Misallocation, Selection, and Productivity: A Quantitative Analysis with Panel Data from China

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Big Picture

- Large productivity differences across countries.
- Resource allocation matters for aggregate productivity.
- Agriculture key for understanding development.
- Resource misallocation pervasive in agriculture.
    - Particularly linked to land institutions.

Main Idea

land market frictions $\Rightarrow$ disproportionately affect more productive farmers

Reduce aggregate agricultural productivity by distorting two margins:

(1) Allocation of resources across farmers (misallocation).

(2) Type of farmers who operate in agriculture (selection).

Main insight:

- Selection potentially amplifies the misallocation effect,
- by affecting the productivity distribution and measured misallocation.

Study these channels using panel micro data from China.

Why China?

- Rapidly growing economy with substantial sectoral reallocation.
- Productivity in agriculture is low.
- Average farm size: 0.7 hectares (BEL 17, NLD 17, USA 178 ha).
  Farm Size Distribution
- Lack of well-defined property rights over land.
  - Households are allocated use rights on egalitarian basis.
  - Thin rental markets ("use it or lose it").
- Unique panel data set of households with detailed information on farm's output and inputs and non-agricultural wages.
  - Key: Can identify selection across sectors and link to misallocation.

What We Do

(1) Exploit panel data from China and a quantitative framework to:

- Construct for each household permanent fixed effect farm-level productivity and distortions,
- devoid of village level differences that limit scope of measurement error in productivity and distortions,
- document extent and productivity cost of misallocation.

(2) Develop and estimate a tractable two-sector general-equilibrium model with heterogeneous abilities across individuals and sectors.

- Use model structure to infer population moments from observed data.
- Key moments: dispersion and correlation of income across sectors.

(3) Assess quantitative impact of land institution (distortions) on occupational choice, selection, and agricultural productivity.

What We Find

- Substantial misallocation of land and capital across farmers within villages in China, not due to mismeasurement using fixed-effect estimates of farm productivity and distortions.
- Agricultural output (TFP) gains from efficient reallocation within villages: 24.4%.
  - No significant variation over period of study (93-02).
- Implicit farm-level distortions systematically positively correlated with farm productivity (correlated distortions): more productive farmers "hit" harder.
- Eliminating correlated distortions increases agricultural labor productivity 3-fold.
- Selection roughly doubles the static impact of misallocation on agricultural TFP, general-equilibrium effects unimportant.

Related Literature I

- Agricultural productivity and development.
  - Gollin, Parente and Rogerson (2002, AER)
  - Restuccia, Yang and Zhu (2008, JME)
  - many others
- Misallocation in agriculture and income differences.
  - Adamopoulos and Restuccia (2014, AER)
- Misallocation driven by land market institutions,
  - Adamopoulos and Restuccia (2020, AEJM)
  - Restuccia and Santaeulalia-Llopis (2015)
  - Chen (2017, AEJM)

Related Literature II

- Selection amplifies economy-wide productivity differences.
  - Lagakos and Waugh (2013, AER)
- China.
  - Benjamin and Brandt (2002, CJE)
  - Benjamin, Brandt, and Giles (2005, EDCC); (2011, EJ)
  - Zhu (2012, JEP)
  - Brandt, Tombe, and Zhu (2013, RED)

Land Market Institutions in China

- Households allocated use rights over farmland on an egalitarian basis.
- Ownership rights of farmland reside with the collective or village.
- Reallocations within villages were common.
- Use rights could be rented but "use it or lose it" practices.
- Land cannot be used as collateral for purposes of borrowing.

Framework for Measuring Misallocation

- Agricultural sector equilibrium framework.
- M farm operators, heterogeneous in farming ability s_i.
- Total endowments of land and capital, L and K.
- Decreasing returns to scale farm-level technology,

$$y_i = (A_a s_i)^{1-\gamma} \left[\ell_i^{\alpha} k_i^{1-\alpha}\right]^{\gamma}, \quad \gamma < 1,$$

  where
  - $(y_i, \ell_i, k_i) =$ real farm output, land and capital inputs.
  - $\gamma =$ span-of-control parameter.

Allocations

- Efficient allocation: planner maximizes aggregate output, given farm TFPs and aggregate resources.
- Efficient allocation equates marginal products across farmers,

$$k_i = \frac{s_i}{\sum_i s_i} K, \qquad \ell_i = \frac{s_i}{\sum_i s_i} L.$$

- Back out implicit farm-level distortions from FOC.

▸ FOC

Micro Data from China

- HH survey panel data from Research Center for the Rural Economy, Ministry of Agriculture.
- HH data from 10 provinces, from 1993 to 2002.
- Unbalanced panel with $\sim$ 8000 HHs per year from 110 villages.
- Detailed information on income by sector.
- Agriculture: data on outputs, inputs, prices, at farm-level.

Measuring Farm-Level TFP and Distortions

Construct residual farm i TFP, village v, time t

$$TFP_{ivt} \equiv (A_a s_{ivt})^{1-\gamma} = \frac{y_{ivt}}{\left[\ell_{ivt}^{\alpha} k_{ivt}^{1-\alpha}\right]^{\gamma}},$$

- $\gamma = 0.54$: estimates of the agricultural labor income share for China.
- $\alpha = 2/3$: implying land and capital income shares of 0.36 and 0.18 (estimates from China).

Construct farm-level distortions (TFPR):

$$TFPR_{ivt} = \frac{y_{ivt}}{\ell_{ivt}^{\alpha} k_{ivt}^{1-\alpha}}.$$

Measuring Farm-Level TFP

- Decompose residual farm TFP as:

$$\log TFP_{ivt} = \mu_t^{TFP} + \mu_i^{TFP} + e_{ivt}^{TFP},$$

where μ_i^{TFP} farm-specific component that does not vary over time.

- We remove village-specific effects by regressing the household fixed effect μ_i^{TFP} on village dummies (μ_v) and extracting the residual,

$$\mu_i^{TFP} = \mu_v^{TFP} + \zeta_i^{TFP},$$

where ζ_i^{TFP} permanent fixed-effect farm-level component.

Measuring Farm-Level TFPR

- Decompose farm-level TFPR as:

$$\log TFPR_{ivt} = \mu_t^{TFPR} + \mu_i^{TFPR} + e_{ivt}^{TFPR},$$

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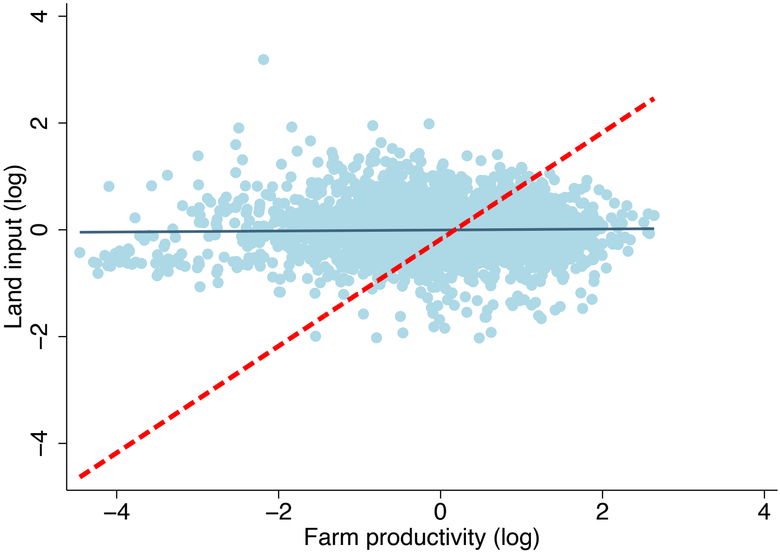
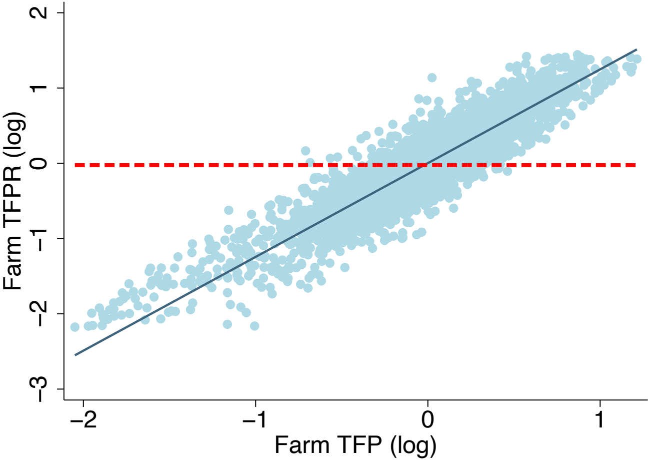
Land Allocation by Farm TFP ▸ MPLa



Farm Productivity and Measured Distortions



- Summary measure of distortions $TFPR_i \propto \frac{1}{1-\tau_i}$.
- SD(log(TFPR))=0.48, CORR(logTFPR,logTFP)=0.91.

Mismeasurement

- Recall that our unit of analysis is the farm household, not a plot operated by the household, outputs and inputs aggregated to the household level.
- We exploit the panel structure of the data to obtain fixed-effect estimates of farm productivity and farm distortions.
- We illustrate the value of our approach by applying the method of Bils, Klenow, and Ruane (2017) for inferring measurement error in panel micro data.
- BKR utilize changes in output relative to changes in inputs as an independent measure of an input's marginal product and is compared to the within-period average product-based measure of TFPR commonly used in the misallocation literature.

Mismeasurement

- When the response of output to changes in inputs is larger for higher TFPR farms, average products better reflect true marginal products and measurement error is less of an issue.

- Regress production-unit growth in measured output on growth in measured inputs and on the interaction of inputs growth and the level of measured TFPR. We estimate,

  $$\Delta \log (y_{it}) = \beta_1 \cdot \log (TFPR_{it}) + \beta_2 \cdot \Delta \log (I_{it}) + \beta_3 \cdot int_{it} + \mu_v + \mu_t + u_{it},$$

  where $\Delta \log (I_{it})$ change in measured log-input bundle $I = \ell^{\alpha} k^{1-\alpha}$; $int_{it} = \Delta \log (I_{it}) \times \log (TFPR_{it})$, and μ_v,μ_t village,time fixed effects.

- Estimate of the share of the dispersion in TFPR that is due to true variation in distortions as $\widehat{\lambda} = 1 + \widehat{\beta}_3 / \widehat{\beta}_2$.

Mismeasurement in Productivity and Distortions

	Fixed Effect Estimates Household Farm	+ Village	Cross-section average
Farm TFP:			
STD(log)	0.35	0.64	0.72
p90/p10	2.19	4.35	5.59
p75/p25	1.48	2.06	2.32
Farm TFPR:			
STD(log)	0.48	0.81	0.92
p90/p10	3.14	7.17	9.70
p75/p25	1.78	2.71	3.23
CORR (logTFP, logTFPR)	0.91	0.88	0.88
BKR $\hat{\lambda}$	1.00	0.96	0.90
Standard error	(.026)	(.039)	(.024)
95% confidence interval	[0.95, 1.05]	[0.88, 1.03]	[0.85, 0.95]

Mismeasurement

- For our baseline measure of permanent TFPR the estimated λ is 1.00, implying no role for the type of measurement error this method can capture.
- The correlation of farm productivity and distortions is strengthened marginally from 0.88 in the cross-section to 0.91 in the baseline household fixed effect case.
- Mismeasurement has virtually no effect on systematic component of distortions, consistent with description of land institution in China and uniform allocation of village land across households independent of farming ability.

Other Evidence

- How useful is the efficient benchmark to assess misallocation?
- Some evidence of stronger relationship between farm size and productivity in developed economies.
  - Correlation between farm size and productivity around 90 percent US Census of Agriculture (Adamopoulos and Restuccia 2014).
  - Average farm size increased substantially with high growth rates of agricultural productivity in historical time-series data for developed economies.
- Actual allocations more closely connected to farm productivity in environments with more exposure to land market rental activity.
  - In our sample, correlation of land input and productivity increases from 0.02 in full sample to 0.13 in provinces with significant land rental market activity.
  - Evidence from recent land tenancy reform in China after 2003, increased land rentals, improved land allocation (Chari et al 2021).

Assessing Factor Misallocation

	Output (TFP) gain (%)		
	Total	Across s misallocation	Cross-section average
Eliminating misallocation			
across households:			
within villages	24.4	13.9	54.0
+ across villages	53.2	24.9	83.0

- Substantial gains to reallocation across farming hhs within villages (24.4%).
- About 60 percent ($\log(1.139)/\log(1.244)$) due to reallocation across farming HHs with different TFP
- Reallocation gains across villages also substantial.

A Model of Misallocation and Selection

- Two-sector GE model of agriculture and non-agriculture.
- Representative closed village economy.
- Agriculture features production heterogeneity (Adamopoulos and Restuccia 2014).
- Individuals face a sectoral occupational choice (Roy model):
  - Farm operator in agriculture.
  - Worker in non-agriculture.
- Economy populated by a continuum of individuals of measure 1.
- Individuals indexed by i are heterogeneous with respect to:
  - Ability in agriculture s_{a_i}.
  - Ability in non-agriculture s_{n_i}.
  - Distortion in operating a farm τ_i.

Income in Agriculture

The problem of a farmer facing (s_{a_i}, τ_i) is,

$$\max_{\ell_i, k_i} \left\{ (1 - \tau_i)\, p_a y_{a_i} - q\ell_i - rk_i \right\}.$$

- $p_a =$ relative price of agricultural good.
- Income of individual i in agriculture is after-tax output plus transfers,

  $$I_{a_i} = p_a (1 - \tau_i)\, y_{a_i} + T,$$

  which includes not only return to labor, but also land and capital.
- Tax revenues T are redistributed equally to all individuals.

Production — Non-Agriculture

- Representative (stand-in) firm hires non-agricultural workers.
- Constant returns technology on effective labor input,

$$Y_n = A_n Z_n,$$

where

- Y_n is real non-agricultural output.
- A_n is a productivity parameter in non-agriculture.
- $Z_n = \int_{i \in H_n} s_{n_i} di$ is effective labor input in non-agriculture.

Income in Non-Agriculture

- Each worker in non-agriculture receives w_n per efficiency unit of labor.

- Non-agricultural work is subject to a labor mobility barrier η.
- A worker of non-agricultural ability s_{n_i} receives income in non-agriculture of,

$$I_{n_i} = (1 - \eta) \cdot w_n \cdot s_{n_i} + T.$$

Preferences

Individual i has preferences over the consumption of the two goods:

$$U_i = \omega \log\left(c_{a_i} - \bar{a}\right) + (1-\omega)\log(c_{n_i}),$$

- $\bar{a} =$ minimum subsistence requirement agricultural good.
- $\omega =$ preference weight on agricultural goods.

Farm Income

Agricultural income,

$$I_{a_i} = w_a \varphi_i s_{a_i} + T,$$

where

- w_a is a common component,

$$w_a = A_a \gamma^{\frac{\gamma}{1-\gamma}} p_a^{\frac{1}{1-\gamma}} \left(\frac{1-\alpha}{r}\right)^{\frac{\gamma(1-\alpha)}{1-\gamma}} \left(\frac{\alpha}{q}\right)^{\frac{\alpha\gamma}{1-\gamma}},$$

- and φ_i captures idiosyncratic distortion,

$$\varphi_i \equiv (1-\tau_i)^{\frac{1}{1-\gamma}}.$$

Correlated Abilities and Distortions

- Tri-variate log-normal distribution for (s_a, φ, s_n) with mean $(\mu_a, \mu_\varphi, \mu_n)$ and variance,

$$\Sigma = \begin{pmatrix} \sigma_a^2 & \sigma_{a\varphi} & \sigma_{an} \\ \sigma_{a\varphi} & \sigma_\varphi^2 & 0 \\ \sigma_{an} & 0 & \sigma_n^2 \end{pmatrix}.$$

- Allow for correlation between idiosyncratic distortions and agricultural abilities,

$$\rho_{\varphi a} = \frac{\sigma_{\varphi a}}{\sigma_\varphi \sigma_a}.$$

- Allow for correlation between abilities across sectors,

$$\rho_{an} = \frac{\sigma_{an}}{\sigma_n \sigma_a}.$$

Occupational Choice

- Define effective agricultural ability as product of actual ability and idiosyncratic distortion,
$$\widehat{s}_{a_i} = \varphi_i s_{a_i}.$$

- Can re-write occupational choice problem in terms of $\{\widehat{s}_{a_i}, s_{n_i}\}$.

- Individual i chooses to operate a farm in agriculture if,
$$I_{a_i} > I_{n_i} \Rightarrow w_a \widehat{s}_{a_i} > (1-\eta) w_n s_{n_i}.$$

Effect of Distortions on Occupational Choices

- Standard Roy model,

$$w_a s_{a_i} > (1-\eta) w_n s_{n_i}.$$

- In our framework,

$$w_a \varphi_i s_{a_i} > (1-\eta) w_n s_{n_i}.$$

- Farm-level distortions directly affect occupational choices even if no aggregate change (general equilibrium).

Calibration

- Strategy: Calibrate distortions, abilities, and sectoral selection in a Benchmark Economy (BE) to the panel household-level data from China.

- Proceed in two steps:

  (1) Infer population parameters on abilities and distortions from observed moments on sectoral incomes, farm TFP, and estimated wedges.

  (2) Given population moments, calibrate remaining parameters from general equilibrium equations of the sectoral economy to match data targets.

Calibration Step (1) — Population Parameters

- 5 population parameters/moments to calibrate:
  - 3 variances, σ_a^2, σ_n^2, σ_φ^2.
  - 2 covariances, $\sigma_{a\varphi}$, σ_{an}.

- Procedure:
  (a) Construct model moments on sectoral incomes, farm TFP and distortions conditional on sectoral choices (depend on population moments).
  (b) Compute counterparts in panel data for China.
  (c) Solve system of equations for population moments.

- Conditional moments in data (and model):
  - SD log – agricultural income, non-agricultural income, distortions.
  - COV log – TFP and distortions in agriculture.
  - COV log – agricultural income and non-agricultural income (contemporaneous or switchers from agriculture to non-agriculture).

Targeted Empirical Conditional Moments

Statistic	Description	Value
N_a	Share of labor in agriculture	0.46
$\widehat{v}_a$	STD of agricultural income	0.34
$\widehat{v}_n$	STD of non-agricultural income	0.46
$\widehat{v}_\varphi$	STD of farm distortions	1.05
$\widehat{c}_{an}$	COV between ag. and non-ag. incomes	0.005
$\widehat{c}_{a\varphi}$	COV of agricultural income and farm distortions	-0.14

Note: All variables refer to logs.

Calibrated Population Parameters

Parameter	Description	Value
σ_a	STD of agricultural ability	1.30
σ_n	STD of non-agricultural ability	0.65
σ_φ	STD of distortions	1.06
$\rho_{a\varphi}$	CORR of agricultural ability and distortions	-0.95
ρ_{an}	CORR of agricultural–non-agricultural ability	-0.15

Note: All variables refer to logs.

Calibration Step (2) — Remaining Parameters

Using calibrated population parameters:

- Normalize A_n to 1, A_a to solve for normalized $w_a = 1$.
- $\alpha = 0.66$ and $\gamma = 0.54$ (same as before when measuring farm TFP and misallocation).
- $\omega = 0.01$ to match a long-run share in agriculture of 1%.
- Endowments (K_a, L) to match:
  - (a) Capital-output ratio in agriculture of 0.3.
  - (b) Average farm size of 0.45 Ha.
- Solve the model for $(\bar{a}, \eta)$ to match two targets:
  - (a) Share of employment in agriculture of 46%
  - (b) Non-ag. to ag. labor productivity ratio of 4.

The Effects of Correlated Distortions

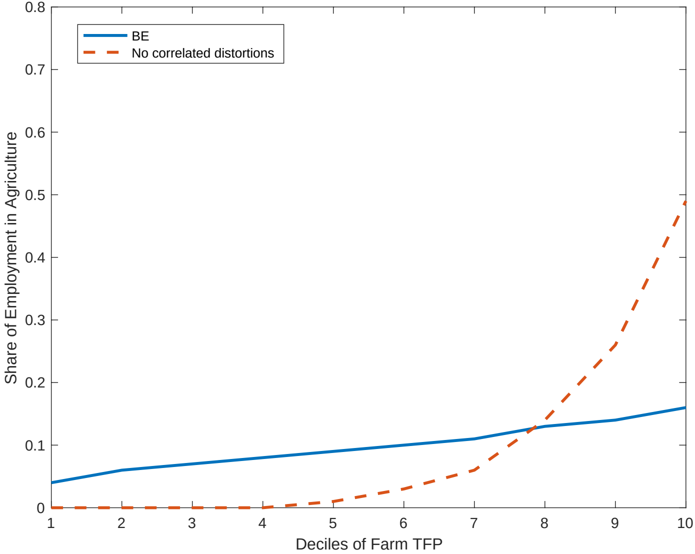
Statistic	Benchmark Economy (BE)	No Correlated Distortions
Aggregate Statistics		
Real Agricultural Productivity (Y_a/N_a)	1.00	2.96
Share of Employment in Agriculture (N_a) (%)	0.46	0.16
TFP in Agriculture (TFP_a)	1.00	1.67
TFP in Agriculture, constant BE farms	1.00	1.10
Real Non-Agricultural Productivity (Y_n/N_n)	1.00	0.78
Average Ability in Agriculture (Z_a/N_a)	1.00	2.34
Average Ability in Non-Agriculture (Z_n/N_n)	1.00	0.78
Real GDP per Worker (Y/N)	1.00	1.18
Conditional Micro-level Statistics		
STD of log–farm TFP	0.56	0.39
STD of log–farm TFPR	0.48	0.14
CORR of log–(farm TFP, farm TFPR)	0.97	0.44
CORR of log–(agr. ability, non-agr. ability)	0.15	0.49
CORR of log–(agr. income, non-agr. income)	0.03	0.40

Decomposing Gain in Agricultural Labor Productivity

Eliminating correlated distortions increases agricultural labor productivity by 2.96-fold via:

- Increased agricultural TFP of 1.67-fold and input intensity of 1.77-fold (reallocation of labor out of agriculture).
- Agricultural TFP increase due to reduced misallocation (1.1-fold) and improved selection by 1.52-fold.
- From the overall effect on agricultural TFP, $1/5$ is accounted for by reduced misallocation and $4/5$ by improved selection.

Selection Effect in Agriculture



The Effects of Eliminating All Distortions

Statistic	Benchmark Economy BE	No Correlated Distortions	No Distortions $\varphi_i = 1$
Real Ag. Productivity (Y_a/N_a)	1.00	2.96	3.42
Share of Employment in Ag. (N_a) (%)	0.46	0.16	0.14
TFP in Agriculture (TFP_a)	1.00	1.67	1.80
TFP in Ag. constant BE farms	1.00	1.10	1.15
Real Non-Ag. Productivity (Y_n/N_n)	1.00	0.78	0.77
Average Ability in Ag. (Z_a/N_a)	1.00	2.34	2.65
Average Ability in Non-Ag. (Z_n/N_n)	1.00	0.78	0.77
Real GDP per Worker (Y/N)	1.00	1.18	1.19

- The bulk of selection effect arises from correlated distortions associated with the land institution.

Comparison with Exogenous TFP Increase

Statistic	BE	No Corr Dist	$\uparrow (A_a^{1-\gamma}) \times 1.10$	$\uparrow (A_a^{1-\gamma}, A_n) \times 1.10$
		Aggregate Statistics		
Real Agricultural Productivity (Y_a/N_a)	1.00	2.96	1.35	1.35
Share of Employment in Ag. (N_a) (%)	0.46	0.16	0.34	0.34
TFP in Agriculture (TFP_a)	1.00	1.67	1.15	1.15
Real Non-Ag. Productivity (Y_n/N_n)	1.00	0.78	0.92	1.01
Average Ability in Agriculture (Z_a/N_a)	1.00	2.34	1.11	1.11
Average Ability in Non-Ag. (Z_n/N_n)	1.00	0.78	0.92	0.92
Real GDP per Worker (Y/N)	1.00	1.18	1.09	1.18

- Reduction in misallocation associated with elimination of correlated farm-level distortions has much larger effect on agricultural labor productivity than an equivalent-in-magnitude exogenous increase in TFP.
- Farm-level distortions directly impact occupational choices, particularly those with high agricultural ability.

Robustness — Variation in Population ρ_{an}

Statistic	$\rho_{an} = -0.15$		$\rho_{an} = 0$		$\rho_{an} = 0.15$	
	BE	NC	BE	NC	BE	NC
Aggregate Statistics:						
Real Agricultural Productivity (Y_a/N_a)	1.00	2.96	1.00	3.44	1.00	4.23
Share of Employment in Ag. (N_a) (%)	0.46	0.16	0.46	0.14	0.46	0.11
TFP in Agriculture (TFP_a)	1.00	1.67	1.00	1.80	1.00	1.98
Real Non-Ag. Productivity (Y_n/N_n)	1.00	0.78	1.00	0.78	1.00	0.77
Average Ability in Agriculture (Z_a/N_a)	1.00	2.34	1.00	2.72	1.00	3.35
Average Ability in Non-Ag. (Z_n/N_n)	1.00	0.78	1.00	0.78	1.00	0.77
Real GDP per Worker	1.00	1.18	1.00	1.21	1.00	1.22
Conditional Micro-level Statistics:						
STD of log–farm TFP	0.56	0.39	0.56	0.35	0.56	0.31
STD of log–farm TFPR	0.48	0.14	0.48	0.13	0.48	0.12
CORR of log–(farm TFP, farm TFPR)	0.97	0.44	0.97	0.24	0.97	-0.08
CORR of log–(ag.,non-ag. ability)	0.15	0.49	0.28	0.54	0.38	0.57
CORR of log–(ag.,non-ag. income)	0.03	0.40	0.45	0.58	0.76	0.72

- Removing correlated distortions has even larger effects on agricultural labor productivity with higher values of ρ_{an}.

Robustness — Idiosyncratic Mobility Barriers

Statistic	$\sigma_\theta = 0$		$\sigma_\theta = 0.5$		$\sigma_\theta = 0.9$	
	BE	NC	BE	NC	BE	NC
Calibrated Ability Correlation	$\rho_{an} = -0.15$		$\rho_{an} = -0.08$		$\rho_{an} = -0.03$	
Aggregate Statistics						
Real Agricultural Productivity (Y_a/N_a)	1.00	2.96	1.00	3.17	1.00	3.10
Share of Employment in Ag. (N_a) (%)	0.46	0.16	0.46	0.15	0.46	0.15
TFP in Agriculture (TFP_a)	1.00	1.67	1.00	1.73	1.00	1.72
Real Non-Ag. Productivity (Y_n/N_n)	1.00	0.78	1.00	0.83	1.00	0.89
Average Ability in Agriculture (Z_a/N_a)	1.00	2.34	1.00	2.51	1.00	2.47
Average Ability in Non-Ag. (Z_n/N_n)	1.00	0.78	1.00	0.83	1.00	0.89
Real GDP per Worker	1.00	1.18	1.00	1.26	1.00	1.33
Conditional Micro-level Statistics						
STD of log–farm TFP	0.56	0.39	0.56	0.38	0.56	0.42
STD of log–farm TFPR	0.48	0.14	0.48	0.13	0.48	0.13
CORR of log–(farm TFP, farm TFPR)	0.97	0.44	0.97	0.30	0.97	0.17
CORR of log–(ag.,non-ag. ability)	0.15	0.49	0.10	0.40	0.05	0.26
CORR of log–(ag.,non-ag. income)	0.03	0.40	0.03	0.35	0.03	0.24

- Results robust against different σ_θ (implied ρ_{an}), indicating targeted cross-sector income correlation imposes discipline on magnitude of amplification effect.

Conclusions

- Exploiting panel micro data, we estimate permanent household fixed-effect farm-level productivity and distortions devoid of village differences, limiting extent of mismeasurement.
- Substantial factor misallocation within villages in Chinese agriculture from uniform land allocations and restricted land markets.
- Operational farm scales should be able to adjust to raise agricultural productivity.
- This would also keep more able farmers in agriculture, contributing substantially to agricultural productivity and structural change.
- Implementing a system of secure property rights would generate large productivity gains.

Farm Size Distribution in China

	(%)	
Land Farm Size	1995	2000
< 0.5 ha	69.2	71.6
$0.5 - 1$ ha	20.7	20.2
$1 - 1.5$ ha	6.1	5.8
> 1.5 ha	4.0	2.4
Average Farm Size	0.49	0.43

Return

Inferring Wedges From FOC

Farm-level FOCs for land and capital,

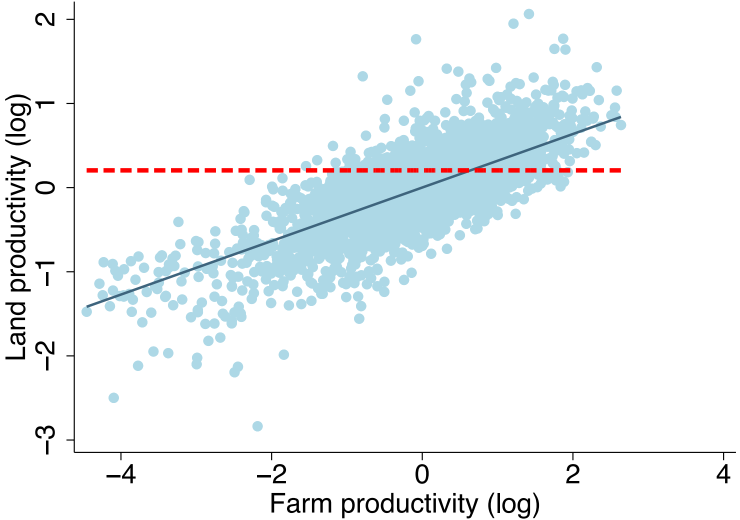
$$\frac{MRPL_i}{\alpha\gamma} = \frac{y_i}{\ell_i} = \frac{q_v\left(1+\tau_i^{\ell}\right)}{\alpha\gamma\left(1-\tau_i^{y}\right)} \propto \frac{\left(1+\tau_i^{\ell}\right)}{\left(1-\tau_i^{y}\right)}$$

$$\frac{MRPK_i}{(1-\alpha)\gamma} = \frac{y_i}{k_i} = \frac{r\left(1+\tau_i^{k}\right)}{(1-\alpha)\gamma\left(1-\tau_i^{y}\right)} \propto \frac{\left(1+\tau_i^{k}\right)}{\left(1-\tau_i^{y}\right)}$$

Note: Only two of the three wedges can be separately identified.

Return

Marginal Product of Land



Return