The Macroeconomics of Microfinance

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  - business loans

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- High growth rates, desire to scale up even more... ▸ data
- ... but no evaluation of general equilibrium effects ▸ quote

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  3. and no intermediation costs

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     - increases welfare/consumption of workers/marginal entrepreneurs
- Important GE effects: more redistribution and welfare gains...but smaller impact on aggregate output and consumption... opposite impact on TFP and capital

Road Map

- Benchmark calibrated model
    - Compare with microevaluations
    - Present GE aggregate impacts
    - Present GE distributional impacts
    - Compare GE with PE effects
- Extensions:
    - Small open economy
    - Model w/ market labor shock
    - Add large-scale sector with fixed cost

Benchmark Model

- Heterogeneous agents: entrepreneurial ability and wealth.

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- Occupational choice: Work for wage or operate their own technology.
- Financial friction: limited enforcement.

Model: Plant Technology

$$f(z, k, l) = zk^{\alpha} l^{\theta}$$

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- z: entrepreneurial productivity
- 1 unit of entrepreneur's time
- k: capital input
- l: labor input (workers)
- $\alpha + \theta < 1$

Model: Process of Entrepreneurial Talent

$$z_s = \begin{cases} z_{s-1} & \text{w/ prob. } \gamma \\ \zeta_s & \text{w/ prob. } 1-\gamma \end{cases}$$

$$\zeta_s \overset{iid}{\sim} \eta \zeta^{-\eta-1}, \ \zeta \geq 1$$

- γ measures persistence

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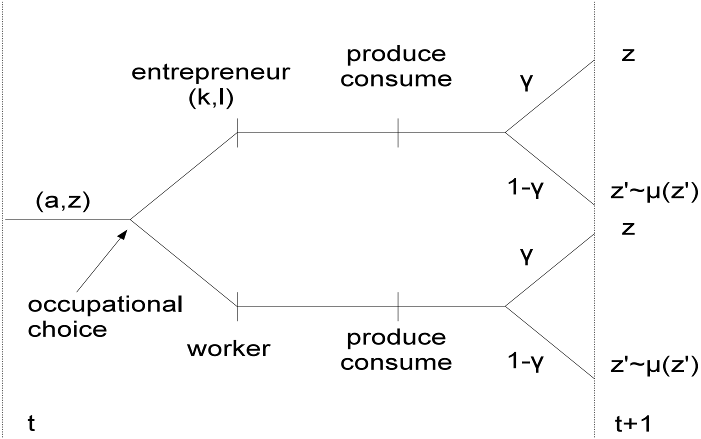
- $-\eta$ measures the thickness of the right tail

Model: Timing



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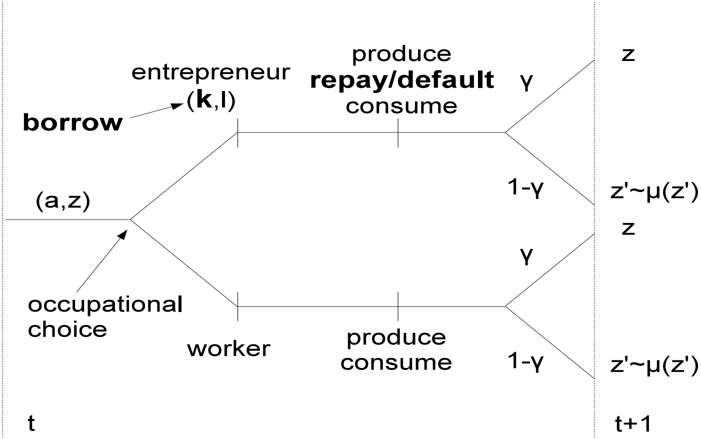

Model: Individual Problem

Workers' Bellman Equation

Workers supply 1 unit of labor at w

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$$v^w(a,z) = \max_{c,a' \geq 0} u(c) + \beta \mathbb{E}_z \max \left\{ v^w\left(a', z'\right), v^e\left(a', z'\right) \right\}$$

$$c + a' \leq w + (1+r)a$$

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where entrepreneur's value $v^e(a', z')$ is given next

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$$c + a' \leq zk^\alpha l^\theta - (r+\delta)k - wl + (1+r)a$$

$$zk^\alpha l^\theta - (r+\delta)k - wl + (1+r)a$$
$$\geq (1-\phi)\left[zk^\alpha l^\theta - wl + (1-\delta)k\right]$$

(enforcement constraint, EC)

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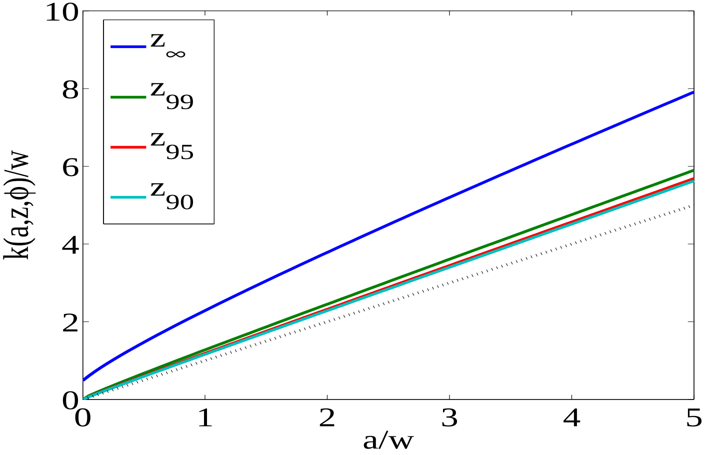
$$c + a' \leq zk^\alpha l^\theta - (r+\delta)k - wl + (1+r)a$$

$$k \leq \bar{k}(a,z;\phi)$$

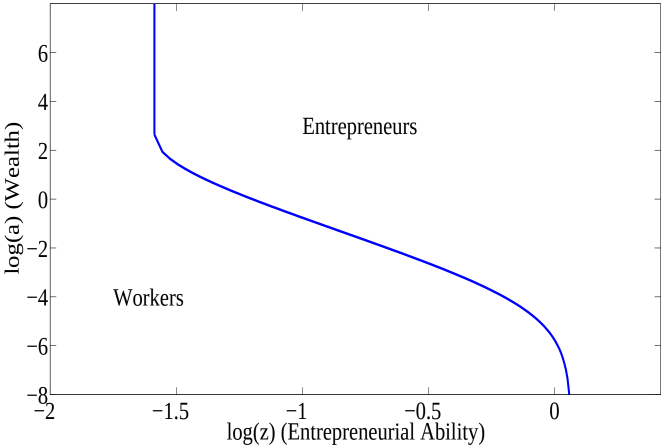
(rental limit)

details

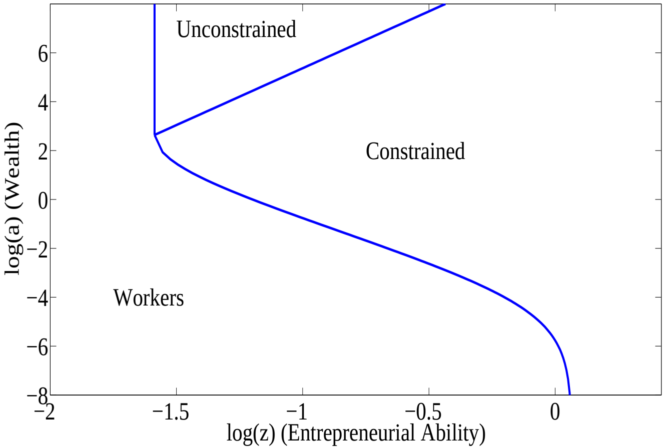
Rental Limit



Occupational Choice



Occupational Choice (cont'd)



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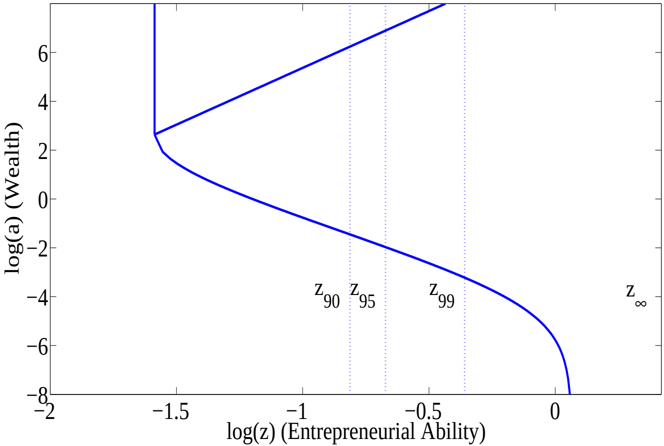
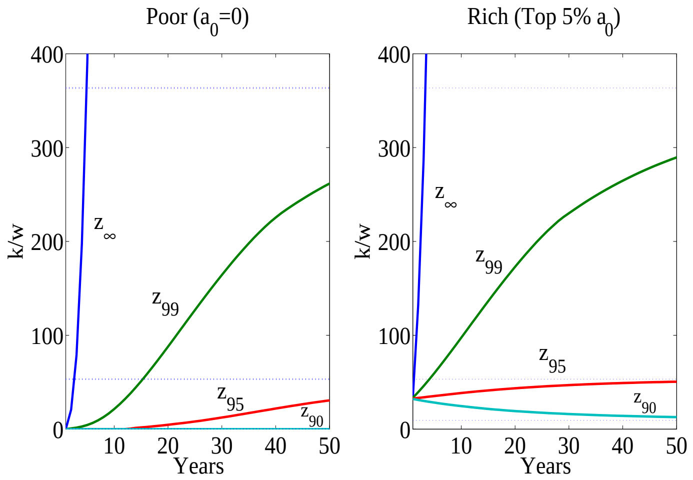


Dynamic of Capital Input



Modeling Microfinance Revolution

Introduce new technology that:

1. guarantees a minimum (uncollateralized) loan for production
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Modeling Microfinance Revolution

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New technology that changes rental limit from:

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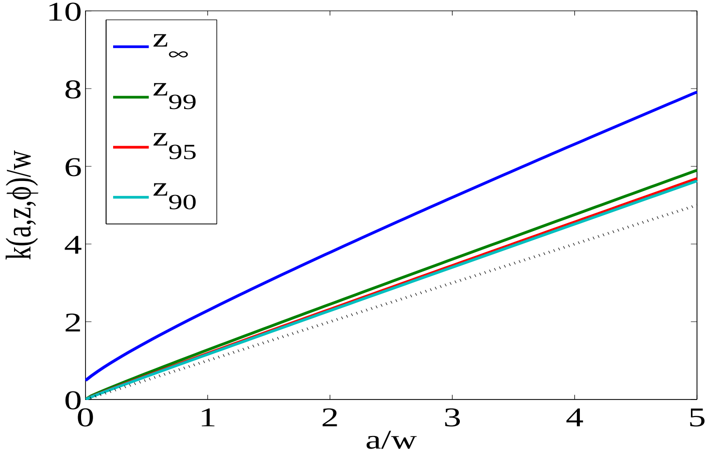
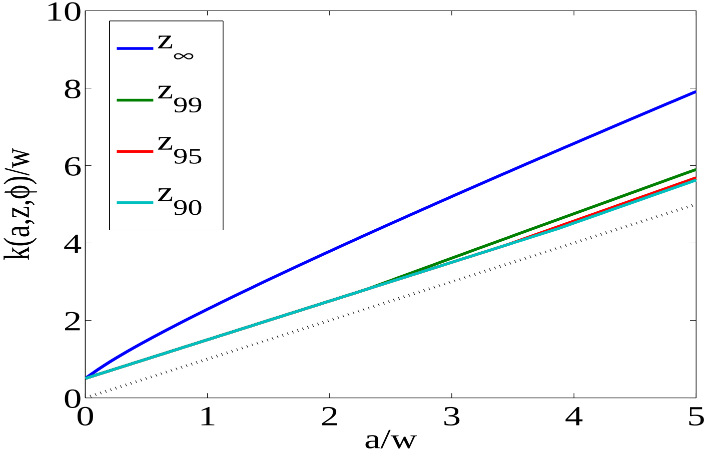
to

$$k \leq \max\{\bar{k}(a, z; \phi), a + b^{MF}\}$$

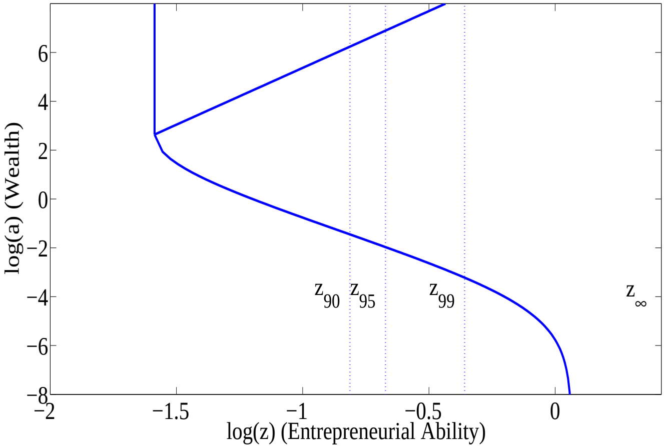
Rental Limit



Rental Limit w/ Microfinance, $b^{MF} = \frac{1}{2}w$



(Partial Equilibrium) Impact on Occupational Choice



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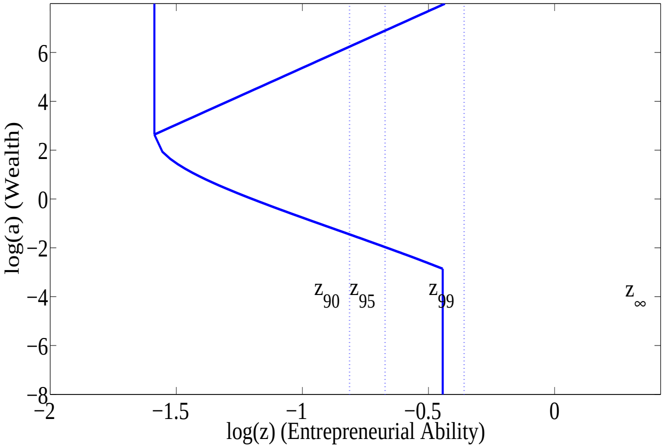
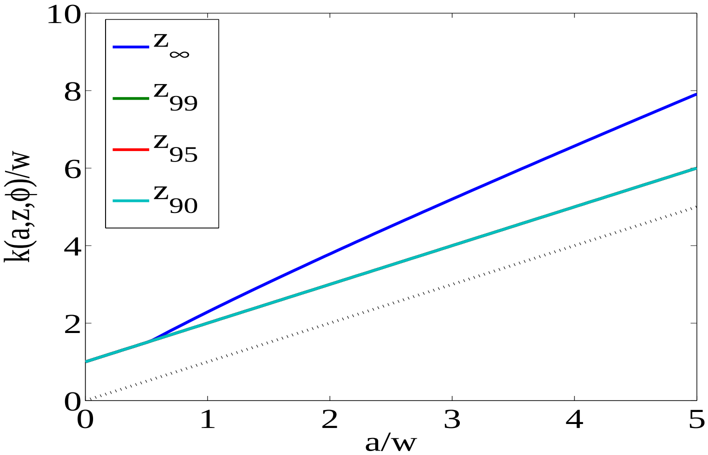


Rental Limit w/ Microfinance, $b^{MF} = w$



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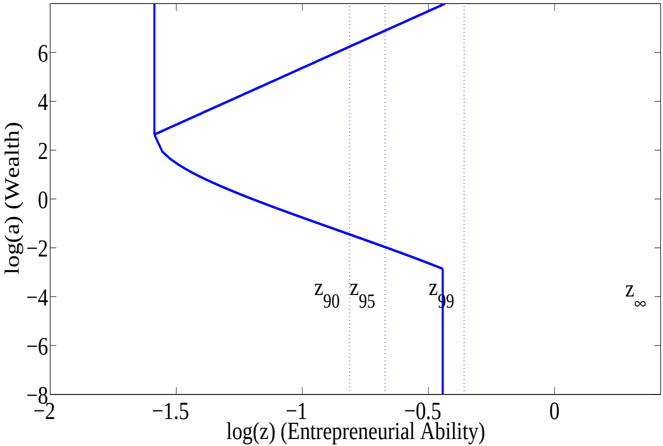

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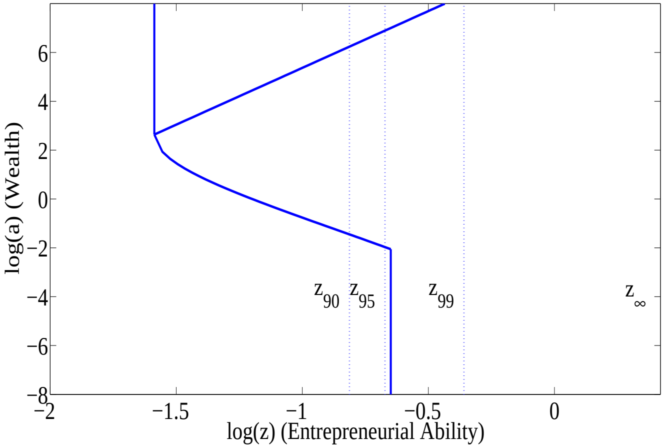

Objects for Stationary Competitive Equilibria

- $o(a, z)$: occupational choice
- $G(a, z)$: joint distribution of a, z
- $\mu(z) = 1 - z^{-\eta}$: stationary distribution of z

Definition: Stationary Competitive Equilibria

$G(a,z)$, policies $o(a,z)$, $c(a,z)$, $a'(a,z)$, $k(a,z)$, $l(a,z)$, rental limit $\bar{k}(a,z;\phi)$, and prices w and r such that:

- Allocations solve individuals' problems given prices and rental limit;
- $\bar{k}(a,z;\phi)$ satisfies EC;
- Labor and credit markets clear;
- $G(a,z)$ satisfies

$$G(a,z) = \gamma \int_{\tilde{z}<z, a'(\tilde{a},\tilde{z})\leq a} G(d\tilde{a}, d\tilde{z}) + (1-\gamma)\mu(z) \int_{a'(\tilde{a},\tilde{z})\leq a} G(d\tilde{a}, d\tilde{z}).$$

Empirical Strategy

- Choose technology (α, θ) and productivity process (η^{US}, γ) to match US data on size distribution and dynamics of establishments and income concentration, given $\phi^{US} = 1$

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- Choose contract enforcement and distribution of productivity (η^{IND}, ϕ^{IND}) to match Indian data on the size distribution and external finance to GDP
- Evaluate impact of b^{MF}

Empirical Strategy

Target	US Data	Model	Parameter
top 10% employment share	0.69	0.69	$\eta^{US} = 4.84$
top 5% income share	0.30	0.30	$\alpha + \theta = 0.79$
Exit rate	0.10	0.10	$\gamma = 0.89$
Interest rate	0.04	0.04	$\beta = 0.92$
Target	**Indian Data**	**Model**	**Parameter**
top 10% employment share	0.58	0.58	$\eta^{IND} = 5.56$
Ext. fin./GDP	0.34	0.34	$\phi^{IND} = 0.08$

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- We simulate similar sized intervention and compare short-run, partial equilibrium impacts
- Model capture key features (heterogeneity, orders of magnitude) reasonably well

Impacts on Marginal Ability Entrepreneurs

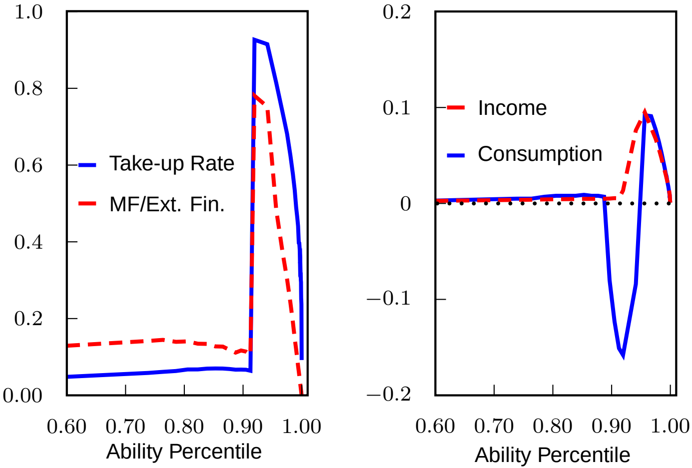

Table: Comparison Summary

	Model	India	Thailand
Max Loan/Exp per Cap	1	1-2	1
Credit/Exp per Cap	0.1	0.1	0.1
Microfinance/Total Credit	29%	44%	33%
Entrepreneurship	+4 pp	+2 pp	+1 pp
Investment	+46%	+16/128%	+30% (prob).
Consumption	+1%	+16/0%	+15%

More on Thai Study

- Rural Thailand vs. Urban India and Model

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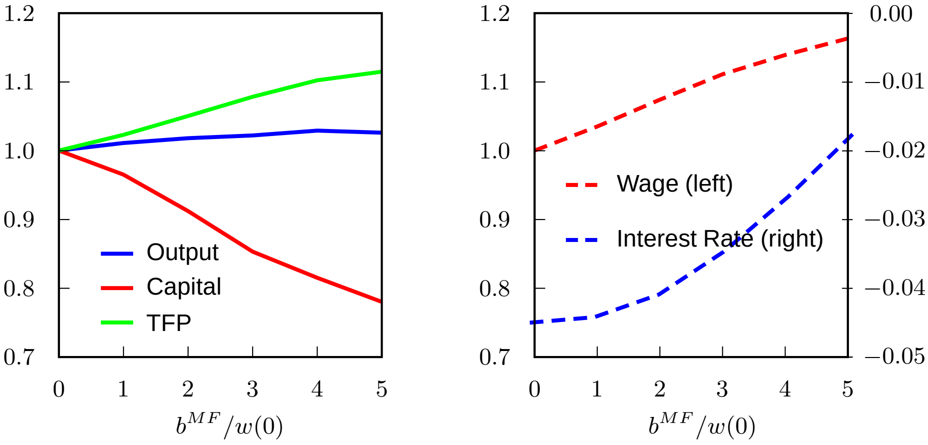
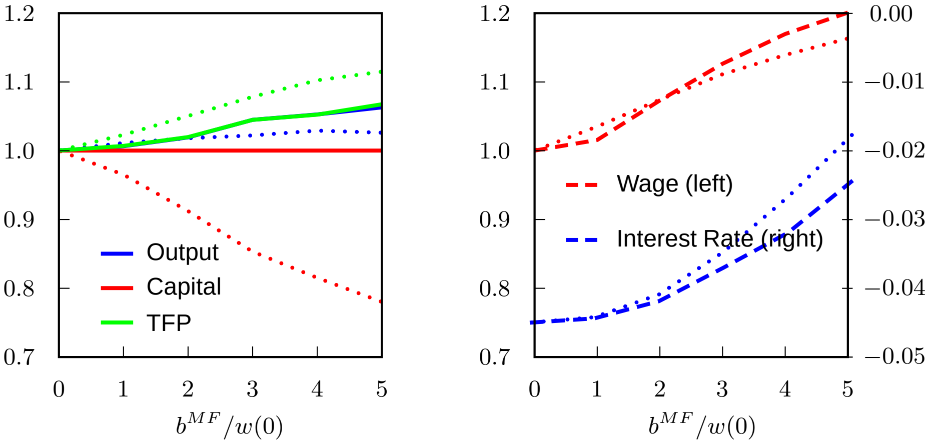
  - Rural villages likely to have segmented markets, 7 percent overall wage increase
    - concentrated in low-skilled labor in the village

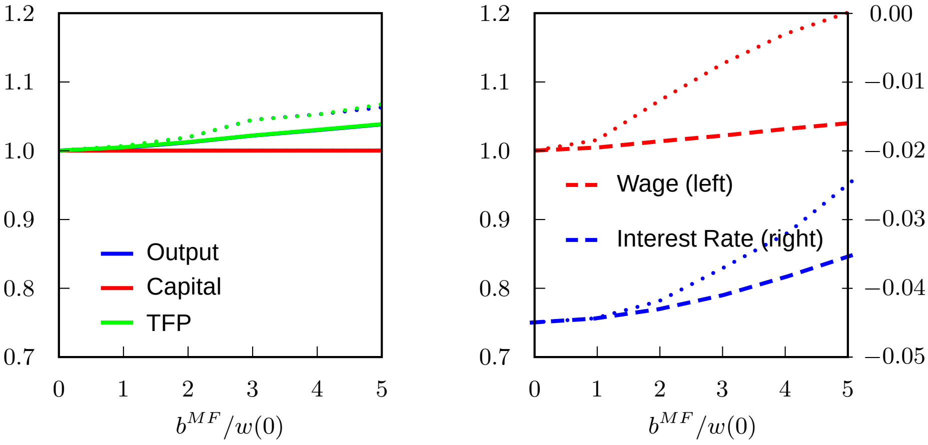
Aggregate Implications



Aggregate Implications: Short-Run vs. Long-Run



Aggregate Implications: Role of Occupational Choice



Explaining Aggregate Effects

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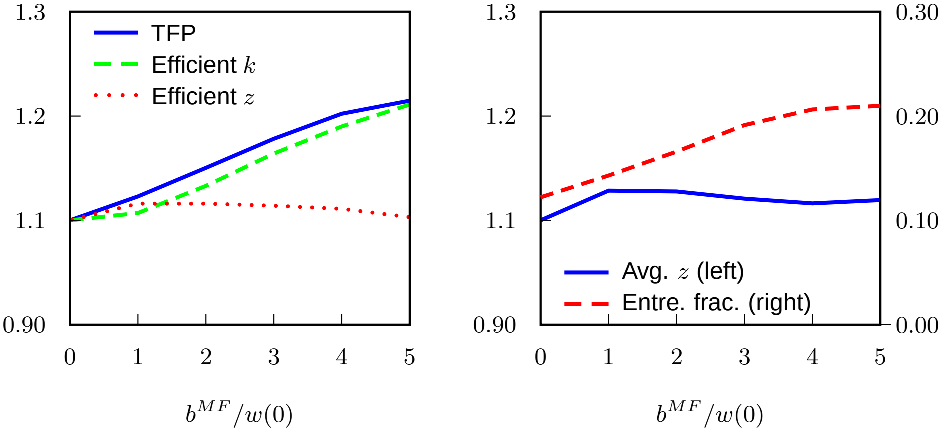
- Why does TFP increase?
  - Microfinance allows entrepreneurs with high marginal product of capital to invest more
- Why does capital fall?
  - Microfinance redistributes income from talented (high saving) to untalented (low saving) individuals

Understanding TFP



details

Understanding Capital Accumulation

Aggregate savings rate, S/Y, is an (income) weighted average of individual savings:

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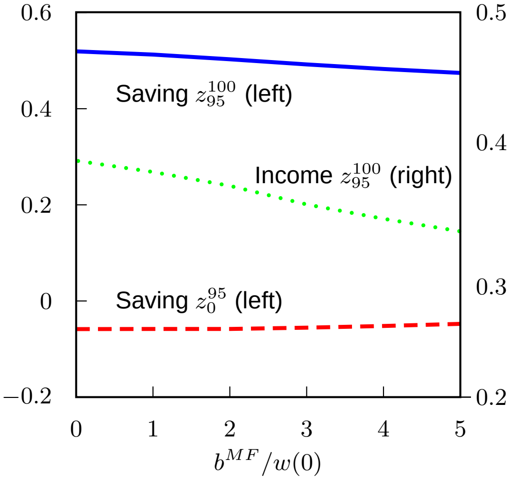
$$\frac{S}{Y} = \frac{Y(z_{low})}{Y} \frac{S(z_{low})}{Y(z_{low})} + \frac{Y(z_{high})}{Y} \frac{S(z_{high})}{Y(z_{high})}$$

Understanding Capital Accumulation



Distribution of Welfare Gains

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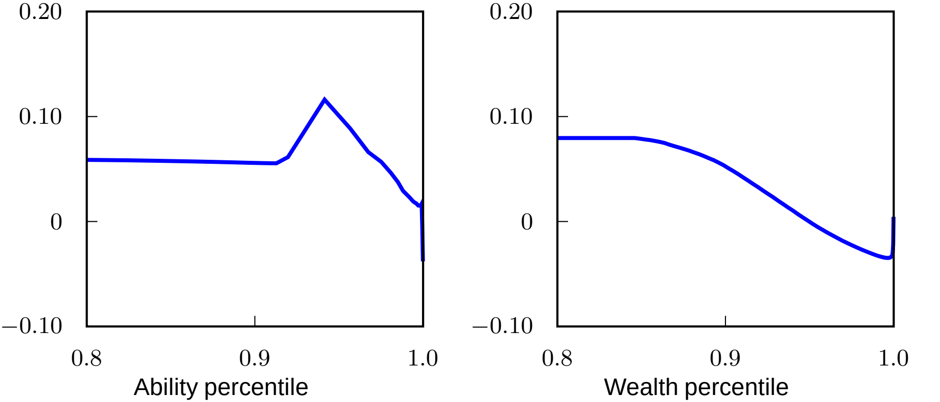
fraction of permanent consumption



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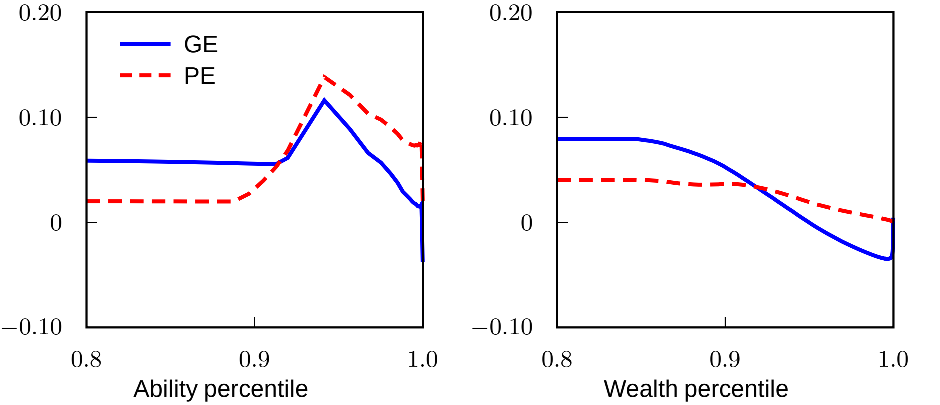
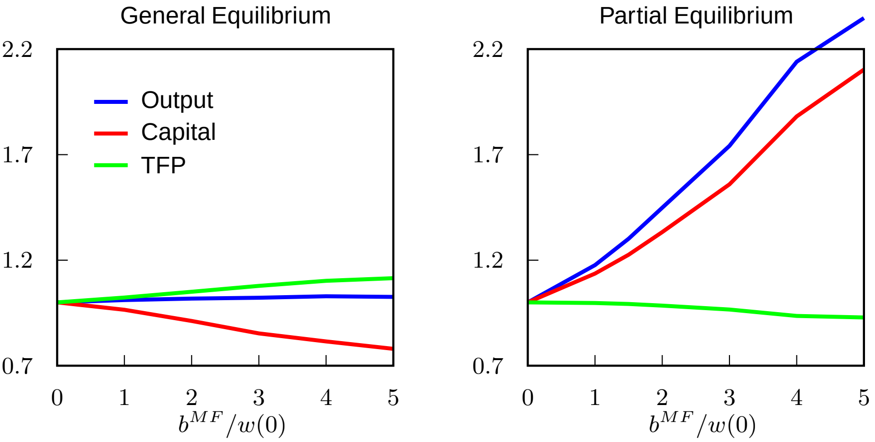
   - lower TFP (less entry, talented guys get less resources)
   - less capital (wages redistribute to low savers)

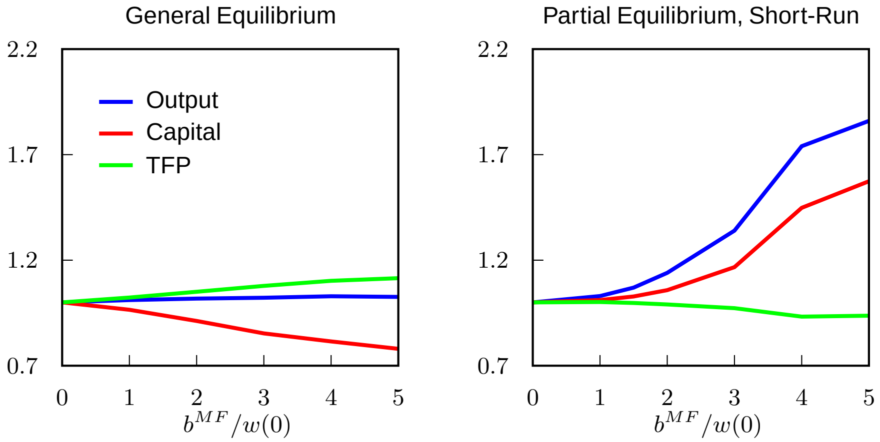
More Redistribution in GE



Smaller Aggregate Impacts in GE



Smaller Aggregate Impacts in GE vs PE short-run



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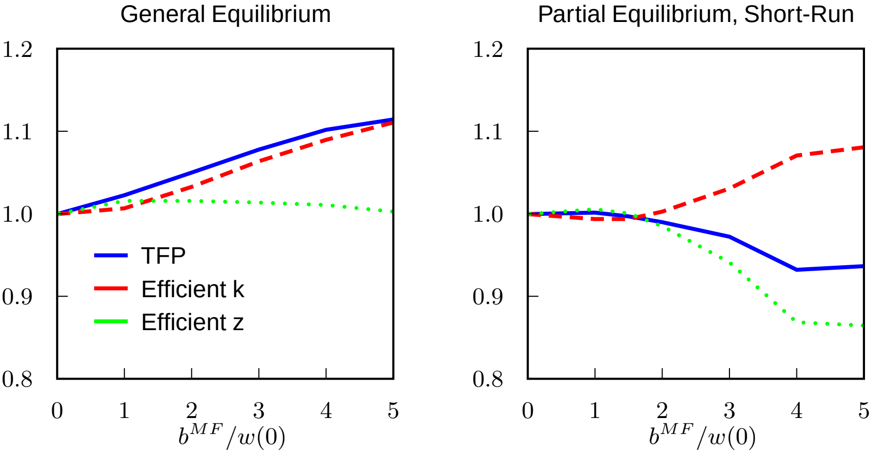
TFP Decomposition



Extensions

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  (capturing capital supplied by foreign donors)

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- Two-sector model with fixed costs Ext3
  (capturing additional GE effect on relative price)

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  (capturing additional GE effect on relative price)
  - Large impact of large loans

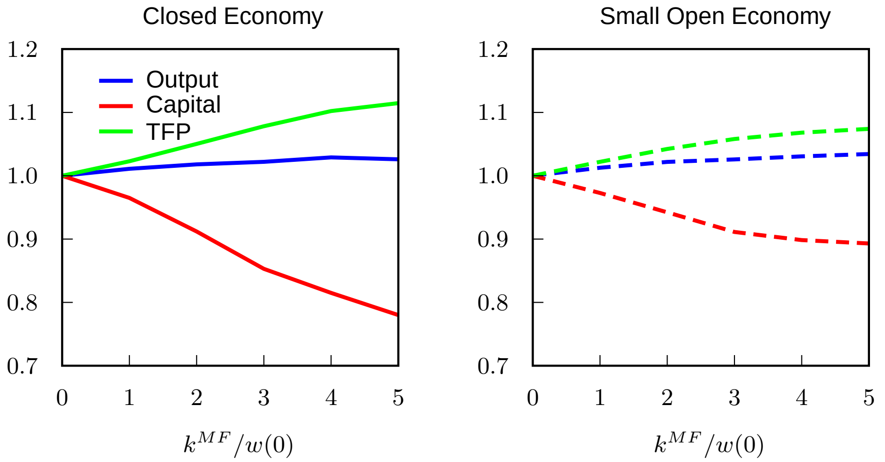
Conclusion

- In GE microfinance is primarily a redistributive policy
- Potential impact on consumption & productivity, but not aggregate output as it discourages capital accumulation.
- GE effects differ from PE
  - smaller effects on output and consumption
  - more redistribution in GE
  - opposite effects on TFP and capital accumulation

Small Open Economy Model

- Fixed interest rate, wage rate still adjusts
- Captures idea that microfinance capital may come from abroad
- Capital still linked to savings decisions through collateral constraints

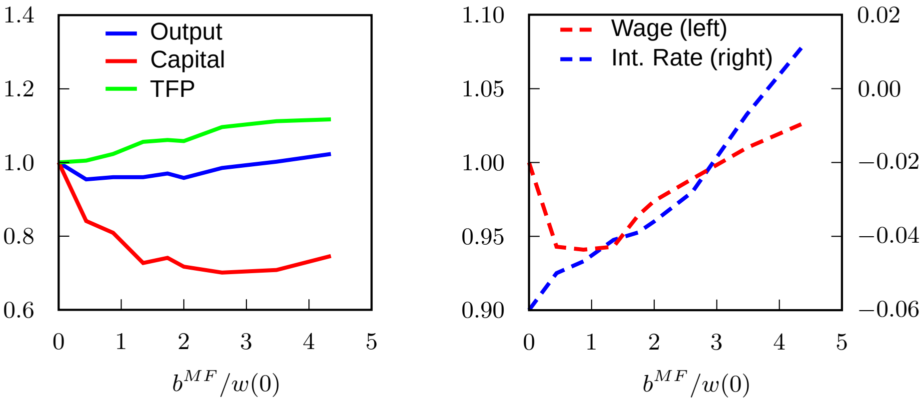
Closed vs. Small Open Economy



Labor Shock Model

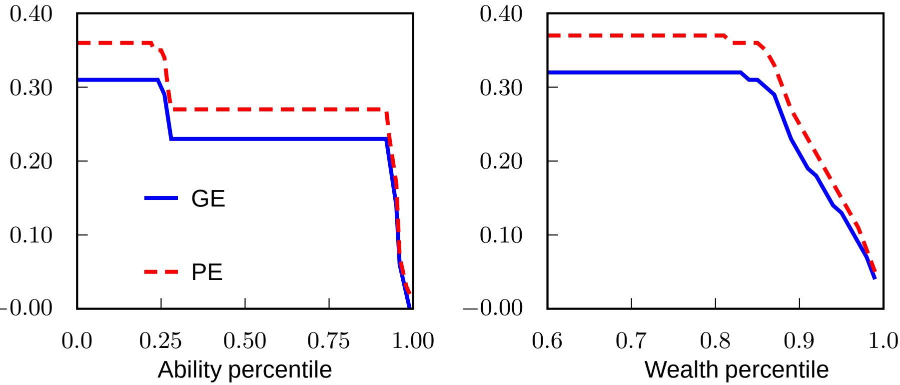
- When idea dies, draw zero labor endowment with probability π
- Captures idea of poor, potentially undercapitalized, low ability entrepreneur
- Calibrate π to match 35 percent self-employed (India)

Aggregate Impacts: Labor Shock



Poorest, i.e., self-employed, benefit most

back

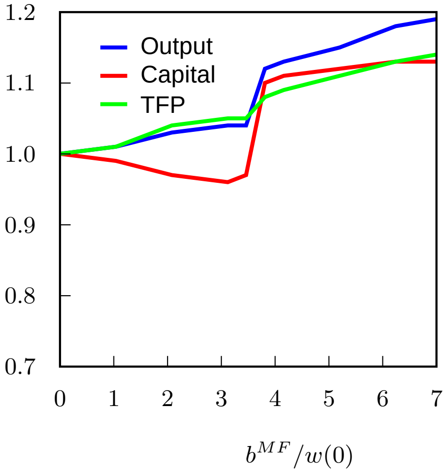


Two-Sector Model

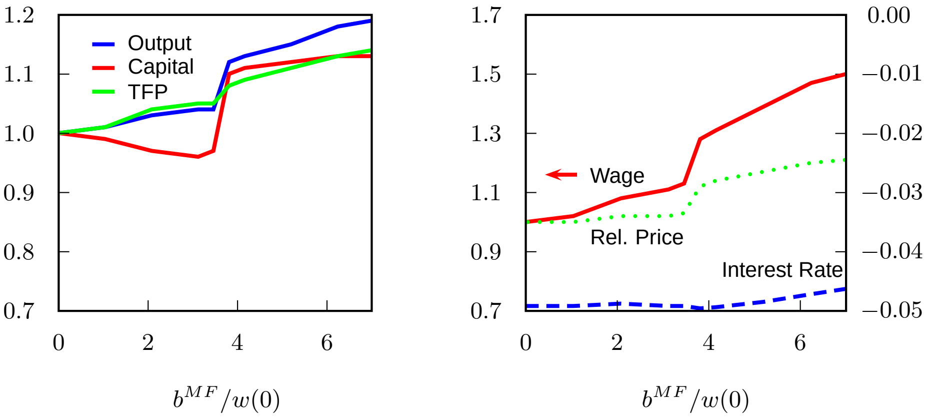
- Two sectors: $p = (p_S, p_M)$, with different fixed costs, $\kappa_S < \kappa_M$, S: Services M: manuf./investment
- Heterogeneous individuals: entrepreneurial ability, z_S and z_M, and wealth,
- Choice of occupation and sector: Work for wage or operate their own technology in either sector,
- Financial friction: collateral constraint, limited enforcement.

details

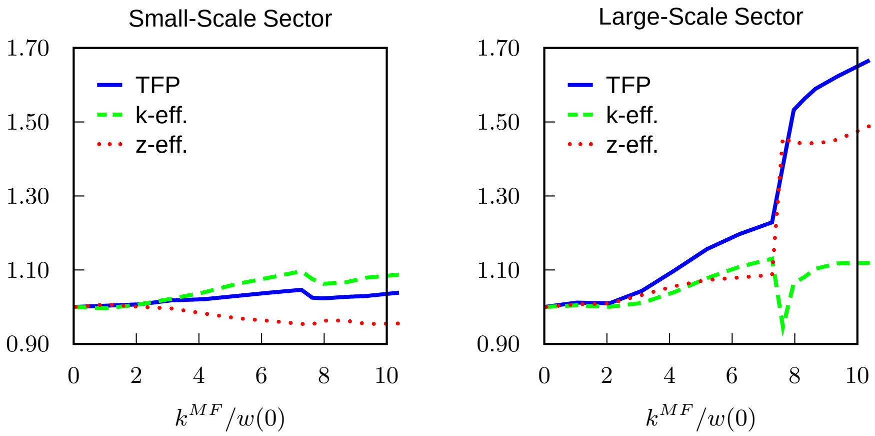
Aggregate Implications: Two-Sector



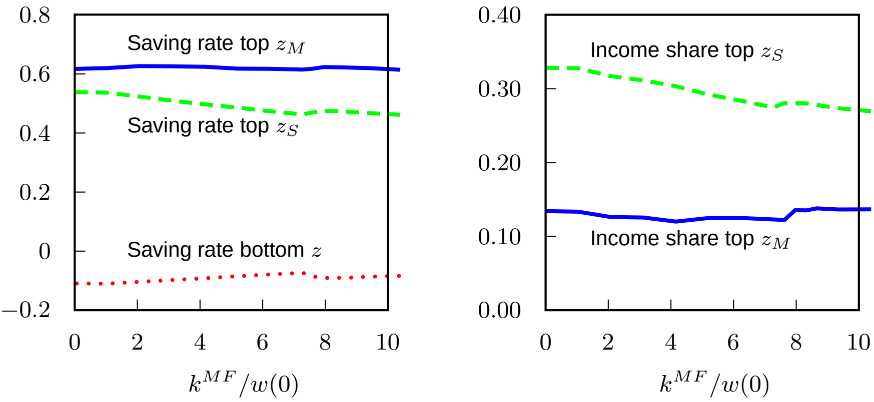
Aggregate Implications: Two-Sector (Cont'd)



Understanding TFP: Two-Sector



Understanding Capital Accumulation: Two-Sector



Model: Endogenous Rental Limits

$$\max_{c,a',l} \; u\left(c\right) + \beta \mathbb{E}_z v\left(a', z'\right) \geq v^{def}$$

Model: Endogenous Rental Limits

$$\max_{c,a',l} \; u(c) + \beta \mathbb{E}_z v\left(a', z'\right) \geq v^{def}$$

where

$$v^{def} = \max_{c,a',l} u(c) + \beta \mathbb{E}_z v\left(a', z'\right)$$

$$c + a' \leq (1-\phi)\left[zk^{\alpha} l^{\theta} - wl + (1-\delta)k\right]$$

Model: Endogenous Rental Limits

$$\max \ u(c) + \beta \mathbb{E}_z v\left(a', z'\right) \geq v^{def}$$

back

Model: Endogenous Rental Limits

$$\max \; u(c) + \beta \mathbb{E}_z v\left(a', z'\right) \geq v^{def}$$

$$\Updownarrow$$

$$zk^{\alpha}l^{\theta} - (r+\delta)k - wl + (1+r)a$$

$$\geq (1-\phi)\left[zk^{\alpha}l^{\theta} - wl + (1-\delta)k\right]$$

back

Model: Endogenous Rental Limits

$$\max\ u(c) + \beta \mathbb{E}_z v\left(a', z'\right) \geq v^{def}$$

$$\Updownarrow$$

$$zk^{\alpha}l^{\theta} - (r+\delta)k - wl + (1+r)a$$

$$\geq (1-\phi)\left[zk^{\alpha}l^{\theta} - wl + (1-\delta)k\right]$$

$$\Updownarrow$$

$$k \leq \overline{k}(a, z; \phi)$$

back

Table: Summary of Public Small Business Credit Programs

	India	Indonesia	Philippines	Thailand
Program	NABARD	BRI-KUPEDES	PCFC	MBVF
Program Size	$2.7 Bn	$21 Bn	$150 M	$1.5 Bn
Typical/Avg. Loan	$1,200	up to $2,800	up to $3,500	$500
Loan/Income per-Capita	1.4	up to 1.3	up to 2	0.4

back

Country	Borrowers per-capita	MF Loans /GDP	Average Loan Balance	Per-capita Income	Total Credit / GDP
Bangladesh	0.13	0.028	112	547	0.37
Mongolia	0.13	0.129	1393	1410	0.62
Peru	0.11	0.041	1590	4658	0.21
Bolivia	0.09	0.107	1926	1776	0.31
Vietnam	0.09	0.044	510	1024	1.06
Kenya	0.04	0.036	744	803	0.20
India	0.02	0.003	146	1154	0.53
Mean	0.02	0.004	655	3192	0.50
Std. Dev.	0.03	0.020	3192	3071	0.30

back

Two-Sector Model: Plant Technology

Fixed cost $\kappa_S < \kappa_M$ (units of sector output)

back

Two-Sector Model: Plant Technology

Fixed cost $\kappa_S < \kappa_M$ (units of sector output)

Gross output: $f^i(z_i, k, l) = z_i k^\alpha l^\theta$

back

Two-Sector Model: Preferences

Households maximize

$$U(c) = E_0 \sum_{t=0}^{\infty} \beta^t u(c_t)$$

$$u(c_t) = \frac{1}{1-\sigma} \left(c_{S,t}^{1-\varepsilon} + c_{M,t}^{1-\varepsilon} \right)^{\frac{1-\sigma}{1-\varepsilon}}$$

back

Two-Sector Model: Individual Problem

Entrepreneurs' Bellman Equation, Sector i

$$v^i(a,z) = \max_{c,a',k,l} u(c) + \beta \mathbb{E}_z v(a',z')$$

$$pc + a' \leq p_i f(z_s,k,l) - Rk - wl - (1+r)p_i \kappa_i + (1+r)a$$

$$k \leq \overline{k}^i(a,z;\phi)$$

back

Modeling Microfinance

$$k \leq \max\{\bar{k}(a, z; \phi), \underline{k}^{MF} - p_i \kappa_i\}$$

back

Pareto Distribution of Productivity

$$z_i \sim \eta z_i^{-(\eta+1)}, \;\; z_S \perp z_M$$

- Thick right tail within *each* sector.
- Exact Cobb-Douglas benchmark.

▸ back

Perfect Credit Benchmark

Size Distribution of Establishments

- Sector i:

$$\Pr\left[\tilde{l}_i > l\right] = \left(\frac{l\left(\hat{z}_i\right)}{l}\right)^{\eta(1-\alpha-\theta)}$$

back

Perfect Credit Benchmark

Size Distribution of Establishments

- Sector i:

$$\Pr\left[\tilde{l}_i > l\right] = \left(\frac{l\left(\hat{z}_i\right)}{l}\right)^{\eta(1-\alpha-\theta)}$$

- Average employment per establishment $\bar{l}_i$:

$$\frac{\bar{l}_i}{\bar{l}_{i'}} = \frac{p_i \kappa_i + w}{p_{i'} \kappa_{i'} + w}$$

back

Empirical Strategy

Target	Data	Model	Parameter
US			
Avg. scale in services	14	14	$\kappa_S = 0.00$
Avg. scale in manuf.	47	47	$\kappa_S = 1.00$
Manuf. share of GDP	0.25	0.25	$\psi = 0.91$

back

"It is worth noting that a fairly low take-up (16% after two years), similar to what was found in other studies, suggest that the effect of the program on poverty reduction and welfare is necessarily going to be relatively limited, even in the longer run. This is not necessarily a failure of this program in particular, or micro-credit in general. It may well be a very effective tool precisely for the minority of households who wants to expand their activity."

Crepon, Devoto, Duflo and Pariente (2011) back

Understanding TFP

$$Y = \underbrace{\frac{\left[\int_{i:o_i=e} z_i^{\frac{1}{1-\theta}} \left(\frac{k_i}{K}\right)^{\frac{\alpha}{1-\theta}} di\right]^{1-\theta}}{N^{1-\alpha-\theta}} \left(\frac{L}{N}\right)^{\theta}}_{TFP} K^{\alpha} N^{1-\alpha}$$

where $N = L + E$, $L = \int_{i:o_i=w} di$ and $E = \int_{i:o_i=e} di$

Understanding TFP (cont'd)

$$TFP^{k-eff} = \left[\frac{\int_{i:o_i=e} z_i^{\frac{1}{1-\alpha-\theta}} di}{E} \right]^{1-\alpha-\theta} \left(\frac{E}{N} \right)^{1-\alpha-\theta} \left(\frac{L}{N} \right)^{\theta}$$

Understanding TFP (cont'd)

$$\frac{TFP(b^{MF})}{TFP(0)} = \underbrace{\frac{\frac{TFP(b^{MF})}{TFP^{k-eff}(b^{MF})}}{\frac{TFP(0)}{TFP^{k-eff}(0)}}}_{k-efficiency} \underbrace{\frac{TFP^{k-eff}(b^{MF})}{TFP^{k-eff}(0)}}_{z-efficiency}$$

back