high income inequality in larger cities (whole nation);
- ▶ Generate high income inequality across cities;

A migration-based land supply redistribution lowers income inequality.

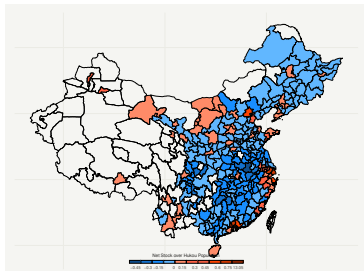
- ▶ Allowing "trade" of land quota between cities is meaningful!

Appendix

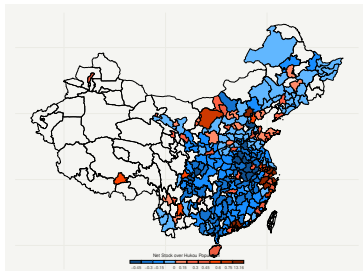
Fact 1: Migrant workers are highly & increasingly concentrated in certain cities

Figure: Net Stock (%) of migrants by city in China

(a) Net Stock(%) of Workers in 2005



(b) Net Stock(%) of Workers in 2010



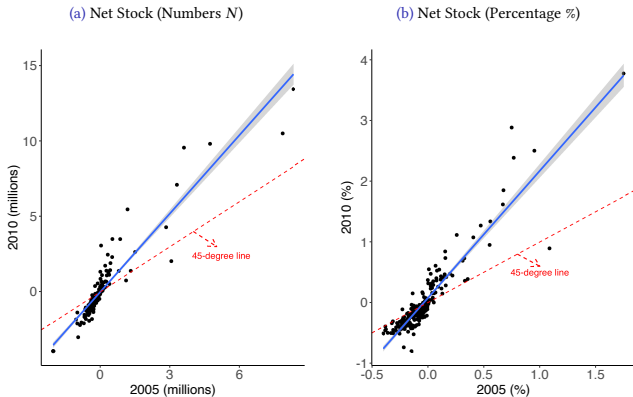
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Fact 1: Migrant workers are highly & increasingly concentrated in certain cities

Table: Distribution of Net Stock of Migrant Workers

<i>Panel A: Net Stock (measured in numbers, Unit: million)</i>											
Year	No.	(-4,-2)	(-2,-1)	(-1,-0.5)	(-0.5,0)	(0, 0.5)	(0.5,1)	(1,2)	(2,4)	(4,8)	(8+)
2005	287	1	1	23	188	59	4	4	4	2	1
2010	266	6	29	41	115	39	9	13	7	3	4
<i>Panel B: Net Stock (measured in percentage, Unit: %)</i>											
Year	No.	(-80, -45)	(-45,-30)	(-30,-15)	(-15,0)	(0, 15)	(15,30)	(30,45)	(45,60)	(60,75)	(75+)
2005	287	0	11	63	139	48	9	5	3	3	6
2010	266	12	47	61	71	19	17	14	6	4	15

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Fact 2: Housing costs increase drastically with net stock of migrants and across time

Quality-adjusted Housing Rents and Migration

$$rent_{ij} = \beta_0 + \beta_1 NetMig_j + \mathbf{Z}_{ij}' \alpha + \epsilon_{ij} \quad (11)$$

\mathbf{Z}_{ij} is a vector of housing characteristics for house i , including whether the house is also used as a business facility, the total area of the house, the number of the floors, the construction structure of the house, the building year of the house, the main cooking equipment, whether it has a tap water system, whether it has an independent kitchen, the type of restroom, and the type of showering system.

Table: The Relation between Housing Rents and Migration

Variables	(1) OLS-2005	(2) OLS-2010
Net Stock of Migrant Workers (10k)	0.0113*** (0.000173)	0.00396*** (0.0000516)
Observations	81,051	150,298
R-squared	0.207	0.181

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Fact 2: Housing costs increase drastically with net stock of migrants and across time

Table: Quantile Statistics

Model IV: Equilibrium

A **Spatial General Equilibrium** for this economy is defined by a set of a list of exogenous economic conditions $\{A_j^s, \phi_j, L_j, H_i^s\}$, a list of endogenous prices $\{Q_j, w_j^s\}$, quantities $\{v_{ij}^s, y_j, H_j^s, S_j\}$, and proportions $\{\pi_{ij}^s\}$ that solve firms' problem, workers' problem, floor space producers' problem, and market clearing such that:

- (i).[**Worker Optimization**] Taking the exogenous economic conditions $\{A_j^s\}$ and the aggregate prices $\{Q_j, w_j^s\}$ as given, workers' optimal choices of migration pins down the equilibrium labor supply in each city H_j^s and the migration flow between each city pairs π_{ij}^s .
- (ii).[**Firm Optimization**] Taking the exogenous economic conditions $\{A_j^s\}$ and the aggregate prices $\{w_j^s\}$ as given, firms' optimal choices of production pins down the equilibrium labor demand H_j^s .
- (iv).[**Market Clearing**] For all cities, labor supply equals labor demand and floor space supply equals floor space demand. This pins down the equilibrium aggregate prices $\{Q_j, w_j^s\}$, the equilibrium floor space S_j , and the equilibrium output y_j .

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Migration Elasticity (ϵ)

Migration Flows

$$\pi_{ij}^s = \frac{(\tau_{ij}^s Q_j^{1-\beta})^{-\epsilon} (v_{ij}^s)^\epsilon}{\Phi_i^s}$$

Regression

$$\ln(\pi_{ij}^s) = \epsilon \ln(v_j^s) + \psi_{ij} + \gamma_{is} + \zeta_j + \phi_{ijs}, \text{ for } i \neq j \quad (12)$$

where

$\psi_{ij} = -\epsilon \rho \ln(d_{ij})$ is the origination-destination pair FE;

$\gamma_{is} = -\epsilon \ln(\tau_i^s) - \ln(\Phi_i^s)$ is the origination-skill FE;

$\zeta_j = -\epsilon(1 - \beta) \ln(Q_j)$ is the destination FE;

$\phi_{ijs} = -\epsilon \xi_{ij}^s + v_{ij}^s$ where v_{ij}^s is the measurement error term.

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Migration Elasticity (ϵ)

Table: Regression of Estimating the Migration Elasticity

Variables	(1)	(2)
$\ln(v_j^s)\{Census\}$	1.847*** (0.0761)	
$\ln(v_j^s)\{CSYB\}$		1.926*** (0.138)
Origin-Destination FE	YES	YES
Origin-Skill FE	YES	YES
Observations	164,738	137,186
R-squared	0.568	0.577

$$\epsilon = 1.90$$

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Quantitative I: Unobserved Variables across Cities & Change Overtime

Table: Average Migration Costs

	Share of Emp.		Migration Costs			
	2005	2010	2005	2010	Relative	Changes
Overall	11%	22%	11.0	7.2	65%	-3.8
Low-skill	11%	23%	11.2	7.3	65%	-3.9
High-skill	9%	17%	8.9	7.0	79%	-1.9

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Quantitative I: Unobserved Variables across Cities & Change Overtime

Table: Average Productivity Growth

Net Migrant Range(2010)	No. of Cities	High-skill				Low-skill			
		2005	2010	Relative	Changes	2005	2010	Relative	Changes
Average	233	6.4	14.0	219%	+7.6	9.4	17.1	182%	+7.7
(6,13)	5	19.2	45.7	240%	+26.5	12.6	21.2	168%	+8.6
(1,6)	19	3.9	12.0	308%	+8.1	12.2	19.5	160%	+7.3
(0, 1)	45	3.7	10.5	184%	+6.8	10.2	16.3	160%	+6.1
(-1,0)	134	0.9	2.3	256%	+1.4	8.2	16.3	199%	+8.1
(-4,-1)	30	0.4	1.6	400%	+1.2	7.8	15.2	195%	+7.4

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Quantitative I: Unobserved Variables across Cities & Change Overtime

Table: Construction Land Supply and Floor Space

Net Migrant Range(2010)	No. of City	Total Land Supply Floor Space				Total Floor Space			
		2005	2010	Relative	Changes	2005	2010	Relative	Changes
Overall	233	24,277	31,705	131%	+7,428	2.19	3.30	150%	+1.11
(6,13)	5	5,135	5,648	110%	+513	5.92	7.84	132%	+1.92
(1,6)	19	3,801	5,912	155%	+2,111	1.79	4.10	229%	+2.31
(0, 1)	45	5,555	7,250	131%	+1,695	1.53	2.48	162%	+0.95
(-1,0)	134	7,950	10,363	130%	+2,413	1.48	2.17	147%	+0.69
(-4,-1)	30	1,836	2,532	138%	+696	2.55	3.12	122%	+0.57

Counterfactual II: Property Tax

Table: Migration Flow and Housing Costs: Property Tax

Net Migrant Range(2010)	No. of Cities	Net Migrant			Housing Cost		
		2010	$\widehat{2010}$	Relative	2010	$\widehat{2010}$	Relative
Overall	233	96m	97m	101%	114	115	101%
(6,13)	5	+45m	+46m	102%	226	230	102%
(1,6)	19	+38m	+39m	102%	136	137	101%
(0, 1)	45	+13m	+13m	100%	118	118	100%
(-1,0)	134	-48m	-47m	102%	87	87	100%
(-4,-1)	30	-48m	-50m	104%	80	80	100%

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Counterfactual II: Property Tax

Table: Within-city Theil Index: Property Tax

Net Migrant Range(2010)	No. of Cities	Wage Theil Index			Income Theil Index		
		2010	$\widehat{2010}$	Relative	2010	$\widehat{2010}$	Relative
Average	233	0.0070	0.0071	101%	0.0184	0.0145	79%
(6,13)	5	0.0097	0.0100	103%	0.0908	0.0670	74%
(1,6)	19	0.0079	0.0080	101%	0.0223	0.0171	77%
(0, 1)	45	0.0083	0.0084	101%	0.0092	0.0081	88%
(-1,0)	134	0.0058	0.0058	100%	0.0052	0.0047	90%
(-4,-1)	30	0.0058	0.0058	100%	0.0062	0.0053	85%

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Counterfactual II: Property Tax

Table: Share of National Theil Index: Property Tax

Net Migrant Range(2010)	No. of Cities	Share of Wage Theil			Share of Income Theil		
		2010	$\widehat{2010}$	Relative	2010	$\widehat{2010}$	Relative
National Theil	233	0.062	0.062	100%	0.092	0.074	80%
(6,13)	5	+1.41	+1.42	104%	+1.27	+1.31	103%
(1,6)	19	+0.83	+0.83	101%	+0.70	+0.73	104%
(0, 1)	45	+0.26	+0.26	88%	+0.20	+0.21	105%
(-1,0)	134	-1.00	-0.98	95%	-0.78	-0.82	111%
(-4,-1)	30	-0.49	-0.52	118%	-0.39	-0.44	116%

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