

Migration Costs, Sorting, and 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 \implies 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 observable cross-sectional 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); Hicks et al. (2017); Herrendorf and Schoellman (2018); Alvarez (2020)

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 2. Unobservable skills and sorting across sectors
 - ▶ Beegle et al. (2011); Lagakos and Waugh (2013); Young (2013); Hicks et al. (2017); Herrendorf and Schoellman (2018); Alvarez (2020)
- ▶ We quantify the contributions of both sources to the observed APG: (i) underlying nominal labor productivity gap, (ii) barriers of switching sectors, and (iii) sorting
- ▶ With a unique large panel dataset from China and an instrumentation strategy based on a policy experiment

Data and Policy Experiment

- ▶ **Data:** National Fixed Point Survey (NFP)
 - ▶ An origin based annual panel survey collected by the Chinese Ministry of Agriculture
 - ▶ The data in our study covers around 80,000 individuals over 20,000 households from more than 350 villages in 31 provinces during 2003-2012

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- ▶ **Policy experiment:** 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 rollout 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

Empirical Analysis: Overview

- ▶ Two approaches:
- 1. Reduced form analysis: (less dependent on functional form assumptions) OLS, FE, IV and control function (CF) estimates
 - ▶ Interpretation through the lenses of a generalized Roy model
 - ▶ Both OLS and FE are biased estimates of APG (and their relative size is ambiguous)
 - ▶ IV: average migration cost of compliers
 - ▶ CF: Average treatment effect (ATE) \implies underlying nominal productivity gap

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 2. Structural estimation of a general equilibrium Roy model
 - ▶ Consistent estimates from the two approaches
 - ▶ Decomposition of APG: migration costs and sorting
 - ▶ Impacts of counterfactual policies of changing migration costs on underlying nominal sectoral productivity difference, reallocation, etc.

Main Empirical Findings

Reduced Form Estimation

Dep. Var.:	(1) In Annual Earnings OLS	(2) In Annual Earnings FE	(3) NonAgri FS	(4) In Annual Earnings RF	(5) In Annual Earnings 2SLS	(6) In Annual Earnings OLS	(7) In Annual Earnings CF
NonAgri _{it}	0.6814*** (0.0119)	0.6916*** (0.0137)			0.7862** (0.3789)	0.6814*** (0.0119)	0.4636*** (0.0334)
Elder60 _{it} × NPRS _{it}			0.0401*** (0.0086)	0.0315** (0.0149)		0.0042 (0.0150)	
NRPS _{it}			0.0019 (0.0097)	-0.0506* (0.0288)	-0.0521* (0.0280)	-0.0519* (0.0279)	
Elder60 _{it}			0.0212*** (0.0026)	0.0404*** (0.0058)	0.0237** (0.0116)	0.0259*** (0.0057)	
Individual and household controls	Y	Y	Y	Y	Y	Y	Y
Province × Year FE	Y	Y	Y	Y	Y	Y	Y
Village FE	Y	Y	Y	Y	Y	Y	Y
Individual FE	N	Y	N	N	N	N	N
Control functions	N	N	N	N	N	N	Y
Observations	234,025	234,025	234,031	234,025	234,025	234,025	232,961
R-squared	0.3904	0.6810	0.3486	0.3272	0.1618	0.3904	0.3381
Kleibergen-Paap F-Stat	—	—	—	—	21.52	—	—

- ▶ OLS and FE estimates are statistically similar, in contrast with Hicks et al. (2017) and Alvarez (2020). The relative size hinges on the joint distribution of the two dimensional abilities

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- ▶ The triple-differences estimates indicate that the introduction of the NRPS induces more workers to migrate to the non-agricultural sector
 ⇒ higher earnings

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- ▶ The baseline migration costs faced by the NRPS induced switchers is at least 55% of their potential non-agri income
- ▶ The mediation analysis supports the exclusion restriction of the IV

Main Empirical Findings

Reduced Form Estimation

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- ▶ The CF estimate captures ATE and reveals the nominal sectoral productivity difference, i.e., $R = \ln(p_{na}A_{na}) - \ln(p_aA_a)$ (Card, 2020; Cornelissen et al., 2016)

Main Empirical Findings

Structural Estimation and Counterfactuals

- ▶ Structurally estimate a generalized Roy model based on the simulated MLE method using the panel data
 - ▶ permanent abilities follow a joint normal distribution
 - ▶ heterogeneous migration cost
 - ▶ idiosyncratic shocks to migration costs and sectoral income that are i.i.d. across individuals and time
 - ▶ NRPS and Hukou policies as exclusive migration cost shifters

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 - ▶ permanent abilities follow a joint normal distribution
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 - ▶ idiosyncratic shocks to migration costs and sectoral wage that are i.i.d. across individuals and time
 - ▶ NRPS and Hukou policies as exclusive migration cost shifters
- ▶ Embed this Roy model into a general equilibrium model featured by:
 - ▶ Three sectors: urban non-agri, rural non-agri, and rural agri
 - ▶ Non-homothetic preference
 - ▶ In GE, the nominal productivity gap $R = \ln(p_{na}A_{na}) - \ln(p_aA_a)$ changes because prices change in response to policy shocks

Main Empirical Findings

Structural Estimation and Counterfactuals

Parameter Estimates (Human Capital)

	Agri	NonAgri
Log price for human capital	8.621 (4.38)	9.206 (3.78)
Human capital – year trend	0.089 (4.52)	
Human capital – male	0.239 (3.62)	
Human capital – years of education	0.027 (8.51)	
Human capital – age	0.084 (3.92)	
Human capital – age square	-0.001 (7.81)	
Sd of wage shock	0.780 (6.20)	0.392 (4.64)
Sd of ability	0.555 (4.53)	0.528 (4.92)
Correlation between abilities	0.943 (3.72)	

Notes: t-statistics in parentheses.

- ▶ The nominal sectoral productivity gap is **0.585** = (9.206 – 8.621) (v.s. 0.464 from the control function estimation)
- ▶ $\sigma_a > \sigma_{na}$
- ▶ Comparative advantage aligns with absolute advantage in both sectors

Main Empirical Findings

Structural Estimation and Counterfactuals

Parameter Estimates (Migration Costs)

	Migration cost
Constant	0.715 (5.42)
Hukou Index	-0.769 (6.16)
Male	-0.106 (4.28)
Years of education	-0.014 (7.04)
Age	0.009 (7.78)
Age square	0.000004 (4.86)
NRPS	-0.050 (3.98)
Elderly above 60	-0.021 (4.64)
NRPS * elderly	-0.061 (5.50)
Sd of migration cost shock	0.103 (4.37)

Notes: t-statistics in parentheses.

- ▶ Workers with average characteristics face migration cost **0.715** (v.s. 0.786 from the IV estimation)
- ▶ The introduction of NRPS lowers migration costs, especially among workers living with an elderly age 60 or above
- ▶ More liberal Hukou policies in destination regions lower migration costs

Main Empirical Findings

Structural Estimation and Counterfactuals

Counterfactual Experiments: the NRPS and Hukou Policies

Migration costs	Partial equilibrium		General equilibrium		
	Migrant worker share (π_{na})	Observed APG	Underlying APG ($\ln R$)	Migrant worker share (π_{na})	Observed APG
Baseline (in year 2012)	0.387	0.538	0.585	0.387	0.538
Without the NRPS	0.297	0.550	0.639	0.377	0.590
Hukou index in 2003	0.331	0.546	0.619	0.381	0.576
Without the NRPS and Hukou index in 2003	0.247	0.557	0.672	0.369	0.624
Set hukou index to the most liberal region	0.693	0.477	0.410	0.422	0.359

- ▶ Policy shocks induce sector switches, which changes prices in GE
 \implies alters the underlying nominal productivity gap $\ln R$
- ▶ This indirect (price) effect offsets the direct effect of a change in the migration costs
- ▶ A large proportion of the observed APG in China can be attributed to the large underlying productivity gap and high migration barriers