Part 3: Financial Frictions and Misallocation

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Misallocation and Aggregate Productivity
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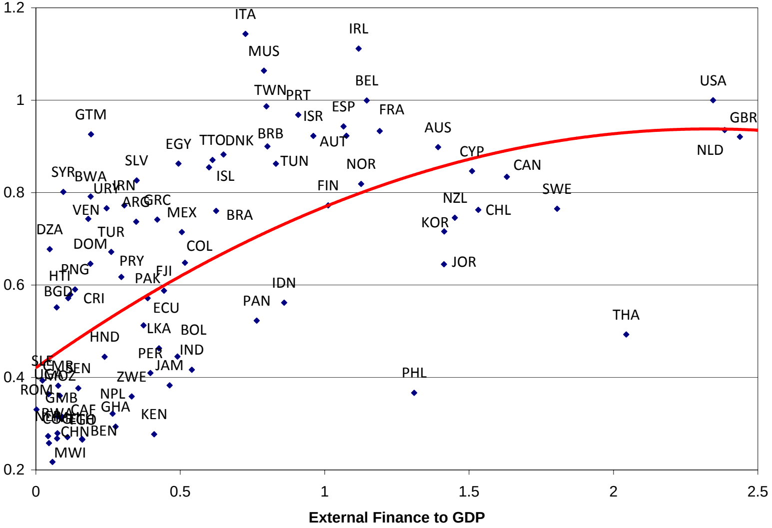
Motivation

- Finance constraints often invoked as important source of misallocation:
  - Financial markets channel funds from low to high productive opportunities
  - Weak financial systems thus hinder reallocation towards productive firms
  - High productivity firms need more K, but unable to borrow to finance it
- Motivating facts:
  - MPRK much more dispersed in data. Finance frictions primarily distort K
  - Strong correlation between Finance and TFP
  - Large variation in borrowing rates in developing countries.

Finance vs. TFP



High and Dispersed Borrowing Rates in Developing Countries

- See Banerjee and Duflo (2005, Handbook of Growth) and references therein
  - Depending on study, rates between 20 and 125 %
    - Much lower than rates of default, 0.5 - 10%
  - Extreme estimates of rates of return on capital:
    - Banerjee and Duflo (2014, Restud): use change in bank lending policies in India as exogenous variation. Estimate 74% rate of return
    - Goldstein and Udry (2009): 125-250% mean rate of return in Ghana to grow pineapples pineapples. Main reason: "I don't have the money"

Outline

- Discuss 2 papers:
    - Moll 2014: sharp intuition with simple model for how finance matters
    - Midrigan and Xu 2013: quantitative evaluation with micro-level data

Moll 2014

- “Productivity Losses from Financial Frictions: Can Self-Financing Undo Capital Misallocation?"
- Tractable due to continuous time, constant returns
- Today: mapping from (wealth, productivity, finance) distribution to TFP
- Paper characterizes evolution of the distribution, which I skip

Setup

- Technology of producer i

$$y_i = z_i k_i$$

- Producer has net worth w_i

- Problem is to

$$\max_{k_i} z_i k_i - r k_i$$

s.t.

$$k_i \leq \lambda a_i$$

  - r: rental rate (user cost) of k.
  - $\lambda \geq 1$ determines severity of financial constraint
    - $\lambda = 1$: no external finance
    - $\lambda = \infty$: no financial constraint

Digression on form of borrowing constraint

- $k_i \leq \lambda a_i$ constraint on how much capital can rent
- Isomorphic to collateral constraint on debt (Kiyotaki-Moore)
- More familiar problem:

$$\max \sum_{t=0}^{\infty} u(c_t)$$

s.t.

$$c_t + k_{t+1} + (1+i)b_t = zk_t + (1-\delta)k_t + b_{t+1}$$

and

$$b_{t+1} \leq \theta k_{t+1}$$

- Let $a_t = k_t - b_t$ be net worth
  - Then budget constraint:

$$c_t + a_{t+1} = zk_t + (1+i)a_{t+1} - (i+\delta)k_t$$

  - Borrowing constraint:

$$k_{t+1} \leq \frac{1}{1-\theta}(k_{t+1} - b_{t+1}) = \frac{1}{1-\theta}a_{t+1}$$

Characterize TFP

- Key object: joint distribution $\mu(a, z)$
- Endogenous object, determined by agent's savings rule (see paper)
- Today focus on mapping from $\mu(a, z)$ to TFP

Recall Problem of Producer

$$\max_{k_i} (z_i - r) k_i$$

s.t.

$$k_i \leq \lambda a_i$$

- Trivial solution:

$$k_i = \begin{cases} \lambda a_i \text{ if } z_i \geqslant r \\ 0 \text{ otherwise} \end{cases}$$

- Aggregate output:

$$Y = \int z_i k_i \mathrm{d}i = \lambda \int_{z_i > r} z_i a_i \mathrm{d}i$$

Implications for TFP

- In aggregate, b is in zero net supply, so

$$K = \int_z \int_a a\mu\left(a, z\right) \mathrm{d}a \mathrm{d}z$$

- Let $\omega\left(z\right)$: share of aggregate K held by producers type z:

$$\omega\left(z\right) = \frac{\int_a a\mu\left(a, z\right) \mathrm{d}a}{K}$$

- Think of $\omega\left(z\right)$ as a pdf. Corresponding cdf is

$$\Omega\left(z\right) = \int_0^z \omega\left(z\right) \mathrm{d}z$$

Implications for rental rate

- Rewrite capital market clearing

$$K = \lambda \int_{z \geqslant r} \int_a a\mu\left(a, z\right) \mathrm{d}a\mathrm{d}z = \lambda K \int_{z \geqslant r} \omega\left(z\right) \mathrm{d}z = \lambda\left(1 - \Omega\left(r\right)\right) K$$

- Gives equilibrium rental (interest) rate r

$$1 = \lambda\left(1 - \Omega\left(r\right)\right)$$

  - For a given Ω, lower λ reduces r
  - Idea: productive bid down demand for capital, and thus rental rate
  - In equilibrium, drop in r reduces savings ($\Delta\ \Omega$) so tightens further

Finance vs. TFP

- Aggregate output:

$$Y = \lambda \int_{z \geqslant r} z \int_a a\mu(a,z)\,\mathrm{d}a\mathrm{d}z = \lambda K \int_{z \geqslant r} z\omega(z)\,\mathrm{d}z = \frac{\int_{z \geqslant r} z\omega(z)\,dz}{(1-\Omega(r))} K$$

- So TFP:

$$\text{TFP} = \frac{\int_{z \geqslant r} z\omega(z)\,dz}{(1-\Omega(r))}$$

  - Weighted average of z of those that operate
  - Weight = wealth share of producers of type z
  - TFP higher if wealth share of productive higher
  - Higher λ reduces $(1-\Omega(r))$ (kicks out unproductive) and raises TFP

Example

- Suppose

$$\Omega(z) = 1 - z^{-\eta}, \quad \eta > 1$$

- Then

$$r = \lambda^{\frac{1}{\eta}}$$

and

$$\text{TFP} = \frac{\eta}{\eta - 1}\lambda^{\frac{1}{\eta}}$$

- With Pareto, low η = fatter tails (productive have more wealth)
    - amplifies effect of λ
    - productive can lever up more

Summary, Moll 2014

- Elegant theory mapping collateral constraints to TFP
- Illustrates how wealth share of various productivity types matters
- Important assumption: constant returns
  - All producers that operate are constrained
  - Efficiency requires having the most productive z operate
- Next paper relaxes CRS and quantitatively evaluates mechanism

Midrigan and Xu 2013

- "Finance and Misallocation: Evidence from Plant Level Data"
- What is the effect of financial frictions on aggregate TFP?
- Study two channels:
    - finance frictions distort *entry* and *technology adoption*
    - finance frictions generate capital *misallocation*

Goal

- Quantitatively evaluate two channels
- Model of establishment dynamics with borrowing constraints
- Producer-level data
    - Korea (before and during 1997 crisis), Colombia, China

Findings

- Modest (5%) losses from capital misallocation
  - self-financing
  - 1/10th misallocation Hsieh and Klenow (2009) document
  - small relative to existing quantitative studies
- Potentially large (40%) losses from inefficient entry and adoption
  - difficult to self-finance long-lived investments

Outline

1. Benchmark Model
2. Data and Quantitative Implications
3. Extension with Technology Adoption
4. Capital Misallocation. Model vs. Data
5. Korean Financial Crisis

Overview of Benchmark Model

- Producers: idiosyncratic efficiency shocks
  - Traditional, *unproductive* sector. Labor only
  - Modern, *productive* sector. Capital + sunk entry cost
  - Limits on how much equity and risk-free debt can issue

- Workers: idiosyncratic labor income risk
  - Save risk-free loans or producer equity

- Balanced growth
  - Worker efficiency grows at rate $\gamma > 1$
  - Measure of producers: $N_{t+1} = \gamma N_t$
  - New producers enter traditional sector. Zero initial assets

Traditional sector producers

- Preferences:

$$E_0 \sum_{t=0}^{\infty} \beta^t \log\left(C_t\right)$$

- Technology:

$$Y_t = \exp\left(z + e_t\right)^{1-\eta} L_t^{\eta}$$

z: permanent productivity component, $\sim G(z)$

e: transitory component with $f_{i,j} = \Pr\left(e_{t+1} = e_j | e_t = e_i\right)$

- Budget constraint if remain in traditional sector:

$$C_t = Y_t - W L_t - (1+r) D_t + D_{t+1}$$

  - Cannot borrow, $D_{t+1} \leq 0$

Modern Sector Producers

- Technology:

$$Y_t = \exp\left(z + e_t + \phi\right)^{1-\eta} \left(L_t^{\alpha} K_t^{1-\alpha}\right)^{\eta}$$

- One-time sunk cost $\kappa \exp(z)$ to enter

Traditional sector producers who switch

- Budget constraint:

$$C_t + K_{t+1} + \exp\left(z\right)\kappa = Y_t - WL_t - \left(1+r\right)D_t + D_{t+1} + \theta\chi P_t$$

- Borrowing constraint:

$$D_{t+1} \leqslant \theta\left(K_{t+1} + \exp\left(z\right)\kappa\right)$$

- Issue claims to fraction $\theta\chi$ of future profits in modern sector

$$\Pi_t^m = Y_t^m - (r+\delta)K_t - WL_t$$

$$P_t = \textstyle\sum_{s=1}^{\infty}\left(\frac{1}{1+r}\right)^s \Pi_{t+s}^m$$

Modern sector producers

- Preferences:

$$E_0 \sum_{t=0}^{\infty} \beta^t \log \left(C_t\right)$$

- Budget constraint:

$$C_t + K_{t+1} - (1-\delta)\, K_t = Y_t - W L_t - (1+r)\, D_t - \theta \chi \Pi_t^m + D_{t+1}$$

- Borrowing constraint:

$$D_{t+1} \leqslant \theta \left(K_{t+1} + \exp(z)\, \kappa\right)$$

Workers

- Identical log-preferences as entrepreneurs
- Idiosyncratic income risk ν_t
- Budget constraint

$$c_t + a_{t+1} + \int P_t^i \omega_{t+1}^i di = W\gamma^t \nu_t + (1+r)\, a_t + \int \left(P_t^i + \Pi_t^{m,i}\right) \omega_t^i di$$

- ω_t^i : share of equity claims on producer i
- Cannot borrow, $a_{t+1} + \int P_t^i \omega_{t+1}^i di \geq 0$

Recursive Formulation

- Let $A = K - D$: net worth
  - sufficient state variable
- Producer's problem HD 1 in $(A, \exp(z))$
- Rescale: $a = A/\exp(z)$, $c = C/\exp(z)$ etc

Dynamic program in modern sector

$$V^m(a, e_i) = \max_{a', c} \log(c) + \beta \sum_m f_{i,j} V^m(a', e_j)$$

$$c + a' = (1 - \theta\chi)\, \pi^m(a, e) + (1 + r)\, a$$

$$\pi^m(a, e) = \max_{k, l} \exp(e + \phi)^{1-\eta} \left(l^\alpha k^{1-\alpha}\right)^\eta - Wl - (r + \delta)\, k$$

s.t.

$$k \leq \frac{1}{1 - \theta} a + \frac{\theta}{1 - \theta} \kappa$$

Decision rules in modern sector

- Labor and capital:

$$\alpha\eta\frac{y\left(a,e\right)}{l\left(a,e\right)}=W$$

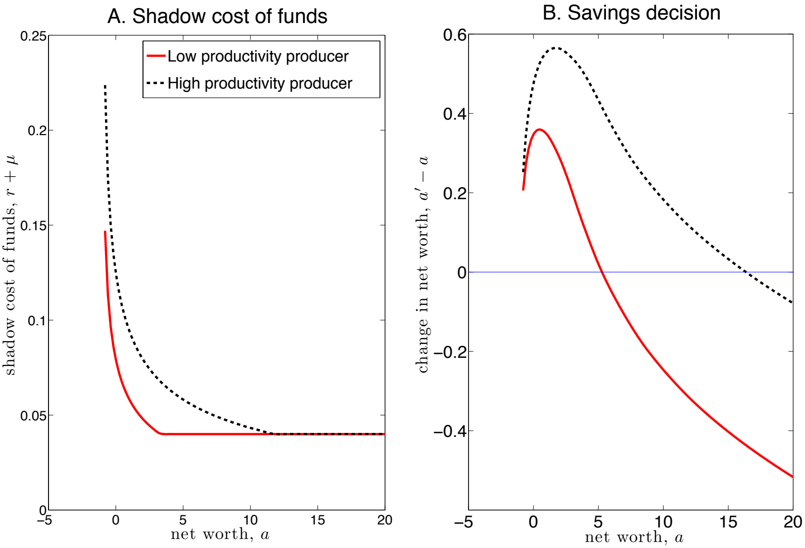
$$\left(1-\alpha\right)\eta\frac{y\left(a,e\right)}{k\left(a,e\right)}=r+\delta+\mu\left(a,e\right)$$

  - Dispersion in μ – TFP losses misallocation

- Savings choice:

$$\frac{1}{c\left(a,e_i\right)}=\beta\sum f_{i,j}\left[\left(1+r\right)+\frac{1}{1-\theta}\mu\left(a',e_j\right)\right]\frac{1}{c\left(a',e_j\right)}$$

Decision rules in modern sector



Implications

- Permanent productivity component does not affect μ
  - Does not affect amount of misallocation
- Holding a fixed, higher e – more constrained
  - Finance frictions act like adjustment cost on k
- Absent e changes and producer growth: no misallocation
  - Finance constraints affect mean, not dispersion μ

Dynamic program in traditional sector

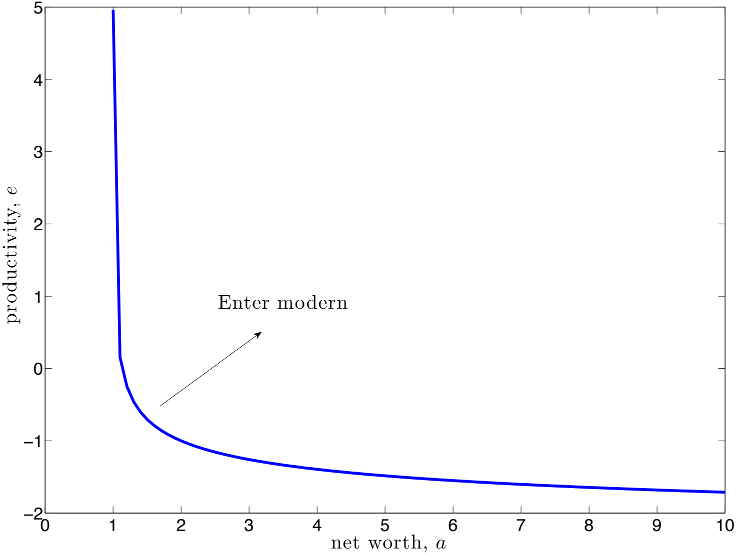
$$V^{\tau}\left(a,e_i\right)=\max_{a',c}\log\left(c\right)+\beta\max\left\{\sum_j f_{i,j}V^{\tau}\left(a',e_j\right),\ \sum_j f_{i,j}V^{m}\left(a',e_j\right)\right\}$$

$$c+x=\pi^{\tau}\left(e\right)+\left(1+r\right)a$$

$$\pi^{\tau}\left(e\right)=\max_{l}\exp\left(e\right)^{1-\eta}l^{\eta}-Wl$$

$$a'=x-\left(\kappa+\theta\chi p\left(a',e_i\right)\right)\times\text{switch}$$

Decision to switch



Equilibrium

$$\int_{A\times E} dn_t^m(a,e) + \int_{A\times E} dn_t^\tau(a,e) = N_t$$

$$n_{t+1}^m(\mathcal{A},e_j) = \int_A \sum_i f_{i,j} \mathrm{I}_{\{a^m(a,e_i)\in\mathcal{A}\}} dn_t^m(a,e_i) +$$
$$\int_A \sum_i f_{i,j} \mathrm{I}_{\{\xi(a,e_i)=1,\ a^{\tau,s}(a,e_i)\in\mathcal{A},\}} dn_t^\tau(a,e_i)$$

$$n_{t+1}^\tau(\mathcal{A},e_j) = \int_A \sum_i f_{i,j} \mathrm{I}_{\{\xi(a,e_i)=0,\ a^\tau(a,e_i)\in\mathcal{A}\}} dn_t^\tau(a,e_i) +$$
$$(\gamma-1) N_t \mathrm{I}_{\{0\in\mathcal{A}\}} \bar{f}_j$$

Equilibrium W, r, $p(a,e)$

- Labor market clears:

$$L_t = \gamma^t = \int_{A\times E} l^\tau(e)\, dn_t^\tau(a,e) + \int_{A\times E} l^m(a,e)\, dn_t^m(a,e)$$

- Asset market clears:

$$A_{t+1}^w + \theta\chi \int_{A\times E} p(a,e)\left(dn_{t+1}^m(a,e) - dn_t^m(a,e)\right) +$$
$$\int_{A\times E} a_{t+1}^\tau(a,e)\, dn_t^\tau(a,e) + \int_{A\times E} a_{t+1}^m(a,e)\, dn_t^m(a,e) = 0,$$

- No arbitrage:

$$p(a,e_i) = \frac{1}{1+r}\sum_j f_{i,j}\left[p(a',e_j) + \pi^m(a',e_j)\right].$$

TFP losses and efficient allocations

- Two sources of TFP losses

  1. Dispersion μ (MPK) modern sector – misallocation
  2. Inefficient entry in modern sector

- Compute 1. by equating MPK in modern sector

  - given $K^m, L^m, n^m(e)$ in original economy

- Compute 2. by solving planner's choice $K^m, L^m, n^m(e)$

  - Same technology constraint, no restrictions on transfers

Losses from Misallocation Modern Sector

- Aggregation: $Y = TFP \left(L^{\alpha} K^{1-\alpha} \right)^{\eta}$

$$TFP = \exp(\phi)^{1-\eta} \frac{\left(\int_{i \in M} \exp\left(e_i\right) \left(r + \delta + \mu_i\right)^{-\frac{(1-\alpha)\eta}{1-\eta}} \, di \right)^{1-\alpha\eta}}{\left(\int_{i \in M} \exp\left(e_i\right) \left(r + \delta + \mu_i\right)^{\frac{\alpha\eta - 1}{1-\eta}} \, di \right)^{(1-\alpha)\eta}}$$

- Efficient level of TFP:

$$TFP^{e} = \exp(\phi)^{1-\eta} \left(\int_{i \in M} \exp\left(e_i\right) di \right)^{1-\eta}$$

TFP losses from misallocation

$$\log\left(\int_{i\in M}\exp\left(e_i\right)\right)^{1-\eta} - \log\frac{\left(\int_{i\in M}\exp\left(e_i\right)\left(\frac{y_i}{k_i}\right)^{-\frac{(1-\alpha)\eta}{1-\eta}}\right)^{1-\alpha\eta}}{\left(\int_{i\in M}\exp\left(e_i\right)\left(\frac{y_i}{k_i}\right)^{\frac{\alpha\eta-1}{1-\eta}}\right)^{(1-\alpha)\eta}}$$

- With log-normal e and y/k:

$$\frac{1}{2}\frac{\left(1-\alpha\eta\right)\left(1-\alpha\right)\eta}{1-\eta}\mathrm{var}\left(\log(y_i/k_i)\right)$$

Overall TFP Losses:

- Planner problem:

  1. Choose entry cutoff $\bar{e}$ to enter modern sector: gives n_i^m, n_i^τ
  2. Can freely transfer resources across workers/entrepreneurs
  3. Choose K^m, L^m, L^τ to max

$$\frac{\beta}{\gamma}\left(\sum_i \exp\left(e_i\right) n_i^\tau\right)^{1-\eta} \left(L^\tau\right)^\eta + \frac{\beta}{\gamma}\left(\sum_i \exp\left(e_i+\phi\right) n_i^m\right)^{1-\eta} \left(\left(L^m\right)^\alpha \left(K\right)^{1-\alpha}\right)^\eta - K + \frac{\beta}{\gamma}(1-\delta)K - \frac{\gamma-1}{\gamma}\kappa\sum_i n_i^m$$

Quantitative Analysis: Overview

- Study manufacturing panels Korea, China, Colombia
- Calibrate to Korea (91-96)
  - high external finance
- Study effect of tighter constraints (lower θ, χ)
- Evaluate predictions against data w/ low external finance
  - China, Colombia, Korea (97-98)
- Mostly focus on misallocation margin
  - associate *modern* sector with formal manufacturing

Assigned Parameters

- Cannot identify with producer-level data:
  - $\beta/\gamma = 0.92$ (discount factor)
  - $\delta = 0.06$ (depreciation rate)
  - $\eta = 0.85$ (span of control)
  - $\alpha = 0.67$ (labor elasticity)

- Worker efficiency: $\nu \in \{0, \bar{l}\}$ with $f_{0,0} = 1/2$ and $f_{\bar{l},\bar{l}} = 0.79$
  - gives emp-pop ratio = 70% and $r = 4.7\%$

- Modern efficiency gap: start $\phi = 0.2/(1-\eta)$, then vary
  - Mean producer 5 $\times$ larger in modern vs. traditional
  - 2 - 40 in the data (LaPorta-Shleifer, Hsieh-Klenow)

Calibration

- Producer productivity
  - Variance permanent productivity component, z_i
  - Transitory component: $e_{it} = \rho e_{it-1} + \sigma \varepsilon_{it}$
  - Calibrate to var(Δy_i), var(y_i), autocorr(y_i) at 1, 3, 5 years
- Collateral constraint, θ, and equity constraint, χ
  - Debt to GDP (1.2), Market Cap to GDP (0.3) in Korea
- Sunk cost to enter modern sector, κ
  - Intangibles Investment to GDP Korea = 4.7%
- Growth rate, γ
  - Output growth Korea manufacturing = 8.0%

Moments used in calibration

	Korea Data	Model
s.d. (Δy_{it})	0.59	0.58
s.d. (y_{it})	1.31	1.30
corr (y_{it}, y_{it-1})	0.90	0.90
corr (y_{it}, y_{it-3})	0.87	0.87
corr (y_{it}, y_{it-5})	0.85	0.86
Intang. invest. to output %	4.6	4.6
Output growth rate %	8.0	8.0
Debt to output	1.2	1.2
Equity to output	0.3	0.3

Parameter values

θ	0.86	collateral constraint
χ	0.10	equity constraint
ρ	0.25	AR(1) productivity
σ	0.50	s.d. shocks
$\mathrm{var}(z_i)$	1.47	
κ	$4\pi^m$ $(30\pi^\tau)$	sunk cost

- Implies z_i accounts 85% variance $z_i + e_i$
- Intangibles investment = 11% total investment

Moments not used in calibration

	Korea Data	Model
s.d. (Δl_{it})	0.49	0.58
s.d. (Δk_{it})	0.57	0.57
s.d. (l_{it})	1.21	1.30
s.d. (k_{it})	1.44	1.30
corr (l_{it}, l_{it-1})	0.92	0.90
corr (l_{it}, l_{it-5})	0.86	0.86
corr (k_{it}, k_{it-1})	0.92	0.90
corr (k_{it}, k_{it-5})	0.86	0.86

Moments not used in calibration

	Korea Data	Model
share producers, ages 1-5	0.51	0.32
share producers, ages 6-10	0.27	0.22
share output, ages 1-5	0.20	0.28
share output, ages 6-10	0.20	0.23
share employment, ages 1-5	0.21	0.28
share employment, ages 6-10	0.20	0.23
share capital, ages 1-5	0.22	0.26
share capital, ages 6-10	0.21	0.23
Relative y growth, 1-5 vs. 11 +	0.11	0.09
Relative l growth, 1-5 vs. 11 +	0.09	0.09
Relative k growth, 1-5 vs. 11 +	0.09	0.13

Aggregate Implications: Open Economy

	'Korea'	Efficient	$\theta = 1$
Interest rate %	4.7		4.7
Debt to Y	1.2		1.3
Equity to Y	0.3		0.3
Percent constrained	17		0
K/Y	2.6	1.9	2.7
TFP modern	1	1.003	1.003
Misallocation, %	0.3	0	0
Producers modern, %	93	93	93
Consumption	1	1.02	1.01
Output	1.68	1.50	1.70

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Misallocation, %	0.3	0	0
Producers modern, %	93	93	93
Consumption	1	1.02	1.01
Output	1.68	1.50	1.70

Aggregate Implications: Open Economy

	$\theta = 1$	$\theta = 0$
Interest rate %	4.7	4.7
Debt to Y	1.3	-0.6
Equity to Y	0.3	0
Percent constrained	0	83
K/Y	2.7	2.1
TFP modern	1	0.83
Misallocation, %	0	4.7
Producers modern, %	93	35
Consumption	1.01	0.82
Output	1.70	1.13

Aggregate Implications: Open Economy

- 20% lower C, 40% lower Y
- mostly due to *entry* distortion
- misallocation loss modern sector $< 5\%$
- Idea:
  - Productive modern producers self-finance
  - Poor traditional producers cannot self-finance entry cost

Role of Equity Constraint

- None for θ near 1 or 0
- Larger for intermediate values
- E.g., $\theta = 0.75$

	E to Y = 0.3	E to Y = 0
Debt to Y	0.92	0.85
TFP modern	0.99	0.92
Misallocation, %	1.4	2.7
Producers modern, %	93	61
Consumption	0.98	0.91
Output	1.62	1.42

Role of Equity Constraint

- 8.5% lower C, 13% lower Y
- Mostly due to entry distortion
- Can borrow to finance sunk cost

$$d' \leq \theta(k' + \kappa)$$

- But tighter natural borrowing limit

$$d' \leq k' + \frac{\pi^m(e_1)}{r}$$

  - equity allows state-contingent repayments

Role of Equity Constraint

- Need to match facts on young producers

	Korea	Benchmark	$\chi = 0$
Δy, 1-5 vs. 11+	0.11	0.09	0.34
Δk, 1-5 vs. 11+	0.09	0.13	0.50
Y/K 1-5 vs. 11+	-0.2/0.2	0.08	0.40
Misallocation, %		0.3	2.3

Closed vs. Open Economy

- Illustrate for $\theta = 0.25$ and $\chi = 0.10$
  - No equilibrium for lower θ: r too low – no entry

	Open	Closed
r, %	4.7	1.9
Debt to Y	-0.14	0.58
Equity to Y	0.14	0.58
TFP modern	0.87	0.93
Misallocation, %	4.4	7.3
Producers modern, %	48	87
Consumption	0.84	0.91

Role of productivity gap, ϕ

- Loss from moving from θ_{Korea} to $\theta = 0$

	$\phi = 0$	$\phi = 0.2$	$\phi = 0.4$
ΔC, %	0.0	19.9	36.0
ΔTFP^m, %	27.1	18.6	26.0
Δ misallocation, %	0.3	4.4	8.8

Larger productivity gap: larger losses from finance frictions.
Mostly due to entry distortions.

Extension: technology adoption

- Benchmark: life-cycle growth only due to K accumulation
  - Data: 27% increase producer productivity over lifecycle
- Add option upgrade productivity by paying one-time cost κ_p

$$Y_t = \exp\left(z + e_t + \phi + \phi_p\right)^{1-\eta} \left(L_t^{\alpha} K_t^{1-\alpha}\right)^{\eta}$$

  - Set $\phi_p = 0.27/(1-\eta)$ so productivity grows 27% lifecycle
  - Set $\kappa_p = \exp(\phi_p)\kappa$
  - Choose κ so intangible investment = 4.6% GDP

Economy with Technology Adoption

- Open economy experiment. Change θ_{Korea} to 0

	Benchmark	Adoption
$\Delta C, \%$	19.9	37.4
$\Delta TFP^m, \%$	18.6	26.5
Δ misallocation, %	4.4	5.1

Summarize

- Potentially large losses from entry/adoption distortions
- Modest losses from misallocation
- Next: why are losses from misallocation small?
  - Decompose losses from misallocation
  - Model vs. Data

Losses from Misallocation

- Two sources of dispersion MPK
- Age channel: young are more constrained, higher MPK
- Adjustment channel: cannot ΔK in response to Δe
- Decompose two channels:
  - Project MPK on age
  - Compare variance residuals w/ fitted values

Two channels of misallocation

- Benchmark model without external finance
  - Age channel: 3.7% of 4.7% total misallocation loss
    - 73% MPK gap between 1-5 vs. 11+ producers
  - Adjustment channel weak:
    - controlling for age, 1.3% loss among 1-5 producers
    - controlling for age, 0.8% loss among 11+ producers

Bound on size of adjustment channel

- Adjustment channel: K responds gradually to Δe
- Worst case: K does not comove at all with e

$$\text{TFP loss} = (1-\eta)\log\int \exp\left(e_i\right) - (1-\alpha\eta)\log\int \exp\left(e_i\right)^{\frac{1-\eta}{1-\alpha\eta}}$$

- With Gaussian e

$$\frac{1}{2}\frac{(1-\alpha)\,\eta}{1-\alpha\eta}\,(1-\eta)\,\sigma_e^2$$

  - Benchmark: $\sigma_e^2 = 0.27$, worst loss $= 1.3\%$

- Losses from adjust. channel small because e shocks small

Misallocation losses data

- Compute *measured* TFP losses using

$$\log\left(\int_{i\in M}\exp\left(e_i\right)\right)^{1-\eta}-\log\frac{\left(\int_{i\in M}\exp\left(e_i\right)\left(\frac{y_i}{k_i}\right)^{-\frac{(1-\alpha)\eta}{1-\eta}}\right)^{1-\alpha\eta}}{\left(\int_{i\in M}\exp\left(e_i\right)\left(\frac{y_i}{k_i}\right)^{\frac{\alpha\eta-1}{1-\eta}}\right)^{(1-\alpha)\eta}}$$

- Overstates role of finance frictions:
    - Δs y/k may reflect technology/other distortions

- Isolate 2 channels:
    - Replace y/k with fitted values from projection on age
    - Worst-case losses from adjustment channel

TFP losses data

- Compare Korea (1.2 Debt-GDP), China (0.7), Colombia (0.2)

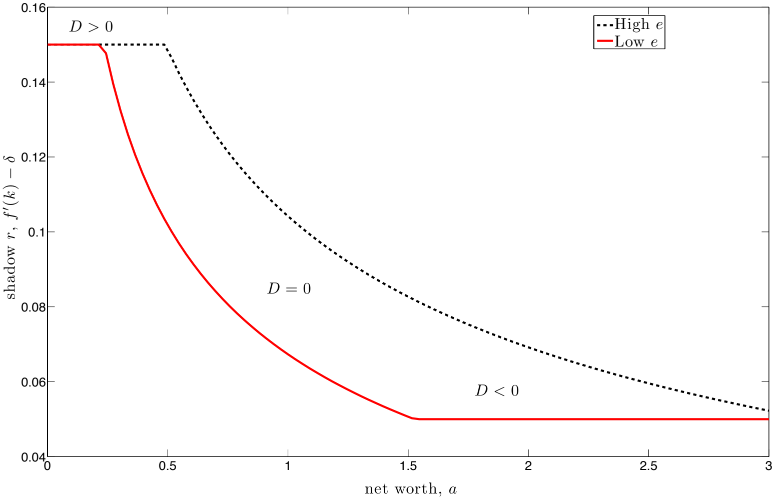
	Korea	China	Colombia
measured TFP Loss, %	16.2	22.4	17.7
loss due to age, %	0.2	0.3	2.7
Y/K 1-5 vs. 11+, %	0.21	0.15	-0.25
worst-case loss, %	2.4	2.9	1.9
var e, %	0.35	0.30	0.24

- Misallocation due to age/adjustment also low in the data

Additional Channel: Δs borrowing rates

- E.g. China: state-owned vs. private firms
  - Qian, Strahan, Yang (2010): 10 % borrowing spreads
- Simple model without entry:
  - 3 types of producers: borrow at 5%, 10%, 15%
  - All save at 5%
  - Calibrate to firm-level data from China

Decision rules



Misallocation with Δs borrowing rates

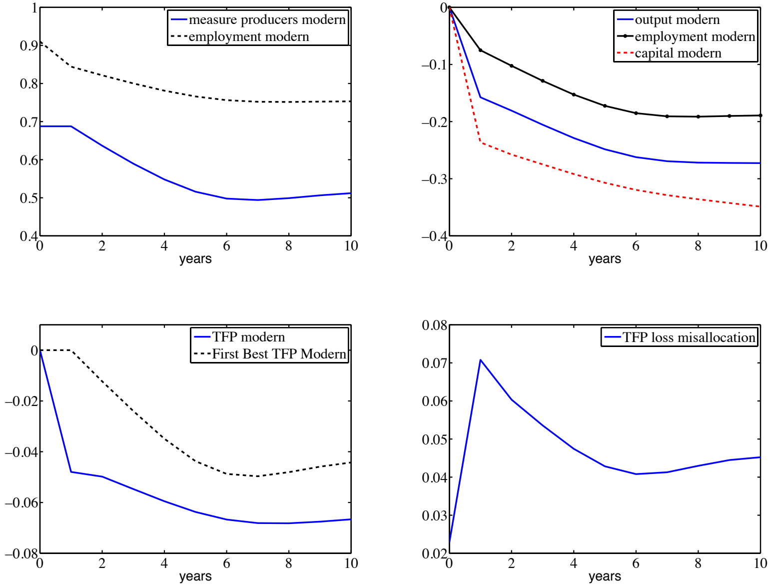
	$r_1 = 5\%$	$r_2 = 10\%$	$r_3 = 15\%$
mean $f'(k) - \delta$ %	5.0	7.6	8.2
Y/K	1	1.25	1.25
within- TFP Loss, %	0.0	1.0	2.2

- Overall TFP loss: 1.6%
- Consistent with Y/K ratio state vs. private firms in China:
  - 1.1 (mean) to 1.25 (aggregate)

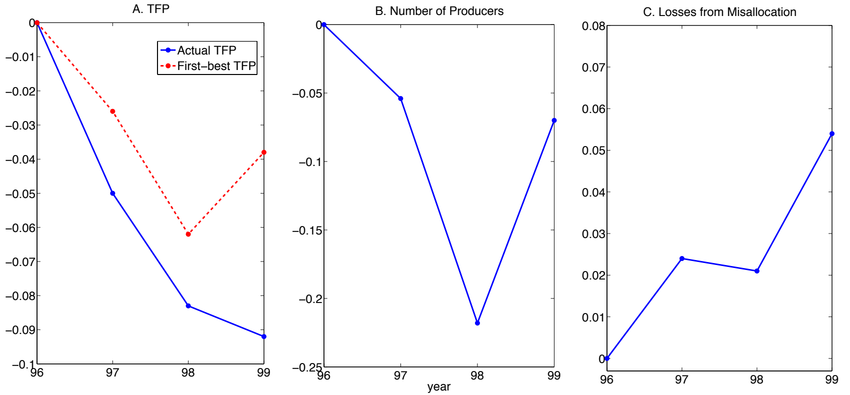
Evidence from Korean crisis

- debt to equity from 4 (early 97) to 2 (late 98)
- compute response to permanent drop θ in model

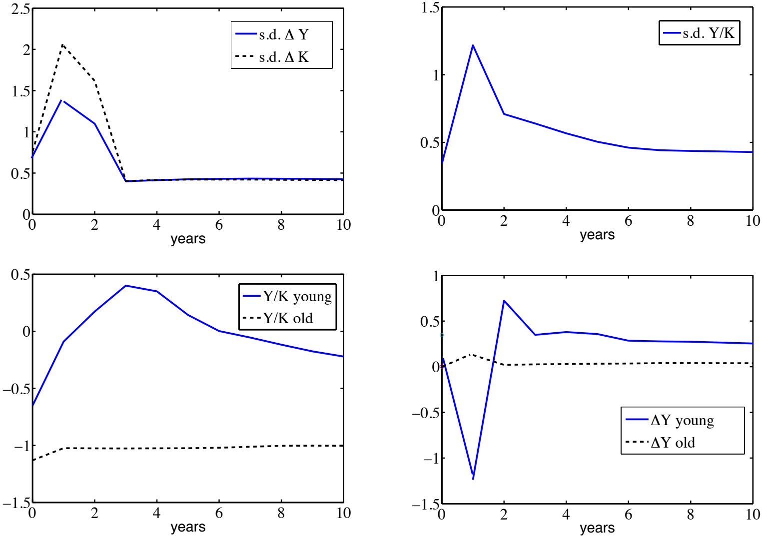
Response to a credit shock: model



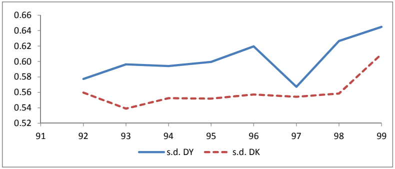
Response to a credit shock: data

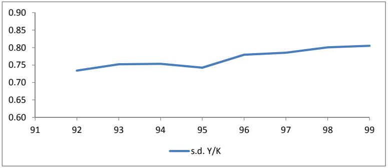


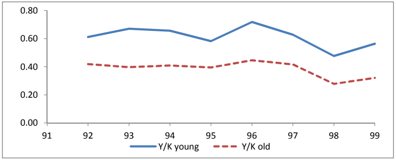
Micro implications: model

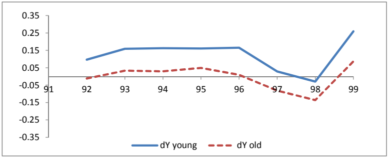


Micro implications: data



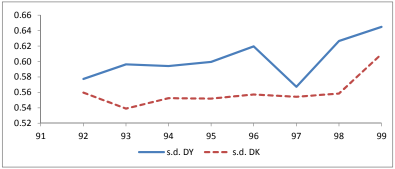


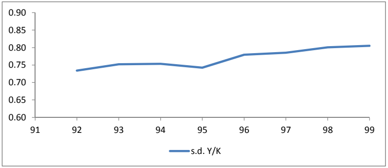


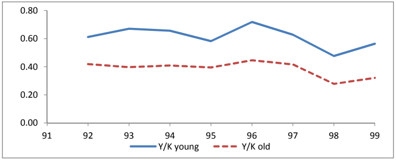


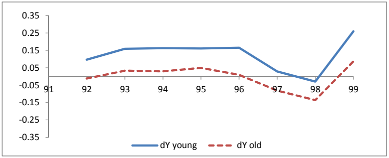
- Bottomline: model overstates importance of age channel

Micro implications: data









- Bottomline: model overstates importance of age channel

Conclusions

- Model with finance frictions predicts:
  - Potentially large TFP losses due to low entry/adoption
    - Unproductive before entry/adoption – cannot self-finance
  - Modest losses from misallocation
    - Productive producers most constrained, easily self-finance
- Predictions about misallocation consistent with micro data