

Migration Costs, Sorting, and the Agricultural Productivity Gap

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Agricultural Productivity Gap (APG)

- ▶ There are large *observed* gaps in value added per worker between the agricultural and non-agricultural sectors in developing economies
⇒ APG
 - ▶ Gollin, Parente, and Rogerson (2002), Caselli (2005), Restuccia, Yang, and Zhu (2008)
- ▶ The gaps remain to be large after controlling for observable differences in worker characteristics between the two sectors
 - ▶ Vollrath (2014), Gollin, Lagakos, and Waugh (2014)
- ▶ Cross-country differences in output per capita is mainly driven by the large differences in agriculture

Research Question

- ▶ What accounts for the large observed APG?
 1. Underlying sectoral productivity difference & mobility barriers
 - Restuccia et al. (2008); Bryan et al. (2014); Munshi and Rosenzweig (2016); Lagakos et al. (2018); Ngai et al. (2019); Tombe and Zhu (2019); Lagakos et al. (2020)
 2. Unobservable skills and sorting across sectors
 - Beegle et al. (2011); Lagakos and Waugh (2013); Young (2013); Herrendorf and Schoellman (2018); Alvarez (2020); Harmory et al. (2021)
 3. A combination of both?

What We Do

- ▶ Estimate rural-urban migration costs in China using both reduced form and structural methods
- ▶ A unique large panel dataset from China and an identification strategy based on a policy experiment
- ▶ A general equilibrium household model with migration that helps to
 - ▶ interpret the reduced form results, and
 - ▶ quantify the effects of reducing migration costs on the observed sectoral productivity difference, migration, and aggregate productivity

Data and Institutional Background

- ▶ The National Fixed Point Survey (NFP)
 - ▶ An origin based annual panel survey collected by the Chinese Ministry of Agriculture for the period 2003-2013
 - ▶ The NFP surveys around 20,000 households and 80,000 individuals annually from 350 villages in 31 provinces
- ▶ New Rural Pension Scheme (NRPS)
 - ▶ Individual aged 60 or older are eligible to receive the basic pension benefit of 660 RMB (around 108 USD) per year
 - ▶ A staggered roll-out across the country during 2009-2012
 - ▶ The NRPS lowers the migration costs of the younger household members through the eldercare or childcare channels
 - ▶ However, it shouldn't change younger household members' innate abilities
 - ▶ A triple-differences estimation strategy

Graduate Roll-out of NRPS

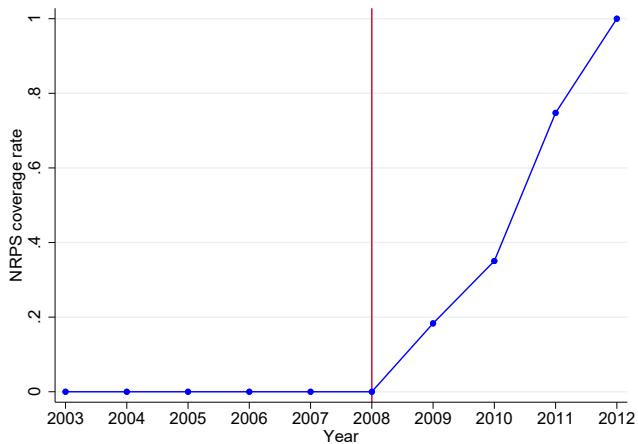


Figure: NRPS coverage rate

Reduced Form Estimation: OLS

Table: Sector of Employment and Daily Wage: OLS

Dep. Var.: In Daily Wage	(1)	(2)	(3)
NonAgri	0.2704*** (0.0141)	0.3080*** (0.0142)	
<i>a-to-na</i> switchers			0.2808*** (0.0173)
<i>na-to-a</i> switchers			-0.1045*** (0.0136)
Sector- <i>na</i> stayers			0.2961*** (0.0165)
Individual controls	N	Y	Y
Province \times Year FE	Y	Y	Y
Village FE	Y	Y	Y
Observations	229,860	229,860	154,607
R-squared	0.4076	0.4175	0.4060

Reduced Form Estimation: FE

Table: Sector of Employment and Daily Wage:
Individual Fixed Effects

Dep. Var.: In Daily Wage	(1)	(2)
NonAgri	0.3672*** (0.0157)	
<i>a-to-na</i> switchers		0.3372*** (0.0197)
<i>na-to-a</i> switchers		-0.0520*** (0.0155)
Sector- <i>na</i> stayers		0.3826*** (0.0200)
Individual and household controls	Y	Y
Province \times Year FE	Y	Y
Individual FE	Y	Y
Observations	229,858	142,209
R-squared	0.6663	0.6742

Reduced Form Estimation: IV

Table: Sector of Employment and Daily Wage: IV Approach

Dep. Var.:	(1) NonAgri First Stage	(2) In Daily Wage Reduced Form	(3) In Daily Wage 2SLS	(4) In Daily Wage OLS	(5) In Daily Wage 2SLS
NonAgri			0.8847** (0.3627)	0.3078*** (0.0142)	
Elder60 × NRPS	0.0410*** (0.0075)	0.0363** (0.0150)		0.0237 (0.0146)	
NRPS	0.0103 (0.0101)	-0.0388 (0.0286)	-0.0479 (0.0303)	-0.0420 (0.0285)	-0.0448 (0.0305)
Elder60	0.0230*** (0.0026)	0.0007 (0.0053)	-0.0197 (0.0120)	-0.0064 (0.0053)	-0.0204* (0.0122)
Hukou Index: below median × NonAgri					1.0384*** (0.3949)
Hukou Index: above median × NonAgri					0.7756** (0.3699)
Individual controls	Y	Y	Y	Y	Y
Province × Year FE	Y	Y	Y	Y	Y
Village FE	Y	Y	Y	Y	Y
Observations	229,860	229,860	229,860	229,860	229,860
R-squared	0.3608	0.4019	—	0.4175	—
Kleibergen-Paap F-Stat	—	—	29.97	—	14.54

Why Does NRPS Affect Rural-Urban Migration?

- ▶ The NRPS provides income transfers to elder household members in the rural areas
- ▶ The income effect is such that elderly members reduce labor supply and increase home production (childcare and elderly care)
- ▶ The increase of home production by elderly allows young members of rural households to reduce their own home production and increase labor supply, which increases the return to migration

Structural Model

Model Setup

- ▶ $N_{r,t}$ Rural households
 - ▶ Each household has two groups of members, parents (o) and adult children (y)
 - ▶ All household members within a group are identical and act collectively.
 - ▶ However, old agents and young agents play a non-cooperative Nash game.
 - ▶ Endogenous labor supply, home production and migration (for young agents) decisions
- ▶ $N_{u,t}$ identical urban workers with exogenous labor supply

Will focus on discussion of rural households next

Human Capital and Household Production

The human capital of young and old agents ($i \in \{y, o\}$) in sector $j \in \{a, na\}$ and time t is a function of observable characteristics X_{it} , sector-specific unobserved ability U_j , and a sector-specific productivity shock e_{jt} ,

$$h_{ijt} = \exp(X_{it}\beta + U_j + e_{jt}).$$

Household members' joint production problem is

$$\max_{l_{oa}, l_{or}, l_{ya}, l_{yr}} \{p_a A_a (h_o l_{oa} + h_y l_{ya})^\alpha + p_{na} A_r (h_o l_{or} + h_y l_{yr})^\alpha\}$$

subject to

$$l_{ij} \geq 0, i = o, y, j = a, r;$$

$$l_{ia} + l_{ir} = l_i, i = o, y.$$

Consumption and Home Production

All members of a household have the same preferences:

$$\mathcal{U}_r = \frac{1}{1-\gamma} (c^r)^{1-\gamma} + G.$$

The private consumption c^r is determined by a non-homothetic CES utility function:

$$\varphi_a^{\frac{1}{\varepsilon}} (c^r)^{\frac{1-\varepsilon}{\varepsilon}} c_a^{\frac{\varepsilon-1}{\varepsilon}} + \varphi_{na}^{\frac{1}{\varepsilon}} c^{\frac{1-\varepsilon}{\varepsilon} \mu} c_{na}^{\frac{\varepsilon-1}{\varepsilon}} = 1. \quad (1)$$

The public consumption G depends on the time input of both old (k_o) and young (k_y) members of the household:

$$G = -\frac{\eta}{1 + \frac{1}{\phi}} \frac{(\xi(n_o - k_o) + n_y - k_y)^{1 + \frac{1}{\phi}}}{(n_o + n_y)^{\delta(1 + \frac{1}{\phi})}}, \delta > 0,$$

Incomes and Migration Costs

Income of old agent:

$$e_o = \frac{h_o l_o}{h_f n_o} y_f + p_a T$$

where T is the potential NRPS pension payment

Income of young agent:

$$e_y = \frac{h_y l_y}{h_f n_y} y_f + \left[\frac{w_{na}}{n_y} h_{na} l_{na} - \left(m_o + m_1 \frac{l_{na}}{n_y} \right) w_{na} h_{na} \right] \chi_{na=1}.$$

There is also an idiosyncratic utility cost of migration for young agents

Table: Estimation Results

α	labor share in Agr	0.84
η	utility of public consumption	1.80
A_a	TFP of Agr	1.56
A_r	TFP of rural NonAgr	1.52
A_{na}	TFP of urban NonAgr	3.91
σ_u^a	std of Agr ability	1.01
σ_u^{na}	std of NonAgr ability	0.48
ρ	correlation of Agr and NonAgr ability	0.65
σ_e^a	std of Agr productivity shock	0.60
σ_e^{na}	std of NonAgr productivity shock	0.46
σ_c	std of migration cost shock	0.20
m_0	lump sum migration cost	0.035
ξ	home productivity efficient of the elderly	5.30
β	coefficients in human capital equation	
β_1	sex	-0.080
β_2	years of schooling	0.042
β_3	age	0.067
β_4	age squared	-0.00072
β_5^a	Agr time trend	0.058
β_5^{na}	NonAgr time trend	0.14
ζ	coefficients in marginal migration costs	
ζ_0	constant	-0.70
ζ_1	sex	0.52
ζ_2	years of schooling	-0.035
ζ_3	age	0.50
ζ_4	age squared	-0.0055
ζ_5	hukou index	-0.20

Table: Model Fit

Moments	Data	Model
Targeted moments		
The average of log daily urban NonAgr earnings	3.488	3.655
The variance of log daily urban NonAgr earnings	0.715	0.709
Regression of log daily urban NonAgr earnings on		
age	0.073	0.071
age squared	-0.001	-0.001
female	-0.103	-0.106
years of education	0.045	0.046
The average of log daily rural Agr earnings	2.951	2.925
The variation of log daily rural Agr earnings	1.002	0.945
Serial correlation in log daily household earnings for rural stayers	0.723	0.752
Serial correlation in log daily household earnings for urban stayers	0.660	0.638
Serial correlation in log daily household earnings for switchers from rural to urban	0.539	0.566
Average migration rate	0.609	0.567
Regression of migration dummy on		
age	-0.055	-0.061
age squared	0.001	0.001
female	-0.135	-0.137
years of education	0.014	0.016
hukou index	0.055	0.057
Linear trend of log daily urban NonAgr earnings	0.145	0.154
Linear trend of log daily rural Agr earnings	0.105	0.097
Average working days of youth in rural for households with migrants	0.281	0.230
Average working days of youth in urban for households with migrants	0.406	0.407
Average working days of youth in rural for households without migrants	0.574	0.566
Average working days of elderly in rural	0.270	0.254
Effect of NRPS on migration rate	0.023	0.023
Moments not targeted		
Effect of NRPS on youth labor supply (rural + urban)	0.104	0.082
Effect of NRPS on elderly labor supply in rural	-0.017	-0.071

Table: Counterfactual

	Migration share	Relative price (P_a/P_{na})	Aggregate real GDP	Aggregate productivity
A. Partial Equilibrium				
No NRPS	0.652	1.000	309.177	27.570
NRPS	0.658	1.000	312.529	27.532
Double NRPS	0.670	1.000	316.382	27.549
Equal transfer	0.646	1.000	306.090	27.478
Hukou reform	0.762	1.000	331.059	28.847
B. Closed Economy				
No NRPS	0.649	1.360	307.853	27.465
NRPS	0.658	1.308	312.529	27.532
Double NRPS	0.675	1.280	317.232	27.599
Equal transfer	0.640	1.363	304.490	27.365
Hukou reform	0.707	1.829	318.577	27.825

Table: Counterfactual: Value-added

	Agr	Rural NonAgr	Migrant	Urban Local	Urban NonAgr
A. Partial Equilibrium					
No NRPS	40.556	6.060	112.130	150.431	262.561
NRPS	41.409	6.188	114.501	150.431	264.932
Double NRPS	41.712	6.233	118.007	150.431	268.438
Equal transfer	40.709	6.083	108.867	150.431	259.298
Hukou reform	33.357	4.984	142.286	150.431	292.718
B. Closed Economy					
No NRPS	42.471	6.346	110.491	150.431	260.922
NRPS	41.409	6.188	114.501	150.431	264.932
Double NRPS	40.192	6.006	119.620	150.431	270.052
Equal transfer	42.759	6.389	106.903	150.431	257.334
Hukou reform	55.138	8.239	122.829	150.431	273.260

Table: Counterfactual: Effective Labor

	Agr	Rural NonAgr	Migrant	Urban Local	Urban NonAgr
A. Partial Equilibrium					
No NRPS	2.808	0.420	2.931	5.056	7.987
NRPS	2.873	0.429	2.992	5.056	8.049
Double NRPS	2.910	0.435	3.083	5.056	8.139
Equal transfer	2.816	0.421	2.846	5.056	7.902
Hukou reform	2.365	0.353	3.702	5.056	8.758
B. Closed Economy					
No NRPS	2.841	0.424	2.887	5.056	7.943
NRPS	2.873	0.429	2.992	5.056	8.049
Double NRPS	2.881	0.430	3.127	5.056	8.183
Equal transfer	2.850	0.426	2.794	5.056	7.851
Hukou reform	2.778	0.415	3.200	5.056	8.257

Table: Counterfactual: Labor Productivity

	Agr	Rural NonAgr	Migrant	Urban Local	Urban NonAgr	NonAgr
A. Partial Equilibrium						
No NRPS	14.445	14.445	38.260	29.752	32.874	31.954
NRPS	14.411	14.411	38.263	29.752	32.916	31.979
Double NRPS	14.334	14.334	38.273	29.752	32.980	32.034
Equal transfer	14.456	14.456	38.249	29.752	32.812	31.884
Hukou reform	14.106	14.106	38.434	29.752	33.422	32.673
B. Closed Economy						
No NRPS	14.950	14.950	38.269	29.752	32.847	31.940
NRPS	14.411	14.411	38.263	29.752	32.916	31.979
Double NRPS	13.951	13.951	38.257	29.752	33.002	32.050
Equal transfer	15.001	15.001	38.257	29.752	32.779	31.864
Hukou reform	19.849	19.849	38.379	29.752	33.096	32.462

Table: Counterfactual: APG

	NonAgr/Agr	Migrant/Agr	Urban NonAgr/Agr	Rural NonAgr/Agr	Underlying
A. Partial Equilibrium					
No NRPS	2.212	2.649	2.276	1.000	1.888
NRPS	2.219	2.655	2.284	1.000	1.888
Double NRPS	2.235	2.670	2.301	1.000	1.888
Equal transfer	2.206	2.646	2.270	1.000	1.888
Hukou reform	2.316	2.725	2.369	1.000	1.888
B. Closed Economy					
No NRPS	2.136	2.560	2.197	1.000	1.824
NRPS	2.219	2.655	2.284	1.000	1.888
Double NRPS	2.297	2.742	2.366	1.000	1.938
Equal transfer	2.124	2.550	2.185	1.000	1.821
Hukou reform	1.635	1.934	1.667	1.000	1.357

Table: Counterfactual: Average human capital

	Agr workers	Migrants	Urban locals
A. Partial Equilibrium			
No NRPS	2.579	2.878	8.260
NRPS	2.594	2.860	8.260
Double NRPS	2.609	2.865	8.260
Equal transfer	2.596	2.867	8.260
Hukou reform	2.505	2.886	8.260
B. Closed Economy			
No NRPS	2.585	2.879	8.260
NRPS	2.594	2.860	8.260
Double NRPS	2.605	2.868	8.260
Equal transfer	2.602	2.874	8.260
Hukou reform	2.587	2.895	8.260

Conclusion

- ▶ Use a nationally representative long-term panel dataset to analyze the effects of migration costs and sorting on the APG in China
- ▶ Use a policy experiment, the NRPS, as an IV to estimate the migration costs
- ▶ A general equilibrium household model with migration to shed light on the impact of the NRPS on migration
- ▶ We also use the GE model to conduct counterfactual policy simulations
- ▶ Structural estimation results reveal substantial migration costs and a large underlying sectoral productivity difference
- ▶ Implementing a *hukou* reform by setting the *hukou* index in all regions of China to the level of the most liberal region has quantitatively significant effect on migration, APG and aggregate productivity