The Impact of Internal Migration Controls on Urban Fiscal Policies and Access to Educational Opportunities in China

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January 25, 2022

Mobility Across Cities

- Let's focus on mobility across cities which may be more interesting than mobility within cities.
- We need to endogenize wages and earnings since there are large differences in productivity across cities as well as differences in agglomeration externalities.
- We need to account for the fact that households may move for other reasons than differences in earnings and local public policies such as amenities.
- We need to account for initial conditions which allows us to capture moving costs.
- We may want to study the long term evolution of human capital and interpret the model as an overlapping generations model.

Application: Hukou Policies in China

- We explore the impact of migration controls on urban fiscal policies and the intergenerational transmission of human capital accumulation in China.
- We show that migrants provide large positive fiscal externalities to major cities.
- We evaluate the feasibility and effectiveness of alternative migration policies.
- These reforms offer the potential of decreasing inequality within China while at the same time promoting growth via increasing the aggregate level of human capital in the economy.

The Literature

- We develop a new spatial overlapping generations model that captures the main institutional features that characterize the fiscal decentralization and the Hukou System in China (Wu and You, 2020).
- Our model builds on the pioneering research on overlapping generations models with endogenous local fiscal policies developed by Benabou (1996) and Fernandez and Rogerson (1996, 1998, 2003).
- We model locational choices within a system of local labor markets using modern versions of Rosen (1979) & Roback (1982) models such as Moretti (2011) or Diamond (2016).
- Fiscal distortions are modeled using wedges as suggested by Chari, Kehoe & McGrattan (2007).
- Hence, we can evaluate the impact of reforming the hukou system on long-run economic development without imposing stationary or balanced growth.

Modeling Mobility Among Cities

- The economy consists of J cities and one rural, less developed area, denoted by location 0. Each location has an exogenous amenity ω_j.
- A central government imposes a consumption tax that finances intergovernmental transfers.
- Each local government provides two public goods: educational quality (g_j) and other local public goods (o_j).
- Local public goods are financed by a combination of local revenues: a proportional local income tax with rate t_j^w, revenues from land sales and new housing construction t_j^h, and transfers from the central government.
- Each city has a local housing market. Let p_j denote the price of a unit of housing in city j.

Households

- There is a continuum of individuals each of whom lives for two periods, one period as a child and one period as an adult.
- A household consists of an adult and a child.
- At each point in time, the economy consists of two overlapping generations.
- There are K discrete skill types with probability q_{jk}.
- In the initial period, each adult with skill s_k living in city j has an endowment of housing denoted by e_{jk}.
- Each child attends a public school within a city. The achievement of a child is a function of g_j and parental skills s_k.

Hukou Policy

Each city has a Hukou policy that affects the following:

- the fraction of migrants that receive Hukou, r_{jk},
- the fiscal wedge for educational expenditures, Δ^g_{jk},
- the fiscal wedge for other expenditures, Δ^o_{jk}, and
- the housing subsidy, s^h_j.
- There are no wedges in the labor market.

Comments:

- We also do not explicitly model social security, return-migration, and retirement.
- One would need a model with three overlapping generations which are hard to solve in a non-stationary setting.

The Timing of Decisions within Each Period

1. Adult household members make migration decisions given correct expectations of prices, wages, taxes, public goods, and Hukou policies in each city.
2. After households move, they learn whether or not they obtain Hukou status in the destination city.
3. Wages are determined, consumption is realized, housing markets clear, government budgets are balanced, and the achievement of children is realized in each city.
4. Adults die and pass on their housing to their children.
5. Children become adults and obtain a skill realization conditional on achievement.
6. New children are born.

A Resident's Decision Problem

A resident household maximizes utility:

$$U(a, b, c = 1, h, o, \omega_j) \quad = \quad \omega_j \; + \omega_a \; a \; + \; \omega_o \; o \; + \; (h - \underline{h^c})^{\beta^c} \; b^{1-\beta^c}$$

subject to a budget constraint:

$$(1 - s_j^h) \; p_j h \; + \; (1 + t^b) \; b \quad = \quad (1 - t_j^w) \; w_{jk} \; + \; p_j e_{jk}$$

and an achievement constraint:

$$a(g_j, s_k) \quad = \quad \gamma_0 \; g_j^{\gamma_1} \; s_k^{1-\gamma_1}$$

A Resident's Decision Problem

- Using a Stone-Geary utility function, the demand functions for housing and consumption are given by:

$$
\begin{aligned}
h^r_{jk} &= \frac{\beta^c}{(1-s^h_j)\ p_j}[(1-t^w_j)\ w_{jk}\ + p_j e_{jk}] + (1-\beta^c)\underline{h^c} \\
b^r_{jk} &= \frac{1-\beta^c}{1+t^b}[(1-t^w_j)\ w_{jk}\ + p_j e_{jk} - (1-s^h_j)\ p_j \underline{h^c}]
\end{aligned}
$$

- Substituting the demand and achievement functions into the utility function, we obtain the indirect utility of a household that was born in j and stays in j. It is given by:

$$
V_{jjk} = U(a^r_{jk}, b^r_{jk}, c=1, h^r_{jk}, o_j, \omega_j)
$$

A Migrant's Decision Problem

The decision problem of a migrant differs from the problem above in four ways.

1. Some migrants move with their children while others leave their children behind. Children that are left behind have a different achievement than children that accompany their parents.
2. Migrants that do not receive Hukou do not have the same access to public goods. We use fiscal wedges to capture the distortions faced by migrants in the economy: $\Delta^g_{jk} \leq 1$, and $\Delta^o_{jk} \leq 1$.
3. Migrants that do not obtain local urban Hukou are not eligible for the housing market subsidies.
4. Migrants do not have housing endowments in the destination city but can sell their housing endowments in the city of origin in which they were born.

A Migrant's Decision Problem

The indirect utility functions

$$
\begin{aligned}
V_{ijk}^{y,c} &= U(a_{ijk}^{y,c}, b_{ijk}^{y,c}, c, h_{ijk}^{y,c}, o_j, \omega_j) - mc_{jk}^{c} \quad i \neq j, \quad c = 0, 1 \\
V_{ijk}^{n,c} &= U(a_{ijk}^{n,c}, b_{ijk}^{n,c}, c, h_{ijk}^{n,c}, \Delta_{jk}^{o}\, o_j, \omega_j) - mc_{jk}^{c} \quad i \neq j, \quad c = 0, 1
\end{aligned}
$$

Note that we assume that mobility costs depend on the destination city, skill types, and the mobility status of the children:

$$mc_{jk}^{c} = mc_j + mc_k\ 1\{k = 2\} + mc^c\ 1\{c = 1\}$$

where $1\{\cdot\}$ is an indicator function. The timing assumption implies that migrants find out whether or not they obtain local Hukou or not after they move. City j gives Hukou status to a fraction of migrants, denoted by r_{jk}. The migrant's expected conditional value function is given by

$$V_{ijk}^{c} = r_{jk}\ V_{ijk}^{y,c} + (1 - r_{jk})\ V_{ijk}^{n,c}$$

Random Utility Shocks and CCPs

- Note that each households must decide where to live and whether to bring the child along when moving.
- Let ϵ^c_{ijk} and ϵ_{jjk} denote additively separable random utility shocks which are type 1 extreme value distributed.
- Hence, the probability that a household of type k moves from city i to city j with child arrangement c is given by:

$$P^c_{ijk} = \frac{\exp(V^c_{ijk}/\sigma_\epsilon)}{\sum_{d=0}^{1}\sum_{l\neq i, l\neq 0}\exp(V^d_{ilk}/\sigma_\epsilon) + \exp(V_{iik}/\sigma_\epsilon)}$$

where σ_ϵ is the scale parameter of the random utility shocks.

The Composition of the Cities

Let us denote the number of resident households living in city j for each skill type k by n^r_{jk} and note that:

$$n^r_{jk} \quad = \quad q_{jk}\, P_{jjk}.$$

Recall that q_{jk} is the initial share of type k households in city j.

The total number of migrants moving to city j for each skill type k with child arrangement c is given by:

$$n^{m,c}_{jk} \quad = \quad \sum_{l \neq j} q_{lk}\, P^c_{ljk} \quad = \quad \sum_{l \neq j} n^{m,c}_{ljk}.$$

Housing Markets

- The aggregate demand for housing in city j is defined as the sum of the demand by the residents, the migrant households with Hukou, and the migrants without Hukou:

$$H_j^d = H_j^{dr} + H_j^{dy} + H_j^{dn}$$

- The existing housing stock in city j is given by:

$$H_j^{es} = \sum_{k=1}^{K} q_{jk} \, e_{jk}$$

- We assume that there is an upward sloping housing supply function which captures land supply constraints and building technology:

$$H_j^{ns}(p_j) = l_j \, p_j^{\eta_j}$$

where l_j is a constant and η_j is the housing supply elasticity in city j.

Local Revenues

- Local governments receive revenues from three sources:
  1. Local governments generate own revenues from local taxes and shared taxes that are proportional to income, T_j^w
  2. Cities generate revenues from land development and new housing construction, T_j^h.
  3. Cities received additional transfers from the central government, denoted by T_j^{tr}, which are financed by a consumption tax.
- Hence we have:

$$T_j = T_j^w + T_j^h + T_j^{tr}$$

- Local governments subsidize new housing purchases of residents and migrants with Hukou:

$$S_j = s_j^h \, p_j \, (H_j^{dr} + H_j^{dy})$$

- Hence, the net fiscal revenues of a city are given by $T_j - S_j$.

Local Expenditures

- Local governments provide education and other public goods and services. Expenditures on education are given by:

$$E_j^g = \left(n_j^r + \sum_k n_{jk}^{m,1} r_{jk} \right) g_j + \left(\sum_k n_{jk}^{m,1} (1 - r_{jk}) \, \Delta_{jk}^g \right) g_j$$

- The first term captures expenditures for children with Hukou. The second term captures expenditures for children without Hukou.
- Similarly, expenditures on other public goods are given by:

$$E_j^o = \left(n_j^r + \sum_k n_{jk}^{m} r_{jk} \right) o_j + \left(\sum_k n_{jk}^{m} (1 - r_{jk}) \, \Delta_{jk}^o \right) o_j$$

Production Function

- In our quantitative model we assume that production function in city j is given by:

$$Y_j = A_j \Pi_{k=1}^{K} n_{jk}^{\alpha_k}$$

where A_j denotes total factor productivity.

- In our setting, we assume that the productive amenity A_j increases in density. Formally, productive amenities take the following form:

$$A_j = A_{0j} \left(\frac{n_j}{l_j} \right)^{A_{1j}}$$

where l_j is a measure of the fixed land area of the city.

- Earnings of skill k in city j are equal to the marginal product of labor.

Equilibrium

Given a transfer policy for the central government (t^b, δ_j), as well as an initial distribution of types and endowments, (q_{jk}, e_{jk}), local tax policies, (t_j^w, t_j^h, s_j^h), local expenditure rules (ζ_j), local Hukou policies $(r_{jk}, \Delta_{jk}^g, \Delta_{jk}^o,)$, and total factor productivity (A_j) for each city j, an equilibrium consists of expenditure policies (g_j, o_j) and housing prices (p_j) in each city, an allocation of households across cities $(n_{jk}^r, n_{jk}^{m,c})$, for $c = 0, 1$, $j = 0, .., J$ and $k = 1, ..K$, and earnings (w_{jk}) for $j = 0, .., J$ and $k = 1, ..K$, such that:

1. resident and migrants maximize utility subject to the relevant constraints;
2. housing markets clear in all communities;
3. local budgets are balanced in all communities; and
4. earnings are determined by marginal products of labor for each type in all communities.

Law of Motion for Skills

- The transition probability that a child with educational achievement a will have skills s' as an adult in the next period is given by $Pr\{s' \mid a\}$.
- Hence, the skill distribution in the next period is a function of household sorting by skill and local expenditures. In our quantitative model, we have two skill types: low- and high-high skill households.
- High-skill households have attended, at least, two years of college.
- We use a Logit distribution for the transition probability in the quantitative model.

How Do We Map the Model into the Data?

- Our empirical analysis is based on a combination of newly available data sets including the China Household Finance Survey (CHFS) and the Migrants Dynamic Monitoring Survey (MDMS).
- We use the state of the economy in 2000 to determine the initial conditions for our model.
- A period in the model is approximately 35 years.
- The CHFS contains a variety of retrospective questions that allows us to characterize the initial distribution of household types.
- We also use data from the 2018 fiscal year central and local public finance data and the China City Statistics Yearbook to measure heterogeneity in local fiscal policies across city tiers.

Revenue Shares and Expenditures per Capita by City Tier

	Tier 1	Tier 2	Tier 3
Own-source Revenues excluding VAT	34%	24%	16%
Land Development Revenues	35%	45%	28%
VAT & Intergovernmental Transfers	31%	31%	56%
Educational Expenditures per Capita	5,995	2,183	1,553
Other Expenditures per Capita	40,447	13,080	8,653

Calculations based on China's City Statistical Yearbook.

Migration and Hukou Status

Share of Migrants and Residents

	Tier 1	Tier 2	Tier 3
Permanent Migrants (with Hukou)	13.5	15.8	20.3
Temporary Migrants (without Hukou)	25.7	30.7	32.2
Residents	60.8	53.5	47.5

Share of Migrants that Changed Hukou Status

	Tier 1	Tier 2	Tier 3
Low-skill Migrant	26.0	27.5	31.5
High-skill Migrant	47.0	52.5	67.1

Calculations based on 2017 CHFS.

College Attainment

	Residents		Migrants	
Parents	Low-skill	High-skill	Low-skill	High-skill
Tier 1	67.7	96.3	29.5	93.5
Tier 2	52.9	91.0	24.2	90.9
Tier 3	41.9	89.3	21.9	87.4
Rural	23.0	78.2		
	Permanent Migrants		Temporary Migrants	
Parents	Low-skill	High-skill	Low-skill	High-skill
Tier 1	59.8	94.5	23.6	92.8
Tier 2	38.9	93.2	19.8	88.7
Tier 3	32.1	88.5	18.0	85.8

Calculations based on 2017 CHFS.

Access to Educational Opportunities: Temporary Migrants

Temporary Migrant Children in Local Public Schools		
Parents	Low-skill	High-skill
Tier 1	71.8	84.3
Tier 2	83.9	87.0
Tier 3	89.1	87.2
Temporary Migrant Children Left Behind		
Parents	Low-skill	High-skill
Tier 1	47.9	19.3
Tier 2	38.7	30.5
Tier 3	42.1	45.0

Calculations based on 2011 Migrants Dynamic Monitoring Survey.

Access to Other Local Public Goods and Services: Temporary Migrants

	Housing Providence Fund		Medical Insurance	
	Low-skill	High-skill	Low-skill	High-skill
Tier 1	3.6	34.6	29.9	68.4
Tier 2	3.2	20.8	17.4	48.0
Tier 3	1.6	19.2	12.2	45.1

Calculations based on 2011 Migrants Dynamic Monitoring Survey.

Estimation

- We estimate the model's parameters using a method of moments estimator.
- Since we condition on observed housing prices, local tax rates, and fiscal wedges in the estimation, the implied equilibrium is unique which allows us to use a nested fixed-point algorithm in estimation.
- Some parameters can be estimated without computing the equilibrium of the model.
- Hence, we use a sequential estimator and compute standard errors using a bootstrap algorithm.

Local Government Policy Parameters

	Income Tax Rate	Share of Education Expend.	Housing Subsidy Rate	Education Expenditure Wedge		Other Expenditure Wedge	
				Low	High	Low	High
Tier 1	0.098	0.156	0.024	0.717	0.843	0.325	0.705
Tier 2	0.058	0.156	0.029	0.839	0.869	0.188	0.505
Tier 3	0.028	0.167	0.038	0.891	0.872	0.143	0.481
Rural	0.020	0.208					

Goodness of Fit

	Revenue Shares					
	Income		Housing		Transfers	
Tier1	0.34	0.39	0.35	0.34	0.31	0.26
Tier2	0.24	0.37	0.45	0.22	0.31	0.41
Tier3	0.16	0.24	0.28	0.20	0.56	0.56

	Expenditures					
	Education Exp Per Capita		Education Quality	Other Exp Per Capita		Other Quality
	data	Model	Model	data	Model	Model
Tier 1	200	180	214	1093	974	1132
Tier 2	73	79	97	413	426	554
Tier 3	50	50	62	264	251	342
Rural	24	27	22	93	101	101

	Net Migration Rates				Children Left Behind			
	Low-skill		High-skill		Low-skill		High-skill	
	Data	Model	data	Model	Data	Model	Data	Model
Tier 1	0.055	0.055	0.034	0.033	0.478	0.439	0.193	0.213
Tier 2	0.187	0.186	0.080	0.082	0.387	0.389	0.305	0.309
Tier 3	0.172	0.175	0.053	0.051	0.421	0.429	0.450	0.376
Rural	0.404	0.403	0.012	0.014				
	College Attendance: Residents				College Attendance: Migrants			
	Low-skill		High-skill		Low-skill		High-skill	
	Data	Model	Data	Model	Data	Model	Data	Model
Tier 1	0.774	0.791	0.927	0.987	0.519	0.570	0.842	0.956
Tier 2	0.656	0.623	0.890	0.955	0.447	0.498	0.905	0.915
Tier 3	0.591	0.523	0.927	0.917	0.389	0.431	0.901	0.872
Rural	0.321	0.320	0.735	0.742				
	Housing Demand: Residents				Housing Demand: Migrants			
	Low Skill		High Skill		Low Skill		High Skill	
	Data	Model	Data	Model	Data	Model	Data	Model
Tier 1	65	61	80	85	40	43	68	80
Tier 2	72	72	95	90	60	60	91	88
Tier 3	87	91	100	100	85	86	105	107
Rural	130	123	120	119				

Fiscal Externalities

- Migrants pay, on average, higher local taxes, but receive lower levels of public goods and services than residents.
- Hence, migrants provide positive fiscal externalities and subsidize residents.
- We find that migrants provide large positive fiscal externalities to all major cities ranging between 6 and 15 percent of total local revenues.
- We thus conclude that residents in all major cities are heavily subsidized by migrants.

Fiscal Externalities by Household Type

	Income Tax A	Land Sales B	Sales Tax C	Total Revenue D	Edu Exp E	Other Exp F	Housing Subsidy G	Total Exp H	Total Dif I=(D-H)
Low-skill, no child									
Tier 1	332	430	195	958	0	566	7	573	385
Tier 2	145	143	157	445	0	228	3	231	214
Tier 3	60	99	135	294	0	141	3	144	150
Low-skill with child									
Tier 1	332	1041	54	1427	169	566	16	751	676
Tier 2	145	218	142	505	86	228	4	318	187
Tier 3	60	106	132	298	58	141	3	202	96
High-skill no child									
Tier 1	719	1172	368	2259	0	955	33	988	1271
Tier 2	293	264	324	881	0	424	10	434	447
Tier 3	126	144	304	574	0	284	9	293	281
High-skill with child									
Tier 1	719	1497	287	2503	195	955	42	1192	1310
Tier 2	293	280	313	886	91	424	11	526	360
Tier 3	126	119	293	538	60	284	8	351	188
All variables are in 1,000 Chinese Yuan and in per capita.									

Reforming the Hukou System

- China's State Council: provide hukou to 100 million migrants.
- Tier 1 cities have limited scope of population growth.
- Policy 1: extend full residency rights to all migrants in tier 3 cities.
- Policy 2: extend full residency rights to all migrants in tier 2 and 3 cities.
- Use consumption tax surcharge to finance reforms.
- We consider each policy with and without agglomeration externalities.

Policy Analysis: Mobility

Agglomeration	Baseline	Policy 1		Policy 2	
		no	yes	no	yes
City	Low-skill Migrants with Hukou				
Tier 1	7.40	7.29	7.14	7.16	7.00
Tier 2	35.18	34.15	33.43	149.00	156.75
Tier 3	41.00	147.93	155.75	142.36	144.04
City	Low-skill Migrants without Hukou				
Tier 1	21.07	20.74	20.31	20.38	19.94
Tier 2	92.73	90.03	88.15	0	0
Tier 3	91.34	0	0	0	0
City	High-skill Migrants with Hukou				
Tier 1	8.36	8.25	7.94	7.96	7.46
Tier 2	24.06	23.30	22.39	49.26	51.66
Tier 3	21.52	34.13	36.19	32.37	32.08
City	High-skill Migrants without Hukou				
Tier 1	9.43	9.30	8.95	8.98	8.41
Tier 2	21.77	21.08	20.26	0	0
Tier 3	10.55	0	0	0	0

All numbers in million.

Policy Analysis: Achievement

Agglomeration	Baseline	Policy 1		Policy 2	
		no	yes	no	yes
City	Children of Low-skill Migrants with College Degree				
Tier 1	16.23	16.06	15.76	15.85	15.55
Tier 2	63.72	62.04	60.74	77.88	81.85
Tier 3	57.58	65.90	69.34	63.49	64.21
City	Children of High-skill Migrants with College Degree				
Tier 1	17.02	16.80	16.17	16.22	15.20
Tier 2	41.98	40.68	39.09	45.39	47.60
Tier 3	27.99	29.97	31.79	28.44	28.17

All numbers in million.

Conclusions

- Migrant children do not have the same access to local public schools as resident children.
- Moreover, many migrants leave their children behind with relatives in less developed cities and rural areas.
- Migrant children obtain a lower quality of education and accumulate less human capital than children of residents.
- Migrants provides large positive fiscal externalities to all major tier cities.
- Alternative internal migration policies offer the potential of decreasing inequality within China while at the same time promoting growth via increasing the overall level of human capital in the economy.
- These policies are feasible, but require significant increases in consumption taxes.