Productivity As If Space Mattered: An Application to Factor Markets Across China

Wenya Cheng, John Morrow and Tong Tacharoen

Christmas Day, 2012

Father's Introduction

- Thank you for welcoming us to HSE and St. Petersburg!
- Extremely globalized series of talks this week:
  - John (US, lives in London)
  - Swati (India, lives in London)
  - Jim (Taiwan, lives in Japan)
- ...and who is a better icon for traveling the whole world than Santa?
- (Sorry if Father Frost doesn't travel much, but then he has Snegurochka.)

Introduction Part 1

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  - Differences between factor markets, especially for labor, are stark.
  - E.g. economies undergoing urbanization, or policies which hamper relocation. [Lewis, 1954]
  - Even US labor market, considered relatively fluid, exhibits high migration costs. [Kennan and Walker, 2011].
  - Institutional mobility constraints (E.g. *hukou* system in China), exacerbate these differences.

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- To pursue this: model and structurally estimate the role of distinct regional labor markets in firm input use, location and productivity.

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  - Skill mix is an important determinant of productivity.
  - "What you can make depends on who you work with."
  - This in turn depends on firm technology and labor supply.

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- Today:
  - Model hiring choices of firms given local supply conditions.
  - Develop method to identify industry technologies.
  - Estimate firm behavior across regional factor markets in China.

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  - Imperfect substitutability between types of workers (Bowles [1970]).
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  - Helps explain productivity differences via local factor markets.
- The methodology is simple and relies on a two stage OLS procedure.
  - 1^{st} stage OLS: local demand using firm employment and region data.
  - 2^{nd} stage: incorporate regional costs into production estimation.
  - Illustrate w/ simulation + Chinese Manufacturing/Census data.

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- GE model describing:
  - Firm hiring in terms of local distribution of worker types and wages.
  - Consequent substition into other (non-labor) inputs.
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- Low labor cost regions attract more industry activity per capita.
- Performance characteristics (survival, growth) more dependent on productivity which accounts for regional effects.

Outline

Related Literature

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- Empirical work consistent with theory.
  - Iranzo et al. [2008]: Italian E-E matched data. An increase in firm-level skill dispersion is associated with higher TFP.
  - Parrotta et al. [2011]: Danish E-E matched data. Employee education diversity -> productivity (industry and ownership FEs).
  - Bombardini et al. [2011]: Literacy across 29 countries. Dispersed skill distribution -> specialize in low skill complementarity industries.

Relation to Work on China

- Fits within growing literature on Chinese productivity.
- Ma et al. [2011] exporting positively correlated with TFP, exporting ex post increases TFP.
- Brandt et al. [2009] new entry accounts for two thirds of TFP growth. This dominates factor accumulation.
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- This paper: another dimension of productivity determinants.
- May interact with above mechanisms.

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Model Overview

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  - L is labor power produced from $\mathbb{S}$ skill types (think education bins).

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  - L is labor power produced from $\mathbb{S}$ skill types (think education bins).
- In region R, there are region specific
  - Distribution of worker types $a_R = (a_{R,1}, \ldots, a_{R,\mathbb{S}})$
  - Wages $w_R = (w_{R,1}, \ldots, w_{R,\mathbb{S}})$.

Human Capital by Locality

- Each industry has a technology for combining labor into teams:

$$L \equiv \left(H_1^{\theta_T} + H_2^{\theta_T} + \ldots + H_S^{\theta_T} \right)^{1/\theta_T} .$$

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- Type specific human capital given by

$$H_i = N \cdot a_{R,i} \underline{m}_{T,i} \int_{\underline{h}_i}^{\infty} h d\Psi.$$

Where Tech T implies human capital $\underline{m}_T = \left(\underline{m}_{T,1}, \ldots, \underline{m}_{T,\mathbb{S}}\right)$.

Trade-offs Between Workers: Role of Skill Mix

- Think about trading offs between types: $L = \left(\sum H_i^{\theta_T} \right)^{1/\theta_T}$.
  - $\theta_T > 1$: More dependent on singular sources of HK. (Submodular)
  - $\theta_T < 1$: Ideal workforce is a mix of all types. (Supermodular)

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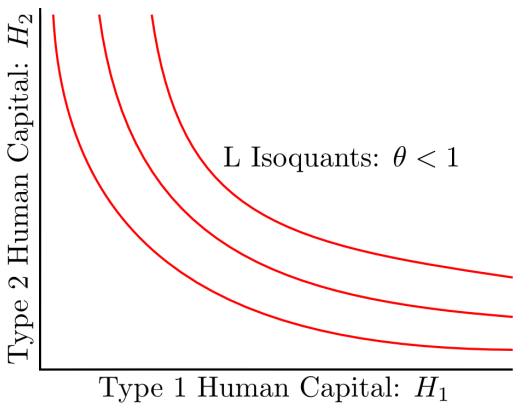
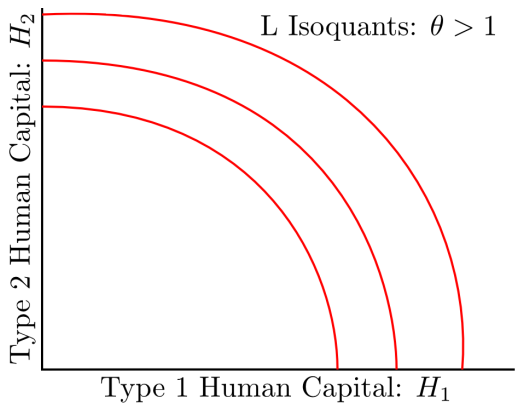


Supermodular Production in H Space



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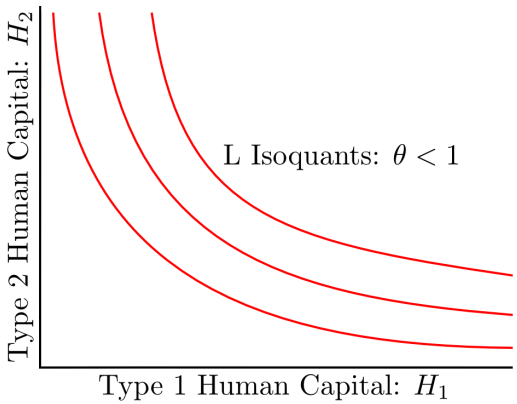

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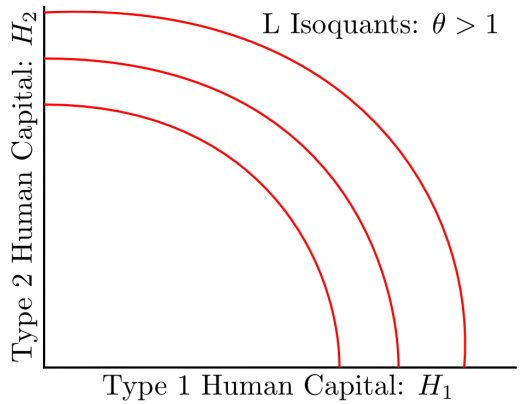

Submodular Production in H Space

- Problem for each case in to explain data in isolation:
  - Supermodular: always have skill mix tending towards same frequencies, i.e. $(1/4, 1/4, 1/4, 1/4)$.
  - Submodular: Why not hire all of one type? i.e. $(0, 0, 1, 0)$.

Trade-offs, Skill Mix and Search

- Solution: change the frame of reference for isoquants...
- With search, always'a few good matches', so all types are hired.

Proposition. If $\beta^T \equiv \theta^T + k - k \cdot \theta^T > 0$ then it is optimal for a firm to hire all types of workers.

- Interpretation: $\mathrm{E}[h] = k/(k-1) > \theta^T$. Tail thick enough.
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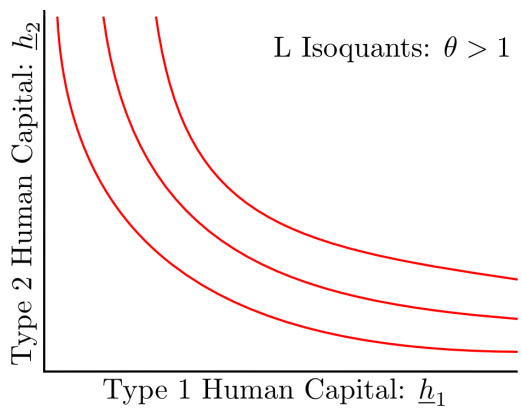

Submodular Production in $\underline{h}$ Space

- Trade-offs between minimum thresholds $\underline{h} = (\underline{h}_1, \ldots, \underline{h}_S)$

Unit Costs By Region

- Solve for unit cost of making $L = 1$ based on regional market composed of:
  - Human capital $\underline{m}^T = (\underline{m}_1^T, \ldots, \underline{m}_S^T)$.
  - Wages $w_R = (w_{R,1}, \ldots, w_{R,S})$.
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- Then unit costs by region are

$$c_R^T = \left[\sum_i \left[a_{R,i} \left(\underline{m}_i^T \right)^k w_{R,i}^{1-k} / f\left(k-1\right) \right]^{\theta^T/\beta^T} \right]^{\left(\beta^T/\theta^T\right)/(1-k)}.$$

- c_R^T: cost of one unit of labor L.
- Note the Pareto k, the technology θ^T and regional a_R and w_R.

Closing The Model

- Total quantities produced are

$$F_j^T(M,K,L) \equiv \eta_j^{-1} \cdot \left(M_R^T\right)^{\alpha_M^T} \left(K_R^T\right)^{\alpha_K^T} \left(L_R^T\right)^{\alpha_L^T}.$$

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- Firm location satisfies

$$\text{Spatial Zero Profit Condition}: \quad \mathrm{E}\left[\pi_{Rj}^T\right] = F_e, \quad \forall R, T.$$

- **Proposition.** Within an industry, regions with lower labor costs have more firms per capita.

Outline

Estimating Equations: First Stage

- First stage: LHS from firm data, RHS from Census, etc.

$$\underbrace{\ln s_{R,ij}^{T}}_{\text{Share Hired}} = -\frac{k}{\beta^{T}} \underbrace{\ln w_{R,i}}_{\text{Wages}} + \frac{\theta^{T}}{\beta^{T}} \underbrace{\ln a_{R,i}}_{\text{Supply}} + \frac{k\theta^{T}}{\beta^{T}} \underbrace{\ln \underline{m}_{ij}^{T}}_{\text{HK}} + \frac{\theta_{T}}{\beta^{T}} \underbrace{\ln \widetilde{c}_{RT}^{k} / f\left(k-1\right)}_{\text{Messy FE}}$$

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- Firm idiosyncratic factors may influence usefulness of types:

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- Comparative statics & (local) isoquants:

$$d \ln s_{R,ij}^T / d \ln w_{R,i} < 0,$$
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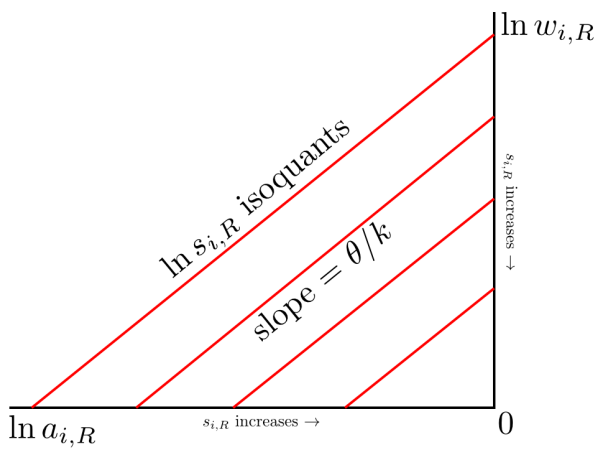

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- Estimates: $\widehat{\theta^T}$, $\widehat{k}$, $\left\{\widehat{\underline{m}_i^T / \underline{m}_S^T}\right\}$ and $\left\{\widehat{\gamma_i^T}\right\}$.
  - Regional data: $\{a_R\}, \{w_R\}$.
  - Unit cost function ($|R|$ is # of regions):

$$\Delta \ln c_{Rj}^T \equiv \mathrm{E}\left[\ln c_{Rj}^T | R, T, \text{Controls}_j\right] - \mathrm{E}\left[\ln c_{Rj}^T | T\right]$$

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- Second Stage: All from firm data but regional cost $\widehat{\Delta \ln c_{Rj}^T}$.

$$\Delta \ln Y_j = \frac{\alpha_M}{1-\alpha_L} \cdot \Delta \ln M_j + \frac{\alpha_K}{1-\alpha_L} \cdot \Delta \ln K_j - \frac{\alpha_L}{1-\alpha_L} \cdot \widehat{\Delta \ln c_{Rj}^T}$$

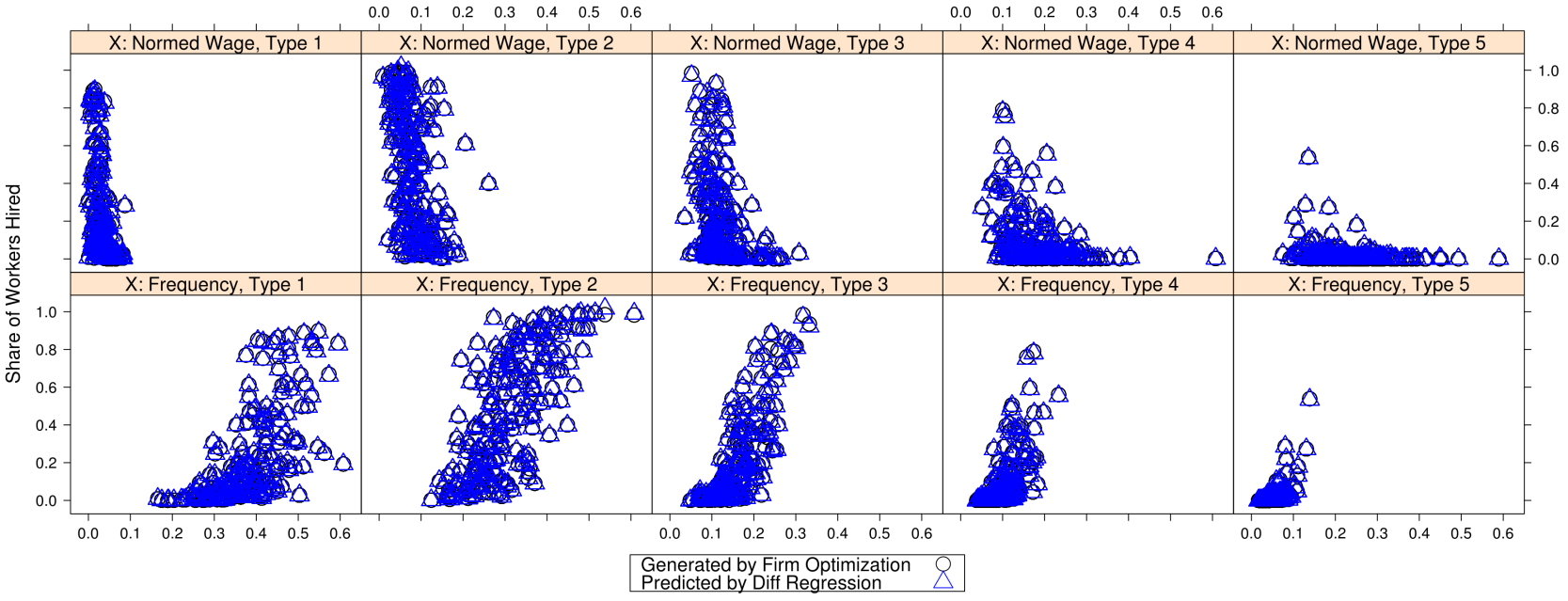
- Simulation shows this method + bootstrap pretty good

Simulation and Estimation

Variable	Description	Value
θ_T	Technological parameter.	2
k	Pareto shape parameter.	1.5
$\{\underline{m_i}\}$	Human capital shifters.	$\{4, 8, 12, 16, 20\}$
$\{w_{R,i}\}$	Regional wages by education.	$\sim$LogNormal $\mu = (12, 24, 36, 48, 60)$, $\sigma = 1/3$.
$\{a_{R,i}\}$	Regional educational freq.	$\sim$LogNormal $\mu = (.4, .3, .15, .1, .05)$, $\sigma = 1/3$. Scaled to sum to one.
K, M	Firm capital and materials.	$\sim$LogNormal with $\mu = 1$, $\sigma = 1$.
L	Amount of L employed by firm.	Profit maximizing given K, M and region.
α_M, α_K, α_L	Cobb-Douglas Prod Params.	$\alpha_M = 1/6$, $\alpha_K = 1/3$, $\alpha_L = 1/2$.
Control	Explanatory output variable.	$\sim$LogNormal with $\mu = 0$, $\sigma = 1$.
Coeff	Coeff on Control Variable	Control Coeff$= \pi$.
$\{\omega_j\}$	Firm idiosyncratic wage costs.	$\sim$LogNormal with $\mu = 0$, $\sigma = .1$.
Error	Idiosyncratic Production Shocks.	$\sim$LogNormal with $\mu = 0$, $\sigma = 1/2$.

Simulation conducted for 200 regions with 20 firms per region.

How does it perform?



Second State Estimates: Production Parameters

Parameter	**Estimate**	**Std Err**	**Predicted**
$\alpha_M / (1-\alpha_L)$	.3298	.0079	.3333
$\alpha_K / (1-\alpha_L)$	.6680	.0080	.6667
$-\alpha_L / (1-\alpha_L)$	-.9303	.0748	-1
Control Coeff	3.148	.0079	3.141
R-squared:	.9767		

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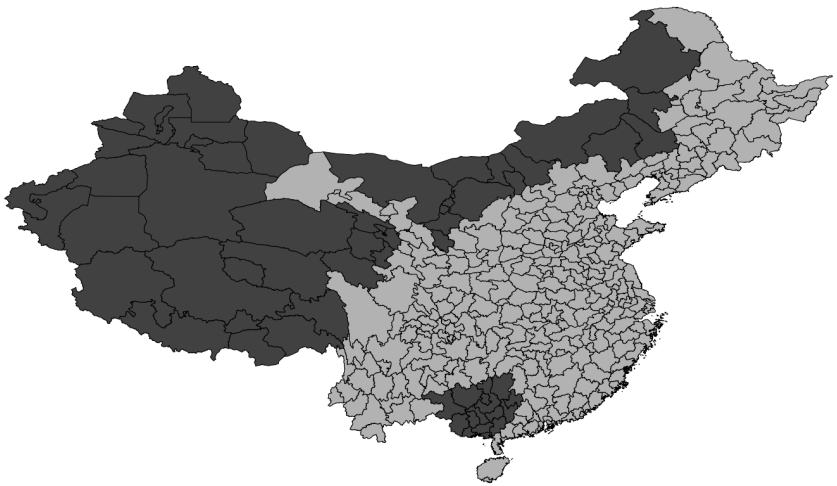


- 33 Provinces, excluding:
  - 5 Autonomous
  - 1 Non-Han
- 345 Prefectures, excluding:
  - 53 Autonomous
  - 8 Non-Han

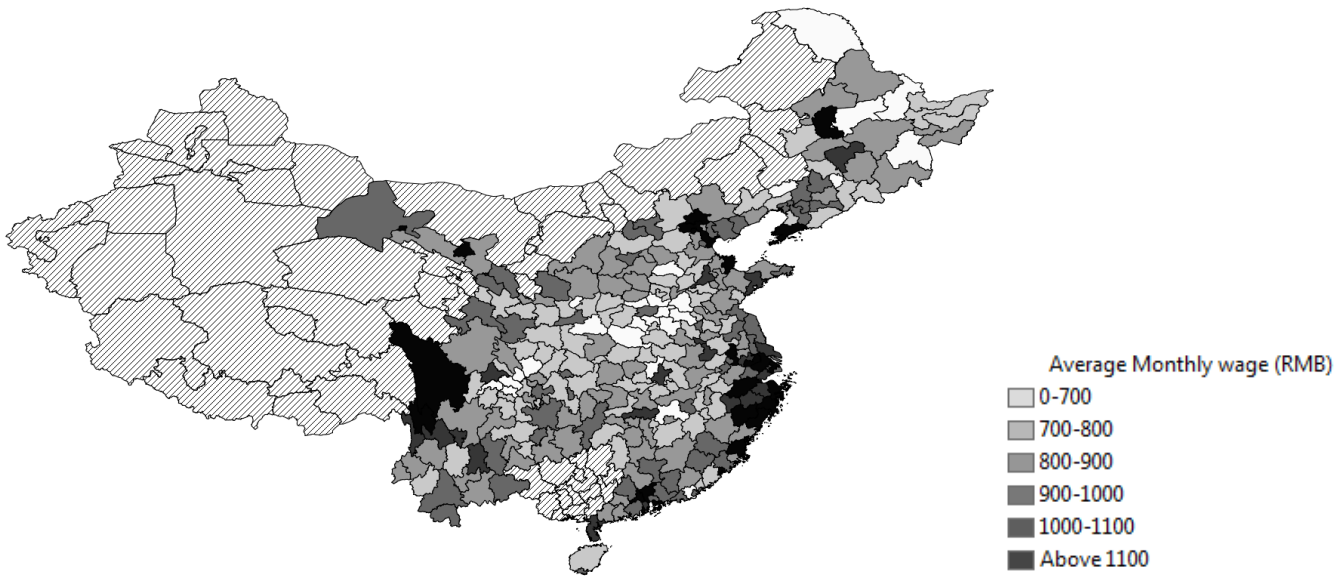
Demographics in China InfoGraphic

- Existing distribution of workers: no stance.

Regional Variation in Income

- Regional wage dispersion of workers: $w_R = (w_{R,1}, \ldots, w_{R,S})$.

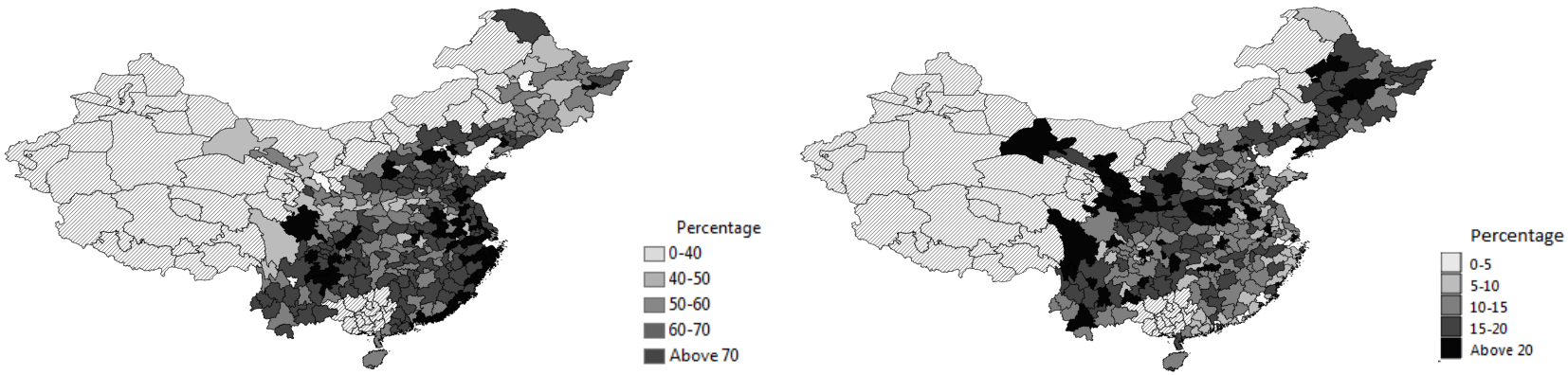
Figure: Average Monthly Income of Employees (2005)



Regional Variation in Education

- Regional distributions of worker types $a_R = (a_{R,1}, \ldots, a_{R,\mathbb{S}})$.

Figure: Low and High Educational Attainment Across China (2005)



(a) % Labor Force $\leq$Junior High School (b) % Labor Force $\geq$Junior College

Outline

First Stage (General Machinery)

Primary Variables	ln (% Hired)
ln $(w_{R,i})$	-2.687***
ln $(a_{R,i})$	1.794***
$\underline{m}_1$ ($\leq$Junior HS:Female)	-10.170***
$\underline{m}_2$ ($\leq$Junior HS:Male)	-6.171***
$\underline{m}_3$ (Senior High School)	-3.180***

Regional Controls	
$\underline{m}_1$*% Non-Ag Hukou	-5.957***
$\underline{m}_2$*% Non-Ag Hukou	-3.072***
$\underline{m}_3$*% Non-Ag Hukou	-3.218***
$\underline{m}_4$*% Non-Ag Hukou	-7.026***

Firm Controls	
$\underline{m}_1$ * Urban Dummy	-1.384***
$\underline{m}_2$ * Urban Dummy	-0.980***
$\underline{m}_3$ * Urban Dummy	0.427***
$\underline{m}_4$ * Urban Dummy	2.336***
$\underline{m}_1$*% Foreign Equity	-2.448***
$\underline{m}_2$*% Foreign Equity	-1.864***
$\underline{m}_3$*% Foreign Equity	0.311***
$\underline{m}_4$*% Foreign Equity	3.847***
$\underline{m}_1$ * ln (Firm Age)	0.934***
$\underline{m}_2$ * ln (Firm Age)	0.403***
$\underline{m}_3$ * ln (Firm Age)	0.143***
$\underline{m}_4$ * ln (Firm Age)	0.351***

Observations: 62,908. R^2 : 0.139 | Includes Regional Fixed Effects

Standard errors in parentheses. Significance: *** p<.01, ** p<.05, * p<.1.

First Stage Primitive Estimates

Industry	k	Std Err	θ^T	Std Err	β^T	Std Err
Beverages						
Electrical Equipment						
Food Manufacturing						
General Machinery	2.50	(0.14)	1.22	(0.03)	0.68	(0.03)
Iron and Steel						
Leather & Fur						
Med & Prec Equip						
Metal Products						
Non-ferrous Metal						
Non-metallic Products						
Paper						
Plastic						
Printing						
Radio TV PC & Comm						
Rubber						
Specific Machinery						
Textile						
Transport Equipment						
Wood						

First Stage Primitive Estimates

Industry	k	Std Err	θ^T	Std Err	β^T	Std Err
Beverages	2.12	(0.38)	1.24	(0.08)	0.75	(0.08)
Electrical Equipment	2.60	(0.15)	1.22	(0.02)	0.65	(0.03)
Food Manufacturing	1.59	(0.36)	1.28	(0.13)	0.86	(0.10)
General Machinery	2.50	(0.14)	1.22	(0.03)	0.68	(0.03)
Iron and Steel	3.21	(0.56)	1.00	(0.06)	1.02	(0.15)
Leather & Fur	2.15	(0.70)	0.76	(0.14)	1.24	(0.24)
Med & Prec Equip	2.34	(0.18)	1.43	(0.05)	0.43	(0.03)
Metal Products	3.20	(0.24)	1.10	(0.03)	0.77	(0.05)
Non-ferrous Metal	2.89	(0.38)	1.15	(0.05)	0.72	(0.08)
Non-metallic Products	2.02	(0.16)	1.25	(0.04)	0.75	(0.03)
Paper	6.25	(3.82)	0.73	(0.11)	2.48	(2.08)
Plastic	3.51	(0.29)	1.08	(0.03)	0.81	(0.06)
Printing	3.93	(0.60)	1.04	(0.04)	0.89	(0.12)
Radio TV PC & Comm	2.21	(0.14)	1.41	(0.04)	0.51	(0.03)
Rubber	1.63	(0.61)	1.15	(0.19)	0.93	(0.17)
Specific Machinery	1.63	(0.18)	1.43	(0.07)	0.74	(0.05)
Textile	3.73	(0.36)	0.95	(0.03)	1.15	(0.09)
Transport Equipment	1.26	(0.24)	1.38	(0.13)	0.92	(0.09)
Wood	1.52	(0.22)	1.62	(0.17)	0.71	(0.09)

Unit Labor Costs Across China

- Substantial regional heterogeniety by region and industry.
- Figure: Unit cost/Min unit cost for General Purpose Machinery.

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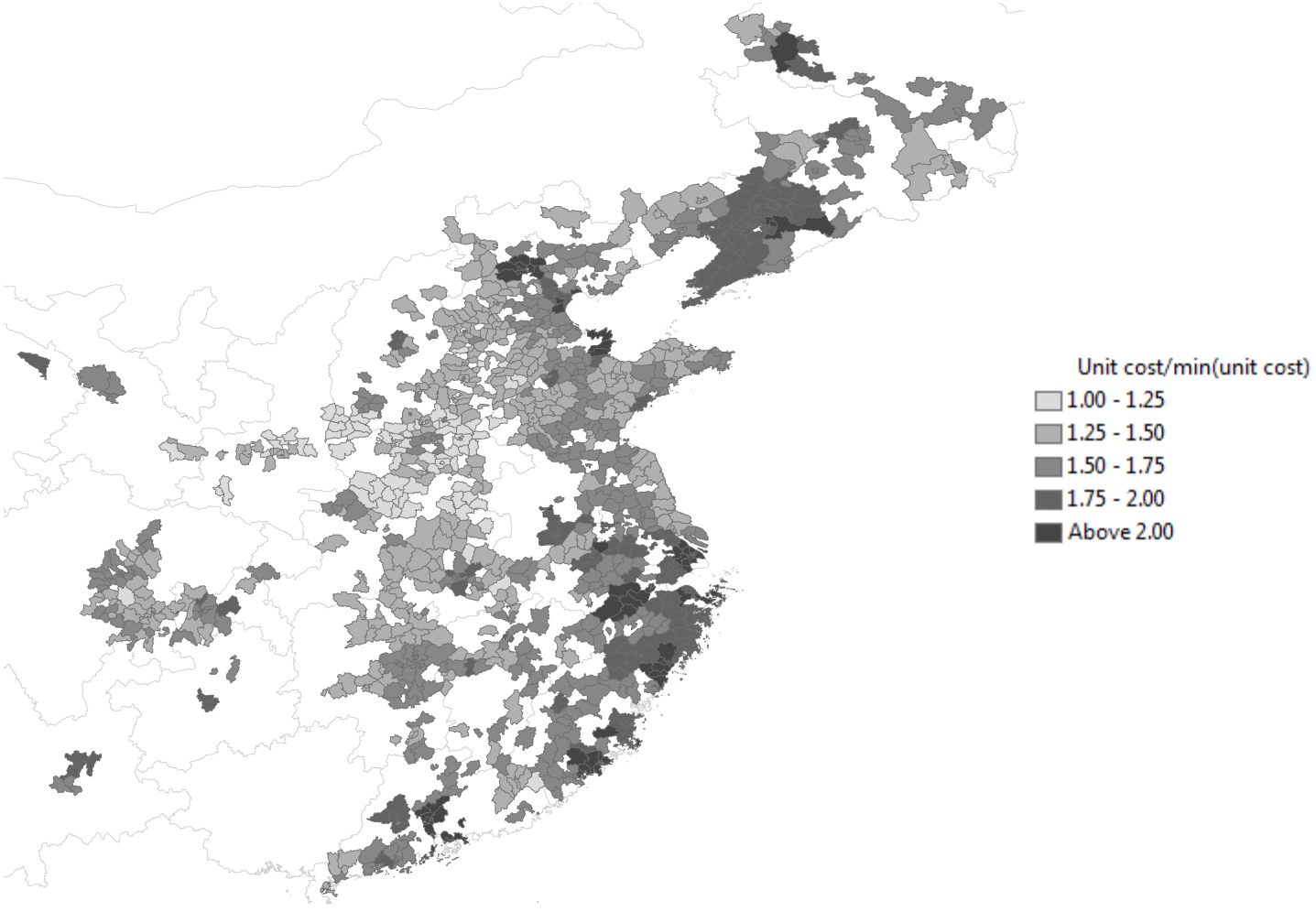

Dependent Variable: ln (Value Added per Capita)							
Industry	$\ln\left(c_R^T\right)$	SE	Port Dist	SE	Const	SE	R^2
Beverages	.	.	.	.	.	.	.
Electrical Equipment	.	.	.	.	.	.	.
Food Manufacturing	.	.	.	.	.	.	.
General Machinery	-0.705^c	(.40)	-1.314^a	(.34)	19.68^a	(4.9)	.11
Iron and Steel	.	.	.	.	.	.	.
Leather & Fur	.	.	.	.	.	.	.
Med & Prec Equip	.	.	.	.	.	.	.
Metal Products	.	.	.	.	.	.	.
Non-ferrous Metal	.	.	.	.	.	.	.
Non-metallic Products	.	.	.	.	.	.	.
Paper	.	.	.	.	.	.	.
Plastic	.	.	.	.	.	.	.
Printing	.	.	.	.	.	.	.
Radio TV PC & Comm	.	.	.	.	.	.	.
Rubber	.	.	.	.	.	.	.
Specific Machinery	.	.	.	.	.	.	.
Textile	.	.	.	.	.	.	.
Transport Equipment	.	.	.	.	.	.	.
Wood	.	.	.	.	.	.	.

Note: a, b and c denote 1, 5 and 10% significance level respectively.

Dependent Variable: ln (Value Added per Capita)							
Industry	$\ln\left(c_R^T\right)$	SE	Port Dist	SE	Const	SE	R^2
Beverages	-0.696^b	(.27)	-0.122	(.20)	18.96^a	(3.4)	.03
Electrical Equipment	-0.057	(.40)	-1.567^a	(.26)	11.98^b	(4.8)	.22
Food Manufacturing	-0.553^b	(.23)	-0.397^b	(.18)	15.49^a	(2.2)	.04
General Machinery	-0.705^c	(.40)	-1.314^a	(.34)	19.68^a	(4.9)	.11
Iron and Steel	-1.245^b	(.57)	-0.576^a	(.19)	16.30^a	(2.2)	.06
Leather & Fur	-1.255^a	(.25)	-1.028^b	(.42)	25.81^a	(3.1)	.27
Med & Prec Equip	-0.267	(.30)	-1.135^b	(.43)	13.13^a	(3.4)	.07
Metal Products	-0.236	(.46)	-1.239^a	(.26)	13.24^a	(4.9)	.14
Non-ferrous Metal	-1.977^a	(.54)	-0.468^c	(.28)	27.29^a	(4.6)	.10
Non-metallic Products	-0.827^a	(.29)	-0.910^a	(.16)	20.89^a	(3.4)	.11
Paper	-0.911^a	(.20)	-0.320	(.25)	20.04^a	(2.1)	.12
Plastic	-0.556	(.35)	-1.406^a	(.22)	16.86^a	(4.0)	.22
Printing	0.103	(.66)	-0.123	(.26)	8.54	(7.1)	.01
Radio TV PC & Comm	-0.212	(.37)	-0.741^b	(.33)	13.92^a	(4.6)	.04
Rubber	-0.424^c	(.22)	-0.470	(.40)	14.06^a	(2.1)	.06
Specific Machinery	-0.316^c	(.18)	-0.680^a	(.19)	14.74^a	(2.3)	.07
Textile	-0.934^a	(.27)	-1.168^a	(.15)	19.70^a	(2.4)	.18
Transport Equipment	-0.105	(.10)	-1.119^a	(.25)	12.69^a	(1.3)	.10
Wood	-2.234^a	(.34)	-1.038^a	(.27)	47.02^a	(5.6)	.20

Note: a, b and c denote 1, 5 and 10% significance level respectively.

Second Stage Results

Industry	α_L	Std Dev	α_K	Std Dev	α_M	Std Dev
Beverages						
Electrical Equipment						
Food Manufacturing						
General Machinery	0.17	(0.02)	0.12	(0.003)	0.60	(0.01)
Iron and Steel						
Leather & Fur						
Med & Prec Equip						
Metal Products						
Non-ferrous Metal						
Non-metallic Products						
Paper						
Plastic						
Printing						
Radio TV PC & Comm						
Rubber						
Specific Machinery						
Textile						
Transport Equipment						
Wood						

Second Stage Results

Industry	α_L	Std Dev	α_K	Std Dev	α_M	Std Dev
Beverages	0.13	(0.05)	0.10	(0.007)	0.70	(0.04)
Electrical Equipment	0.25	(0.01)	0.14	(0.001)	0.47	(0.00)
Food Manufacturing	0.14	(0.08)	0.09	(0.009)	0.70	(0.06)
General Machinery	0.17	(0.02)	0.12	(0.003)	0.60	(0.01)
Iron and Steel	0.40	(0.06)	0.07	(0.010)	0.48	(0.05)
Leather & Fur	0.10	(0.11)	0.13	(0.017)	0.59	(0.07)
Med & Prec Equip	0.20	(0.01)	0.16	(0.003)	0.43	(0.01)
Metal Products	0.24	(0.01)	0.14	(0.001)	0.46	(0.00)
Non-ferrous Metal	0.40	(0.03)	0.08	(0.005)	0.43	(0.02)
Non-metallic Products	0.20	(0.02)	0.07	(0.002)	0.61	(0.02)
Paper	0.18	(0.36)	0.14	(0.026)	0.53	(0.28)
Plastic	0.27	(0.04)	0.14	(0.008)	0.41	(0.02)
Printing	0.09	(0.06)	0.22	(0.014)	0.55	(0.03)
Radio TV PC & Comm	0.16	(0.01)	0.21	(0.003)	0.43	(0.01)
Rubber	0.06	(0.15)	0.13	(0.021)	0.63	(0.10)
Specific Machinery	0.10	(0.03)	0.16	(0.005)	0.55	(0.02)
Textile	0.12	(0.05)	0.11	(0.007)	0.61	(0.03)
Transport Equipment	0.04	(0.03)	0.15	(0.006)	0.65	(0.02)
Wood	0.22	(0.11)	0.10	(0.017)	0.56	(0.08)

Industry	Unit Cost Ratios		Productivity Ratios	
	75%/25%	90%/10%	75%/25%	90%/10%
Beverages	1.51	2.24		
Electrical Equipment	1.38	1.88		
Food Manufacturing	1.81	3.30		
General Machinery	1.41	1.92		
Iron and Steel	1.34	1.72		
Leather & Fur	1.92	2.69		
Med & Prec Equip	1.80	2.69		
Metal Products	1.33	1.71		
Non-ferrous Metal	1.45	1.89		
Non-metallic Products	1.42	1.96		
Paper	1.66	2.78		
Plastic	1.35	1.72		
Printing	1.37	1.72		
Radio TV PC & Comm	1.44	2.13		
Rubber	2.16	3.97		
Specific Machinery	1.99	3.68		
Textile	1.37	1.89		
Transport Equipment	4.01	13.09		
Wood	1.47	2.16		

Calculating Productivity Differences

- Productivity: Need to account for substition into K and M.
- Requires second stage production parameter estimates.

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- Firms 1 and 2: Same K, M and wage bill W.
- Unit labor costs of c_{RT}^1 and c_{RT}^2.
- Effective labor employed: $L^1 = W/c_{RT}^1$ and $L^2 = W/c_{RT}^2$.

$$Y^1/Y^2 = \left(M^{\alpha_M^T} K^{\alpha_K^T} L_1^{\alpha_L^T}\right) / \left(M^{\alpha_M^T} K^{\alpha_K^T} L_2^{\alpha_L^T}\right) = \left(c_{RT}^2/c_{RT}^1\right)^{\alpha_L^T}.$$

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- General Machinery at 25^{th} and 75^{th} percentile: $c_{RT}^2/c_{RT}^1 = 1.41$
- Share of wages is $\alpha_L^T = 0.17$. $1.06 = 1.41^{0.17}$ as much output.

Industry	Unit Cost Ratios		Productivity Ratios	
	75%/25%	90%/10%	75%/25%	90%/10%
Beverages	1.51	2.24	1.06	1.12
Electrical Equipment	1.38	1.88	1.08	1.17
Food Manufacturing	1.81	3.30	1.09	1.19
General Machinery	1.41	1.92	1.06	1.12
Iron and Steel	1.34	1.72	1.13	1.26
Leather & Fur	1.92	2.69	1.04	1.05
Med & Prec Equip	1.80	2.69	1.13	1.22
Metal Products	1.33	1.71	1.07	1.14
Non-ferrous Metal	1.45	1.89	1.17	1.30
Non-metallic Products	1.42	1.96	1.08	1.15
Paper	1.66	2.78	1.07	1.15
Plastic	1.35	1.72	1.09	1.16
Printing	1.37	1.72	1.03	1.05
Radio TV PC & Comm	1.44	2.13	1.06	1.13
Rubber	2.16	3.97	1.04	1.07
Specific Machinery	1.99	3.68	1.08	1.15
Textile	1.37	1.89	1.04	1.07
Transport Equipment	4.01	13.09	1.04	1.07
Wood	1.47	2.16	1.10	1.22

Outline

Results Extravaganza

- Production Estimates by Method: ▸ Results
- Productivity and Survival: ▸ Results
- Productivity and Sales Growth: ▸ Results
- Productivity and Exports: ▸ Results
- Productivity Comparison by Method: ▸ Results

Conclusion

- Local markets important for input use, productivity and location.
- Developed method to identify skill mix technologies.
  - Model for estimating & interpreting variation in local factor markets.
  - Hinges on local distribution of worker types and wages.
  - More information: Firm + pop census + geographic data.

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- Substantial differences in labor costs and firm behavior across China.
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- Further work:
  - Implications for inequality across and within regions/industries.

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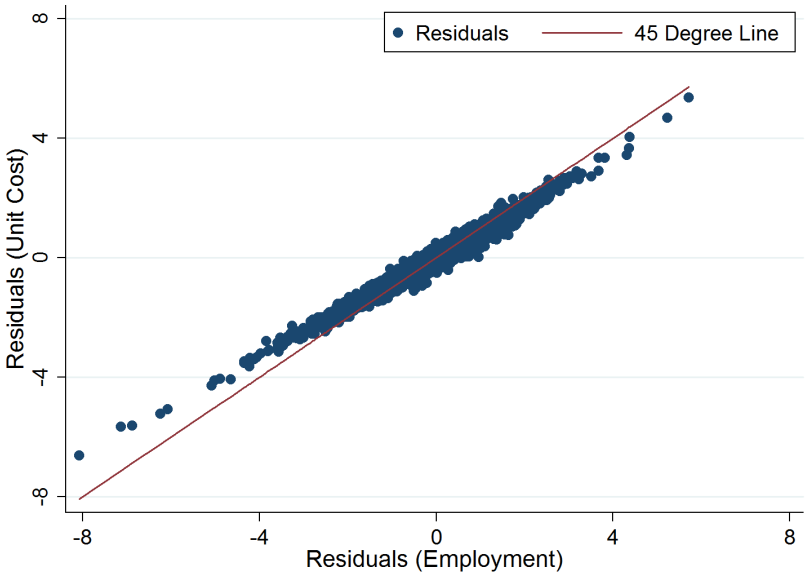
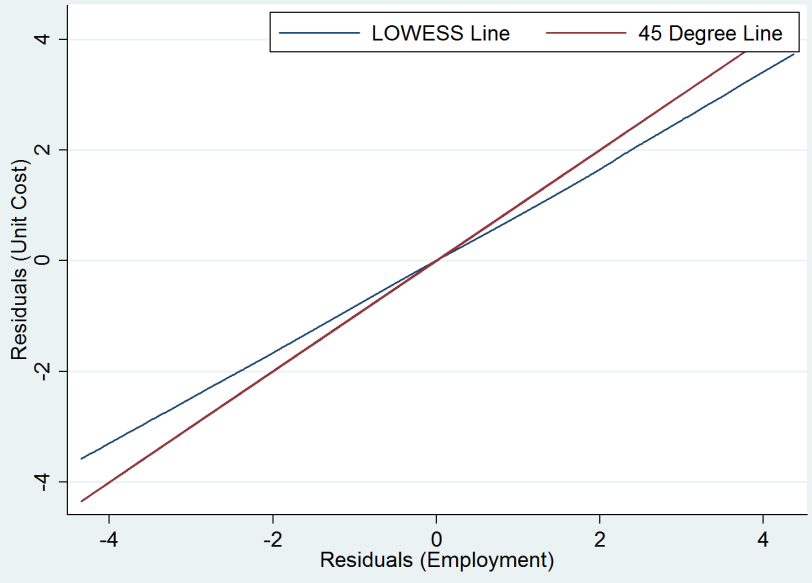
Outline

Second-stage Estimates vs Other Labor Measures





- "Solow Residuals" aka "Productivity" in General Purpose Machinery
- Note residuals are in logs, absolute levels sizable.
- Regional factor markets imply rank fairly stable.

back

Second-stage Estimates vs Other Labor Measures

	Unit Cost Approach			Total Employment		
Industry	α_L	α_K	α_M	α_L	α_K	α_M
Beverages	0.13	0.10	0.70	0.22	0.07	0.73
Electrical Equipment	0.25	0.14	0.47	0.32	0.12	0.51
Food Manufacturing	0.14	0.09	0.70	0.17	0.06	0.75
General Machinery	0.17	0.12	0.60	0.23	0.09	0.64
Iron and Steel	0.40	0.07	0.48	0.29	0.05	0.70
Leather & Fur	0.10	0.13	0.59	0.30	0.09	0.56
Med & Prec Equip	0.20	0.16	0.43	0.36	0.10	0.44
Metal Products	0.24	0.14	0.46	0.30	0.12	0.51
Non-ferrous Metal	0.40	0.08	0.43	0.22	0.08	0.65
Non-metallic Products	0.20	0.07	0.61	0.18	0.06	0.70
Paper	0.18	0.14	0.53	0.31	0.10	0.54
Plastic	0.27	0.14	0.41	0.32	0.13	0.45
Printing	0.09	0.22	0.55	0.34	0.17	0.49
Radio TV PC & Comm	0.16	0.21	0.43	0.40	0.16	0.41
Rubber	0.06	0.13	0.63	0.32	0.06	0.56
⋮	⋮	⋮	⋮	⋮	⋮	⋮
Specific Machinery	⋮	⋮	⋮	⋮	⋮	⋮
Textile	**0.18**	**0.13**	**0.55**	**0.28**	**0.09**	**0.58**

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Idiosyncratic Productivity and Survival

	Survival Rate (2005-7)		
Productivity	0.019***		
(Unit Cost method)	(0.003)		
Productivity		0.010***	
(L =Employment)		(0.002)	
Productivity			0.010***
(L =Wages)			(0.002)
Prefecture and Industry FE	Yes	Yes	Yes
Observations	141,409	141,409	141,409
R-squared	0.023	0.022	0.022

Standard errors in parentheses.
Significance: *** p<.01, ** p<.05, * p<.1.

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Idiosyncratic Productivity and Sales Growth

	Sales Growth Rate (2005-7)		
Productivity	-0.074**		
(Unit Cost method)	(0.030)		
Productivity		-0.052**	
(L =Employment)		(0.021)	
Productivity			-0.054**
(L =Wages)			(0.022)
Prefecture and Industry FE	Yes	Yes	Yes
Observations	119,159	119,159	119,159
R-squared	0.027	0.027	0.027

Standard errors in parentheses.
Significance: *** p<.01, ** p<.05, * p<.1.

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Idiosyncratic Productivity and Exports

	Export Dummy (2005)		
Productivity	0.024***		
(Unit Cost method)	(0.007)		
Productivity		0.015***	
(L =Employment)		(0.004)	
Productivity			0.017***
(L =Wages)			(0.004)
Prefecture and Industry FE	Yes	Yes	Yes
Observations	141,409	141,409	141,409
R-squared	0.202	0.202	0.202

Standard errors in parentheses.
Significance: *** p<.01, ** p<.05, * p<.1.

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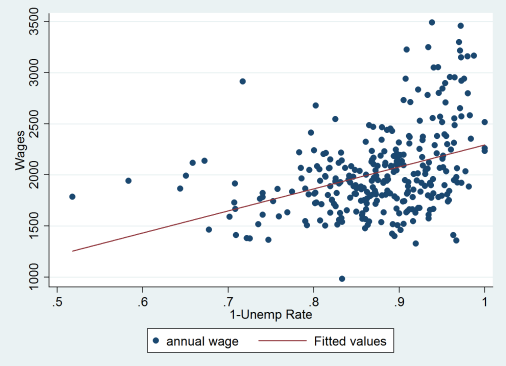
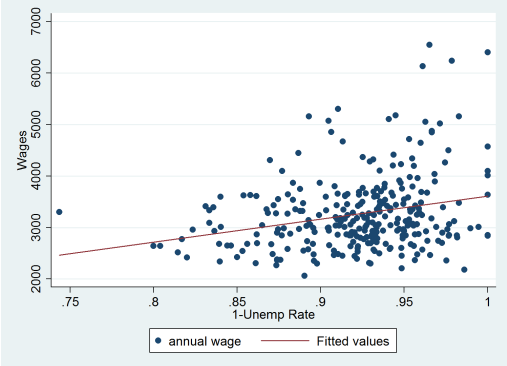
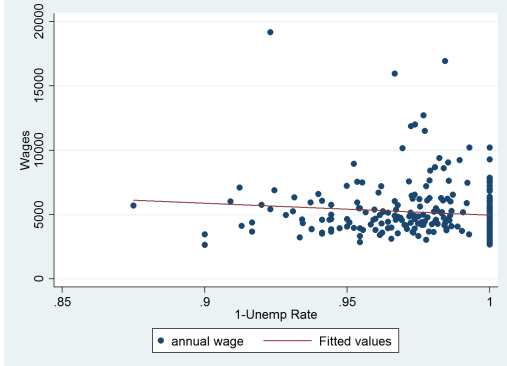
Labor Mobility in China



Low Ed (Female):
$\widehat{\beta} = 2157$



Junior High School:
$\widehat{\beta} = 4457$



Undergrad or Above:
$\widehat{\beta} = -9162$

- With exception of very highly educated (<10% of population), hard to argue labor is mobile across prefectures.
- Anecdotal evidence that rural <-> urban migration substantial.
  - These markets plausibly integrated (we will control for this).