LECTURE 3:

GROWTH, TFP, AND INEQUALITY WITH FINANCIAL
MARKET IMPERFECTIONS
(The Case of Limited Commitment)

Table of Contents

Featuring especially transitions rather than steady state growth. This literature is about reforms, both real and financial, including financial sector expansion.

Featuring cross-sector and cross-country evidence: including countries with and without micro finance

Can constraints be alleviated in the long run, maybe doing nothing is not so costly? Importance of transitions and reconciling cross country evidence.

Song, Storesletten, and Zilibotti (2011), "Growing like China"

How can growth and returns on investment be so high and yet capital outflow abroad; the role of inefficient, state-finance enterprise.

Our paper is part of a recent literature arguing that low aggregate TFP especially in developing countries is the result of micro-level resource misallocation.

Facts:

- ▶ Over the last 30 years, China has undergone a spectacular economic transformation involving not only fast economic growth and sustained capital accumulation, but also **major shifts in the sectoral composition of output**, and a **growing importance of markets and entrepreneurial skills**.

- ▶ The rate of return on investment has remained well above 20%. Saving rates have been even higher: in the last 15 years, China has experienced a growing net foreign surplus: its foreign reserves swelled from 21 billion USD in 1992 (5% of its annual GDP) to 2,130 billion USD in June 2009 (46% of its GDP).

FIGURE 1. FOREIGN RESERVES AND THE DIFFERENCE BETWEEN DEPOSITS AND LOANS

Note: The figure plots China's foreign reserves (solid line) and the domestic bank deposits minus domestic loans (dotted line), both expressed as a percentage of GDP.

The combination of high growth and high return to capital, on the one hand, and a growing foreign surplus, on the other hand, is puzzling.

4

Reforms timeline:

- China introduced its first economic reforms in December 1978
- A new stage of the reform process was launched in 1992, after Deng Xiaopings Southern Tour
- The process gained momentum in 1997, as the 15th Congress of the Communist Party of China officially endorsed an increase in the role of private firms in the economy

Post-1992 transition:

- In spite of very high investment rates (39% on average), the rate of return to capital has remained stable: while the aggregate return to capital has fallen slightly (from 28% in 1993 to 21% in 2005), the rate of return to capital in manufacturing has been increasing since the early 1990s and climbed close to 35% in 2003.
- Financial assets available to individual savers: the average real rate of return on bank deposits, the main financial investment of Chinese households, was close to zero during the same period.

Song, Storesletten, and Zilibotti (2011), "Growing like China"

FIGURE 2. PRIVATE EMPLOYMENT SHARE

Notes: The figure shows, first, the DPE share of employment as a share of SOE + DPE employ-
ment in manufacturing (NBS 1998–2007) and in the urban sector (CLSY 1992–2007). Second,
it plots DPE + FE employment as a share of total employment in manufacturing (NBS 1998–
2007) and in the urban sector (CLSY 1992–2007).

Song, Storesletten, and Zilibotti (2011), "Growing like China"

State-owned enterprises (SOE) are, on average, less productive and have better access to external credit than do domestic private enterprises (DPE).

SOE finance more than 30% of their investments through bank loans compared to less than 10% for DPE.

FIGURE 4. SHARE OF INVESTMENT FINANCED BY BANK LOANS AND GOVERNMENT BUDGETS

Note: The figure plots the average share of investment financed by bank loans and government subsidies across firms of different ownership, in percent.

Sources: CSY 1998 to 2001 and 2003, *China Economy and Trade Statistical Yearbook* 2002 and 2004.

Buera and Shin (2012), "Financial Frictions and the Persistence of History: A Quantitative Exploration"

- The growth success of Asian economies
- Reforms with fixed financial friction
- Explain the high long period of growth of investment and total factor productivity these do not jump up immediately
- This is again how reforms (other than financial) can lead to growth but there is a section at the end which does the opposite, like the next paper, Jeong and Townsend (2007)

Following a reform that triggers efficient reallocation of resources, our model economy with financial frictions converges slowly at half the speed of the neoclassical growth model to the new steady state, and its investment rates and total factor productivity start out low and rise over time. We present data from the so-called miracle economies on the evolution of macro aggregates, factor reallocation, and establishment size distribution, which support the aggregate and micro-level implications of our theory.

The miracle economies financial markets remained largely underdeveloped until the latter stages of their economic transitions, as evidenced by their low ratios of external finance to GDP.

Buera and Shin (2012), "Financial Frictions and the Persistence of History: A Quantitative Exploration"

Figure 1 in the next slide presents the main features of the development dynamics for **China** [year 0 = 1992], **Japan** [1949], **Korea** [1961], **Malaysia** [1968], **Singapore** [1967], **Taiwan** [1959], and **Thailand** [1983]. For each economy, year 0 (in [ ] above) on the horizontal axis is its date of large-scale reforms, and hence the beginning of its economic transition. A point on the horizontal axis therefore corresponds to different calendar years for different countries.

All these economies exhibit large and persistent output gains, which appear slow when seen through the lens of the neoclassical growth theory. In the neoclassical model, such transitions can only be thought of as a transition from an initial state with low capital stock to a steady state with high capital stock, which is characterized by a fast convergence. A reasonably-calibrated neoclassical model a capital share of $1/3$, a discount factor of 0.96, an intertemporal elasticity of substitution of 0.67, and a depreciation rate of 0.06 predicts that it should take fewer than six years for aggregate capital stock to cover half the distance to the steady state. The data suggest a half-life of at least 15 years. Even the economic miracles seem three times slower when compared to a calibrated neoclassical model.

Buera and Shin (2012), "Financial Frictions and the Persistence of History: A Quantitative Exploration"
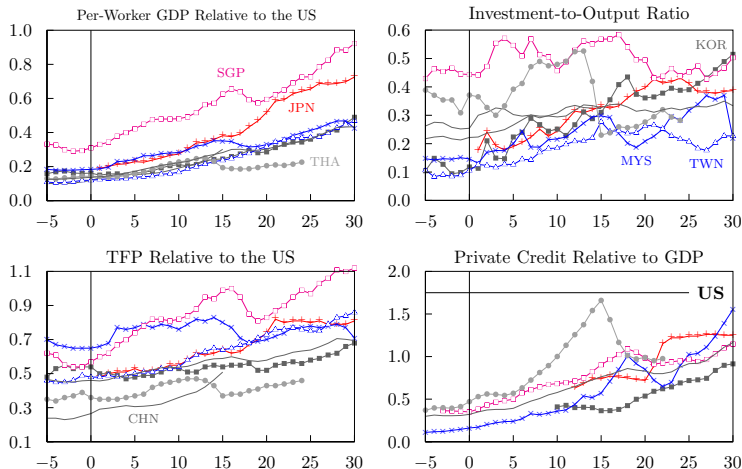

Fig. 1: Transitional Dynamics from the Economic Miracles. In each panel, all available series for the seven economies are shown, and the thick solid line is the unweighted average across them. See the Data Appendix for a detailed description of the data. The horizontal axis is in years, and year 0 corresponds to each economy's reform date.

Buera and Shin (2012), "Financial Frictions and the Persistence of History: A Quantitative Exploration"
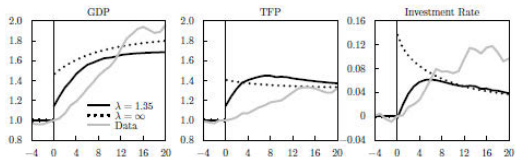

Fig. 3: Benchmark Transition: GDP, TFP, and Investment Rate. The black solid lines are the transitions from the benchmark exercise. For comparison, the transitional dynamics of a comparable neoclassical model are shown with the dotted lines, and the average of the economic miracles from Section 1 is represented by the gray lines. The GDP and TFP series are normalized by their respective pre-reform values. Investment rates are shown as deviations from their pre-reform levels. The horizontal axis is in years, with year 0 being the reform date.
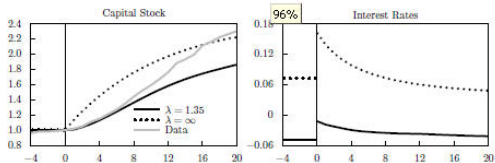

Fig. 4: Benchmark Transition: Capital and Interest Rate. The black solid lines are the transitions from the benchmark exercise. Comparable neoclassical transition dynamics are shown with the dotted lines, and the evolution of the capital stock in the data, averaged across the miracle economies (Section 1), is plotted with a gray solid line in the left panel. The capital stock series are normalized by their respective pre-reform values. The horizontal axis is in years, with year 0 being the reform date.

Buera and Shin (2012), "Financial Frictions and the Persistence of History: A Quantitative Exploration", main exercise part I

Our main exercise analyzes the transitional dynamics triggered by a sudden, unexpected reform that eliminates idiosyncratic distortions, with financial frictions remaining intact.

1. The economic transition is gradual. Following the reform, GDP grows at an annualized rate of 3.6% for 18 years, and it takes 10.5 years for the capital stock to cover half the distance to the new, post-reform steady state almost twice as long as the comparably calibrated neoclassical transition.

2. The model generates endogenous dynamics of TFP, which increases by 5% per year for eight years, although there is no further exogenous change after the reform.

3. The investment rate rises over time, peaking six years after the reform.

4. We show that, in the data from the reform episodes, there is substantial and persistent reallocation of production factors, across different industrial sectors and also from state-owned production units to those in the private sector.

5. For the three countries with available data Japan, Korea, and Singapore the average manufacturing plant size increased after the reforms. On average, plant size increased by 80% over the 15 years following the reform, in line with the model prediction.

6. A similar pattern emerges in Thailand, for which we have data on employment by firm size bins. While the data are available only from 1988, five years after the identified reform, they show a substantial increase in the fraction of workers employed in firms with more than 100 employees (from 21% in 1988 to 41% in 1998), and also a corresponding decline in the fraction of workers employed in firms with fewer than ten employees (from 58% to 39%).

7. These patterns in the data are broadly consistent with the post-reform dynamics of the average establishment size in the model.

Model:

- ▶ Transition dynamics are endogenously determined by the extent of resource misallocation in the pre-reform economy and the degree of imperfections in financial markets.

- ▶ Individuals differ in their entrepreneurial productivity and choose each period whether to be an entrepreneur and operate his technology or to supply labor for wage.

- ▶ Financial frictions in the form of collateral constraints are modeled by assuming imperfect enforceability of contracts.

We calibrate the parameters that are invariant across countries and over time so that our undistorted, perfect-credit model economy matches the US data on standard macroeconomic aggregates, earnings distribution, establishment size distribution, and establishment dynamics. As for the reform-related parameters, the degree of an economys financial frictions is calibrated to the data on external finance to GDP ratios, and the distribution of pre-reform idiosyncratic distortions is chosen to match the changes in TFP and capital-to-output ratios between the year of the reform and the twentieth post-reform year.

We then use our model to quantify the role of initial resource misallocation and financial frictions in explaining the actual time paths of GDP, TFP, and investment rates along the growth accelerations or economic miracles in the data.

Pre-reform economy:

▶ Resources are misallocated.

▶ Subsidized entrepreneurs run larger operations and have more income and wealth than is warranted by their true productivity, while the opposite is true for taxed entrepreneurs.

▶ Productive entrepreneurs returns to saving are high since wealth, via collateral constraints, enables entry and expansion of business and so are their saving rates.

▶ Those with low entrepreneurial productivity are either workers or unconstrained, small-scale entrepreneurs, and hence their returns to saving, and accordingly their saving rates, are much lower.

▶ The aggregate saving rate is an income-weighted average of the two groups saving rates, and as a consequence starts out low.

Buera and Shin (2012), "Financial Frictions and the Persistence of History: A Quantitative Exploration"

The sudden reform initiates a process of massive resource reallocation:

- The underdeveloped financial market acts as a bottleneck: It takes time for productive-but-poor entrepreneurs to save up the collateral needed for starting a business and then operating at the efficient scale.

- This gradual reallocation the entry and expansion of productive-but-poor entrepreneurs and the downsizing and exit of incompetent, previously-subsidized ones manifests itself in the slow pace of the transition overall, and more important, in the persistent TFP dynamics.

- Over time, productive entrepreneurs, with their high saving rates, account for larger fractions of wealth and income, and the aggregate saving rate rises.

- Eventually, the diminishing marginal returns to capital take over, and even the saving rates of productive entrepreneurs, who are less likely to be constrained now, start to fall over time, spanning the downward arc of the aggregate saving rate.

Buera and Shin (2012), "Financial Frictions and the Persistence of History: A Quantitative Exploration"

Exercise: incorporate an exogenous financial development process, which is calibrated to the observed increase in measures of financial intermediation along the growth experiences.

In year 0, we maintain the assumption that all idiosyncratic distortions are removed at once. In addition, assume now an increase in the external finance to GDP ratio from 0.3 to 0.86 over the next 20 years, which also takes 20 years in the data. We assume that individuals in the model have perfect foresight about this exogenous process.

The results are qualitatively similar to the benchmark results. This exercise has more financial frictions than the benchmark exercise exactly when the economy has the most misallocation (i.e., right after the reform). Not surprisingly, especially immediately following the reform, the reallocation and the transitions are slower here: It takes 13 years (rather than 10.5) for the aggregate capital to cover half the distance to the new steady state. The investment rate also rises more gradually than in the benchmark exercise, as the more severe financial frictions in early stages slow down the growth of productive-but-poor entrepreneurs.

Jeong and Townsend (2007), "Sources of TFP Growth: Occupational Choice and Financial Deepening"

Exogenous expansion of financial sector on the extensive margin explains macro, time-varying TFP.

This paper explains and measures the sources of TFP by developing a method of growth accounting based on an integrated use of transitional growth models and micro data. We decompose TFP growth into the occupational-shift effect, financial-deepening effect, capital-heterogeneity effect, and sectoral-Solow-residuals. Applying this method to Thailand, which experienced rapid growth with enormous structural changes between 1976 and 1996, we find that 73% of TFP growth is explained by occupational shifts and financial deepening, without presuming exogenous technical progress. Expansion of credit is a major part. We also show the role of endogenous interaction between factor price dynamics and the wealth distribution for TFP.
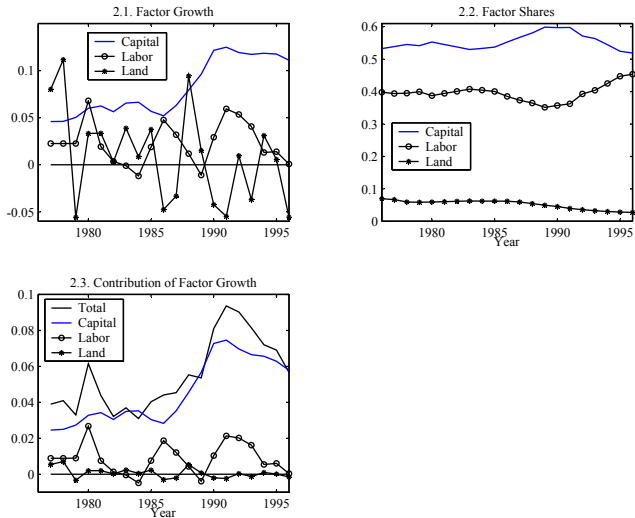
Figure 2. Decomposition of Factor Growth in Thailand

Jeong and Townsend (2007), "Sources of TFP Growth: Occupational Choice and Financial Deepening"
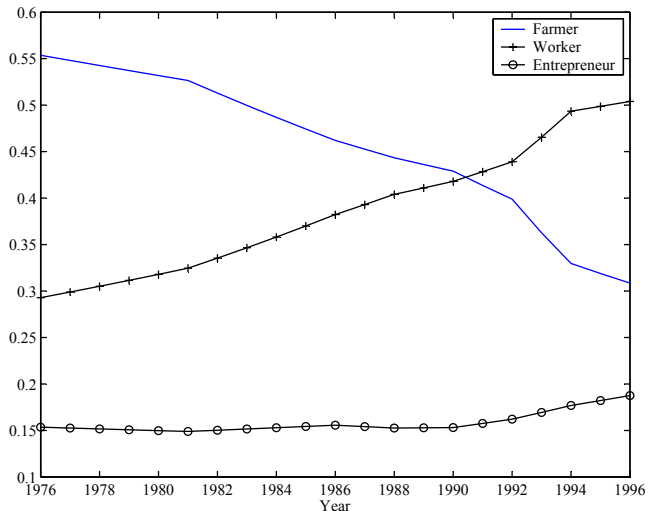
Figure 3. Occupational Transition in Thailand

Jeong and Townsend (2007), "Sources of TFP Growth: Occupational Choice and Financial Deepening"

Figure 4. Financial Development in Thailand

Notes: P: Population fraction of formal financial sector from SES. PRIVY: Ratio of private credit to GDP
PRIVATE: Ratio of private credit to total domestic credit. LLY: Ratio of M3 (measure of liquid liabilities) to GDP

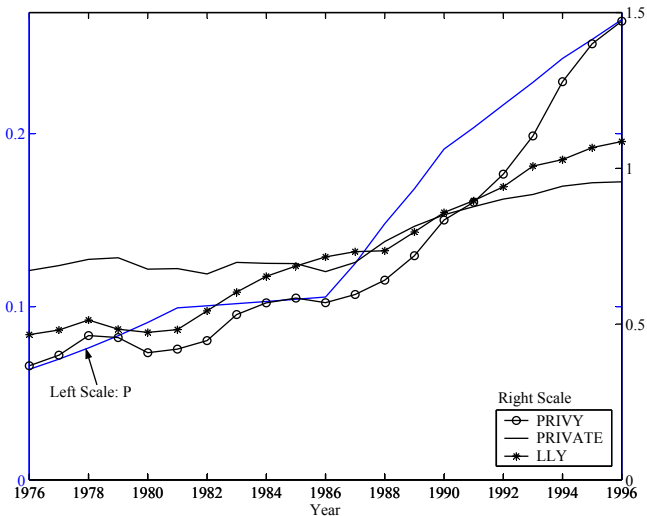# Jeong and Townsend (2007), "Sources of TFP Growth: Occupational Choice and Financial Deepening"
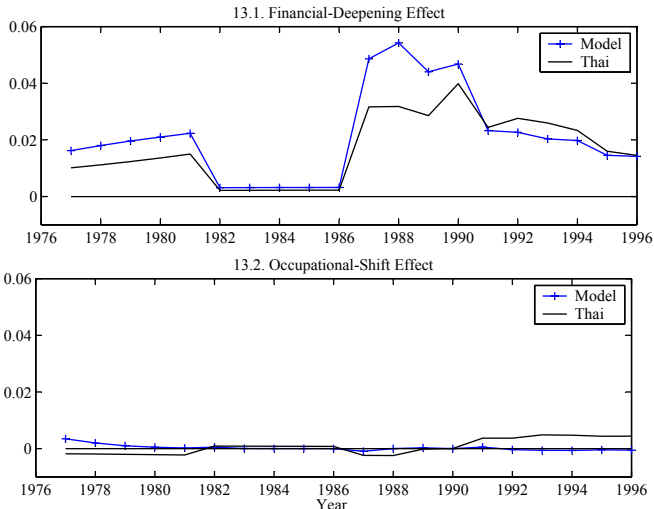

Figure 13. Sources of TFP Growth

Notes: Financial-deepening effect and occupational-shift effect are measured as in equations (38) and (39), respectively.

Coeurdacier, Guibaud and Jin (2012), "Credit Constraints and Growth in a Global Economy"

Divergent savings behavior as in the life cycle across emerging and advanced economies explains capital outflow; must take into account the demographics.

Unprecedented trends:

1. A large and persistent increase in the private saving rate in emerging Asia against a steady decline in the private saving rate in advanced economies.
2. The emergence of global imbalances with developing countries running a large current account surplus and advanced economies a current account deficit.
3. A sustained fall in the world long-term interest rate.

Recent theoretical advances have been designed to explain (2) and (3), with little emphasis placed on (1) despite its underlying centrality.

The pattern is even more obvious when it comes to household saving rates in countries such as the U.S. and China. In 1988, household saving rates were about the same in the two countries at about 5%. By 2007 the household saving rate in China reached almost 30% while that of the U.S. declined to a level of about 2.5%. This begs the question as to why saving behaviors against common world interest rate movements can be diametrically opposite across economies.

23

Coeurdacier, Guibaud and Jin (2012), "Credit Constraints and Growth in a Global Economy"

A full calibration of our model to the experience of these two economies indicates that our mechanism can explain about 40% of the divergence in aggregate saving rates of these two economies and a significant fraction of the changes in saving rate at cohort level in each economy.

The main supportive evidence is that the decline in the young's saving rate is larger in the U.S. than in China, and the rise in the saving rate by the middle-aged in China is larger than the rise in the U.S.

The key departure of this paper from the existing literature is the ability of our framework to explain the divergence in saving rates that is, the differential response of saving rates to interest rate changes that leads to their greater dispersion in the long run. Existing models with a saving-based account of global imbalances tend to focus on differences in the levels of saving rates, and the outflow of capital from the high-saving rate country to the low-saving rate country upon integration of these economies. Over time, however, differences in levels do not become more pronounced whereas in the data, initial differences in saving rates in 1990 are dwarfed by their differences in 2010. Moreover, when incorporating the growth experiences of countries, existing papers tend to predict the opposite patterns.

Coeurdacier, Guibaud and Jin (2012), "Credit Constraints and Growth in a Global Economy"

Our benchmark framework consists of multiple open economies, populated with overlapping generations of agents living for three periods. In all economies, young agents are subject to borrowing constraints, but the tightness of the constraint is more severe in developing countries than in advanced economies. We show that a countrys aggregate saving places a greater weight on the (dis)saving of the young for less credit-constrained economies, and greater weight on the middle-ageds saving for more constrained economies. A fall in the world interest rate induces greater borrowing (lower savings) by the young through a loosening of constraints while leading to greater savings of the middle-aged through a dominant income effect.

In this framework the decline in the world interest rate is brought about by the increasing size of Asia relative to the rest of the world.

Coeurdacier, Guibaud and Jin (2012), "Credit Constraints and Growth in a Global Economy"

Comparisons with other literature:

Our model is an extension and variation of Jappelli and Pagano's (1994) closed-economy three-period OLG model with household credit constraints.

The surge in investment due to the strong neoclassical effect can potentially dominate the effect driven by high precautionary saving in emerging markets. Buera and Shin (2009), Benhima (2012), and Song, Storesletten and Zilibotti (2011) the point of contention with this literature from an empirical viewpoint may be that even though investment as a share of GDP declined during the East Asian crisis, it quickly reverted to and subsequently exceeded its pre-crisis level. The recent period during which global imbalances were most pronounced saw an increase in investment-GDP in Asia rather than a fall.

Another strand of the literature holds that corporate saving behavior is pivotal in accounting for global imbalances. However, levels of corporate savings have risen uniformly in both developing and advanced economies, with China actually experiencing a fall in its corporate saving rate making corporate saving behavior less likely to be the main factor of divergence.

Table of Contents

Impact of micro finance. Promoting financial access is intended to weaken financial constraint and does increase capital and output in partial equilibrium but actually lowers capital (savings and income of top talent guys). In the end the effect is largely distributional, towards relatively low wealth when taking into account GE effect on increases in wages and interest rate.

1. Broad financial frictions impede development (BKS, AER, 2011)
   - TFP, output ↓ substantially
   - Distortion of entry to large-scale sectors is important
2. Wide-scale microfinance: (BKS, wp, 2012)
   - TFP ↑
   - capital ↓
   - per-capita income ≈ 0
   - increases wages, redistributing from "rich" to "poor" (marginal entrepreneurs *and* workers)
3. Important GE effects: more redistribution but smaller aggregate impact

Can Microfinance Undo these Frictions?

$$k \leq \max \left\{ \begin{array}{l} \bar{k}(a,z;\phi), \\ a + b^{MF} \end{array} \right\}$$

entrepreneur
produce consume/save
(a',z)
γ
1-γ
(a', z'~μ(z'))

(assets: a, ability: z)

Add option of microfinance loan

occupational choice (each period)

worker
produce consume/save

(a',z)
γ
1-γ
(a', z'~μ(z'))
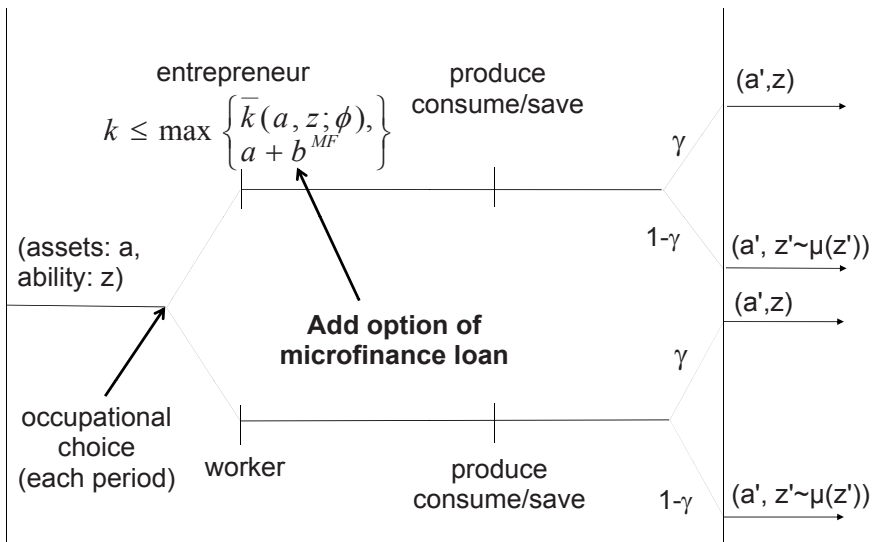
Aggregate Impact: GE vs. PE

General Equilibrium
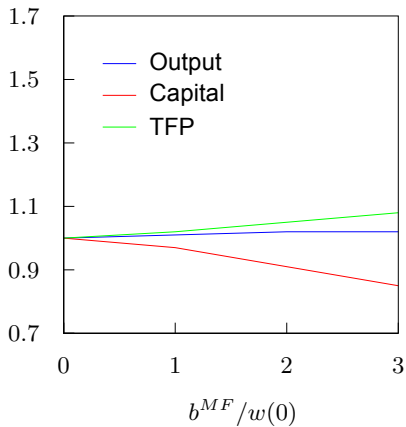
Partial Equilibrium
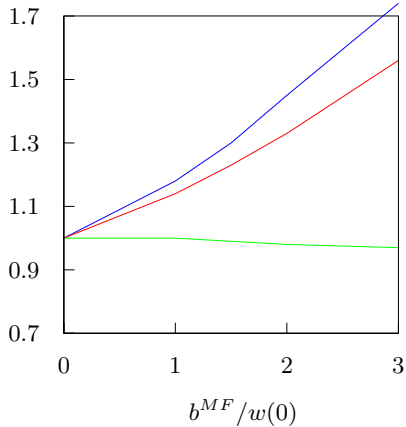
Distribution of Welfare Gains, $b^{MF} = 1.5w$

fraction of permanent consumption
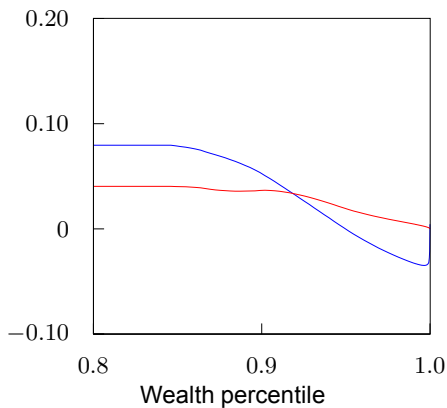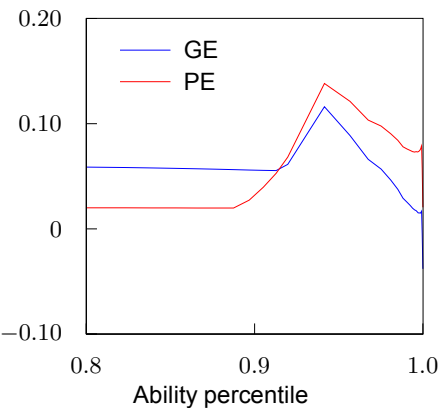
Table of Contents

Featuring especially transitions rather than steady state growth. This literature is about reforms, both real and financial, including financial sector expansion.

Featuring cross-sector and cross-country evidence: including countries with and without micro finance

Can constraints be alleviated in the long run, maybe doing nothing is not so costly? Importance of transitions and reconciling cross country evidence.

**Song, Storesletten, and Zilibotti (2011),
"Growing like China"**

Song, Storesletten, Zilibotti 'Growing Like China'

- ▶ This paper uses theory to understand the growth experience of one specific country in one specific episode: China 1990 - 2010

- ▶ Environment of the Chinese experience after 1990: opening the economy for private enterprise, especially after 1997

- ▶ Stylized facts a theory about China has to account for

  1. Fast, sustained growth
  2. No decline in the return to capital despite high investment rate
  3. Large increases in foreign reserves

- ▶ Why is this a problem for standard theory?

  - ▶ Closed economy neoclassical growth model: marginal return to capital should fall
  - ▶ Open economy: If returns are high, why does not capital flow into China (but ends up in houses in Nevada)?

- ▶ This paper: model with financial frictions can solve this problem

Ingredients

- Two type of firms: private and state-owned
  - Private firms: productive but cannot borrow (much)
  - State firms: unproductive but can borrow
- We will microfound this productivity advantage later
- Private firms expand through saving so that factors get reallocated
- Implications:
  (1) Reallocation keeps aggregate return to capital high as private sector faces inelastic supply of capital with low shadow costs (remember the Lewis 1954 model)
  ⇒Opportunity costs of capital are low because state firms are unproductive
  (2) Reallocation causes capital outflows as savers cannot save in private firms and public firms decline in importance
  ⇒Private firms cannot *demand* capital
- Beautiful example where a simple idea accounts for two aggregate patterns simultaneously

The Model: Households

- ▶ OLG structure (work when young) with preferences

$$U_t = \frac{c_{1,t}^{\frac{\theta-1}{\theta}} - 1}{\frac{\theta-1}{\theta}} + \beta \frac{c_{2,t+1}^{\frac{\theta-1}{\theta}} - 1}{\frac{\theta-1}{\theta}}$$

- ▶ Heterogeneity: some are workers, some are entrepreneurs and skills are perfectly inherited. Differences between the two:

1. Workers earn w_t and invest in bank deposits (at rate R_t)
2. Entrepreneurs work as managers in entrepreneurial firms and can earn $m_t > w_t$ and invest either in bank deposits (at rate R_t) or in their own firm (at rate ρ_t). Because of financial constraints, we can have $\rho_t > R_t$

- ▶ Managers can work as workers, but in equilibrium $m_t > w_t$ so that they do not want to (this is a parametric condition)
- ▶ Population grows at rate ν ("urbanization")

Organizational form

- To generate productivity differences between state and private firms, SSZ tell a story about decentralization
- Each firm (i.e. both state and private) can produce using one of two technologies.

  1. Centralized production: Firms have access to production function
     $$y_t = k_t^{\alpha} (A_t n_t)^{1-\alpha}$$

  2. Decentralized production: Firms can delegate decisions to managers. Then they have a production function of
     $$y_t = k_t^{\alpha} (\chi A_t n_t)^{1-\alpha}$$

     with $\chi > 1$

- Hence: Delegation gives productivity advantage but is contractually intensive as it induces a moral hazard problem due to incomplete contracts

Decentralized production

- ▶ Delegating decision rights to managers is costly
- ▶ In particular: A manager can steal a share ψ of output $y = k^\alpha (\chi A n)^{1-\alpha}$, but if he steals he does not get paid his wage m
- ▶ Hence: value of a decentralized firm with capital k?

$$
\begin{aligned}
V(k) &= \max_{n,m} \left\{ k^\alpha (\chi A_t n)^{1-\alpha} - w_t n - m \right\} \\
m_t &\geq \psi k^\alpha (\chi A_t n)^{1-\alpha}
\end{aligned} \tag{1}
$$

where m is the managerial wage and (1) is the manager's incentive constraint

- ▶ Clearly, $m = \psi k^\alpha (\chi A_t n)^{1-\alpha}$, so that

$$
V(k) = \max_n \left\{ (1-\psi) k^\alpha (\chi A_t n)^{1-\alpha} - w_t n \right\}
$$

- ▶ Standard Cobb-Douglas problem with "extra productivity" $(1-\psi)\chi^{1-\alpha}$ and we assume that $(1-\psi)\chi^{1-\alpha} > 1$ - otherwise, private firms will not produce in equilibrium.

39

State versus Private Firms

- ▶ Difference between state and private firms: Managerial control
  - ▶ State firms have limited corporate control, i.e. managers can steal everything: $\psi = 1$
  - ▶ Private firms are better in monitoring managers: $\psi < 1$
- ▶ This implies:
  - ▶ State firms will use centralized technology: $y_t = k_t^\alpha (A_t n_t)^{1-\alpha}$
  - ▶ Private firms will use decentralized technology: $y_t = k_t^\alpha (\chi A_t n_t)^{1-\alpha}$
- ▶ Hence:
  - ▶ State firms are financially integrated but less productive
  - ▶ Private firms are subject to financial constraints but more productive

The Model: Firms

- E-firms (entrepreneur) and F-firms (financially integrated, state firms) with

$$y_{E,t} = k_{E,t}^\alpha (\chi A_t n_{E,t})^{1-\alpha} \text{ and } y_{F,t} = k_{F,t}^\alpha (A_t n_{F,t})^{1-\alpha},$$

  where $\chi > 1$ and $A_{t+1} = (1+z) A_t$

- Note: with constant returns, F firms only survive because the other firms are financially constrained (we will see this in detail in the recitation)

- Note: 2 frictions

  - Contractual friction between manager and owner: More severe in state firms, which generates comparative advantage in productivity for private firms. However: friction is nice story but less essential.
  - Credit market friction: This is the important friction! Allows state firms to survive, generates transitional dynamics as E-firms save slowly and causes capital outflows.

The Model: Financial Markets

- All savings and investment done via banks
- Banks take deposits and pay R^d
- Banks can lend to domestic firms at rate R^l and face iceberg costs ξ (only needed for quantitative analysis)
- Banks can lend and borrow internationally at rate R
- Hence: in equilibrium

$$R^d = R \text{ and } R^l = \frac{R}{1-\xi}$$

- For quantitative part: ξ_t declines over time ("financial development")
- When lending to E-firms, there will be a constraint (see below)

Analysis: F-Firms

- F-firms are our standard, neoclassical firms with Cobb Douglas production
- Letting $\kappa_F = \frac{k_F}{An_F}$ we get the usual factor demands, where marginal products are equal to the factor price

$$
\begin{aligned}
R = MPK \Rightarrow \kappa_F &= \left(\frac{\alpha}{R^l}\right)^{\frac{1}{1-\alpha}} \\
w = MPL \Rightarrow w_t &= (1-\alpha)\,\kappa_F^\alpha A_t
\end{aligned}
$$

- Hence: κ_F is given (as R^l is) and wages grow at rate A_t
- Like in Lewis (1954): Factor prices do not depend on the allocation of factors between sectors as long as F-firms are active

Analysis: E-Firms

- Given κ_F, we can solve the value function of entrepreneurial firms

$$V(k) = \max_n \left\{ (1 - \psi) k^\alpha (\chi A_t n)^{1-\alpha} - w_t n \right\}. \quad (2)$$

- The FOC for this problem is

$$(1 - \alpha)(1 - \psi) k^\alpha (\chi A_t n^*)^{1-\alpha} = w_t n^*,$$

so that the optimal employment level n^* is

$$n^* = \left[\frac{(1 - \alpha)}{w} (1 - \psi)(\chi A_t)^{1-\alpha} \right]^{1/\alpha} k. \quad (3)$$

- Substituting into (2) and noting that $w = (1 - \alpha) \kappa_F^\alpha A_t$, we get

$$V(k) = \left[(1 - \psi) \chi^{1-\alpha} \right]^{\frac{1}{\alpha}} R^l k \equiv \rho_E k,$$

where ρ_E is the rate of return to capital in entrepreneurial firms

Analysis: E-Firms

- Recall: Internal rate of return is

$$\rho_E = \left[(1 - \psi) \chi^{1-\alpha} \right]^{\frac{1}{\alpha}} R^I$$

- Now note that:
  - Because $(1 - \psi)\chi^{1-\alpha} > 1$ so that private return to capital exceeds R^I (note: this was exactly the condition that E-firms are more productive)
  - Without borrowing constraints, private firms would attract all funds and state firms would not exist

Analysis: Capital supply to E-Firms

- Now we introduce borrowing constraints
- Capital stems from savings and bank loans

$$k_{E,t} = s_{t-1}^E + l_{t-1}^E$$

- E-firms face borrowing constraint: Can only commit to repay share η of profits. Hence

$$\underbrace{R^l l_{t-1}^E}_{\text{Paying back loan}} \leq \eta \underbrace{\rho_E k_{E,t}}_{\text{Profits}} = \eta \rho_E \left(l_{t-1}^E + s_{t-1}^E \right)$$

- This will be binding so that leverage ratio is

$$\frac{l_{t-1}^E}{s_{t-1}^E + l_{t-1}^E} = \frac{\eta \rho_E}{R^l} = \eta \left[(1-\psi) \chi^{1-\alpha} \right]^{\frac{1}{\alpha}} \qquad (4)$$

- Borrowing is "easy" if η is high and productivity χ is high

Accumulation of E-firms

- Entrepreneurs face the dynamic problem

$$U_t = \frac{c_{1,t}^{\frac{\theta-1}{\theta}} - 1}{\frac{\theta-1}{\theta}} + \beta \frac{c_{2,t+1}^{\frac{\theta-1}{\theta}} - 1}{\frac{\theta-1}{\theta}}$$

where

$$
\begin{aligned}
c_{1,t} &= m_t - s_t^E \\
c_{2,t} &= \rho_E s_t^E + \left(\rho_E - R^I\right) I_t^E \\
&= \left[\underbrace{\rho_E}_{\text{Return}} + \underbrace{\left(\rho_E - R^I\right)}_{\text{Premium}} \underbrace{\frac{\eta \rho^E}{R^I - \eta \rho^E}}_{\text{Leverage}} \right] s_t^E
\end{aligned}
$$

- Yields constant savings rate

$$s_t^E = \zeta^E m_t, \tag{5}$$

which is very nice to aggregate (see below)

Aggregate Dynamics

- Entrepreneurial output: AK-model
- To see this note that aggregate entrepreneurial output is

$$Y_{E,t} = \int_0^1 y_{E,t}(i)\,di,$$

because there is a mass one of entrepreneurs

- But using n^* and w (see (3) above)

$$\begin{aligned}
y_{E,t}(i) &= k_t(i)^\alpha (\chi)^{1-\alpha} (A_t n_t(i))^{1-\alpha} \\
&= k(i)\left(\chi(1-\psi)^{1-\alpha}\right)^{\frac{1}{\alpha}} \left(\frac{1}{\kappa_F}\right)^{1-\alpha} \\
&= k(i)\left(\chi(1-\psi)^{1-\alpha}\right)^{\frac{1}{\alpha}} \frac{R^I}{\alpha} \\
&= \frac{1}{\alpha}\rho_E k(i). \quad\quad\quad (6)
\end{aligned}$$

Aggregate Dynamics

▶ Hence:

$$Y_{E,t} = \int_0^1 \frac{1}{\alpha} \left(\rho_E k_{E,t}(i) \right) di = \frac{1}{\alpha} \rho_E K_{E,t}$$

so that aggregate entrepreneurial output is proportional to aggregate entrepreneurial capital

▶ Entrepreneurial capital: grows at constant rate because

1. managerial wages m_t are proportional to $y_{E,t}$ and hence proportional to $k_{E,t}$ (see (6) on last slide)
2. young managers save constant rate of their managerial earnings (see (5))
3. Leverage ratio is constant (see (4))

▶ Hence

$$\frac{Y_{E,t+1}}{Y_{E,t}} = \frac{K_{E,t+1}}{K_{E,t}} = constant,$$

i.e. entrepreneurial sector grows at constant rate

Reallocation and Aggregate Productivity

▶ Reallocation from low to high productive units increases aggregate efficiency. Here

$$
\begin{aligned}
Y_F &= K_F^\alpha (A_t N_F)^{1-\alpha} = \left(\frac{K_F}{A_t N_F} \right)^\alpha A_t N_F = \kappa_F^\alpha A_t N_F \\
Y_E &= (K_E)^\alpha (\chi A_t N_E)^{1-\alpha} = \left(\frac{K_E}{\chi A_t N_E} \right)^\alpha \chi A_t N_E
\end{aligned}
$$

▶ Again substituting for employment N_E and w (see (3))

$$
\begin{aligned}
\frac{K_E}{\chi A_t N_E} &= \frac{K_E}{\chi A_t \left[\frac{(1-\alpha)}{w} (1-\psi) (\chi A_t)^{1-\alpha} \right]^{1/\alpha} K_E} \\
&= \frac{1}{\chi A_t \left[\frac{1}{\kappa_F^\alpha} (1-\psi) (\chi)^{1-\alpha} (A_t)^{-\alpha} \right]^{1/\alpha}} \\
&= \frac{1}{\chi^{1/\alpha} (1-\psi)^{\frac{1}{\alpha}}} \kappa_F
\end{aligned}
$$

Reallocation and Aggregate Productivity

▶ Hence:

$$Y_E = \left(\frac{\kappa_F}{\chi^{1/\alpha}(1-\psi)^{\frac{1}{\alpha}}} \right)^{\alpha} \chi A_t N_E = \frac{1}{1-\psi} \kappa_F^{\alpha} A_t N_E$$

▶ Productivity per worker

$$\frac{Y_t}{N_t} = \frac{Y_{E,t} + Y_{F,t}}{N_t} = \frac{\left(N_F + \frac{1}{1-\psi} N_E \right)}{N_t} \kappa_F^{\alpha} A_t = \left(1 + \frac{\psi}{1-\psi} \frac{N_E}{N_t} \right) \kappa_F^{\alpha} A_t$$

▶ Productivity grows because of
  ▶ technological progress (A_t)
  ▶ because of reallocation, as $\frac{N_{E,t}}{N_t}$ is increasing because the entrepreneurial expands over time

Transitional Dynamics

:][i fY˙fYa cj YX˙Xi Y˙hc˙Wcdmf][\h˙fYghf]Wh̊cbg"; c˙hc˙˜; fck]b[˙@|_Y˙7\]bU˙˙hc˙j]Yk ˙h\Y˙Z[i fY"˙˙

Growth and Capital Outflows

▶ Consider extreme borrowing constraints: $\eta = 0$ so that $I^E = 0$ (i.e. E-firms do not borrow)

▶ Then:

$$\underbrace{K_{Ft}}_{\text{Investment}} + \underbrace{B_t}_{\text{Lending to ROW}} = \underbrace{\zeta w_{t-1} N_{t-1}}_{\text{Deposits by workers}}$$

▶ Hence

$$
\begin{aligned}
B_t &= \zeta (1 - \alpha) N_{t-1} \kappa_F^\alpha A_{t-1} - \kappa_F A_t N_{F,t} \\
&= \left[\underbrace{\frac{\zeta (1 - \alpha) \kappa_F^{\alpha-1}}{(1+z)(1+v)}}_{\text{constant}} - \underbrace{\frac{N_{F,t}}{N_t}}_{\text{decreasing}} \right] \underbrace{\kappa_F A_t N_t}_{\text{increasing}}
\end{aligned}
$$

▶ Consistently high returns and capital outflows because demand for funds (from F firms) declines precisely because they are being replaced by E-firms.

**Buera, Kaboski, and Shin (2011),
"Finance and Development: A Tale of Two Sectors"**

Development Facts

1. Huge differences in economic development across countries.
2. Development "explained" by TFP differences.
3. Poor countries are particularly unproductive in manufacturing sector.
4. Large differences in scale across sectors.
5. Underdeveloped financial/credit markets in less developed countries.

Sectoral Productivity

:][i fY ́fYa c j YX ́Xi Y ́hc ́Wcdmf][\ h ́fYghf]W̃jcbg" J]Yk ̈ ̈:]bUbW̃
UbX ̈8Yj Y ́cda Ybh ̈5 ́HU ́Y ́cZ Hk c ́GYWcfg ̈ ̈hc ́gYY ́h̃ Y ́Z̃[i fYg" ̈

Goal of the Paper

- Construct a quantitative model:
  - where scale is the main difference across sectors;
  - that matches key features of size distribution of establishments across sectors (average size) and within sectors (thick right tail).
- Quantify the effect of credit frictions on:
  - per-capita income, sectoral TFP, establishment size distribution, K/Y ratios.

Preview of Results

Financial frictions

- reduce per-capita output by as much as 50%;
- lower the relative TFP of manuf. sectors;
- increase the relative price of manuf. sector, explaining 80% of the relative price-income relationship;
- decrease K/Y ratios, when severe
- decrease scale in service sector relative to manuf. sector.

Model

- Two sectors: $p = (p_S, p_M)$, with different fixed costs, $\kappa_S < \kappa_M$.
- Heterogenous entrepreneurial ability/productivity and wealth.
- Endogenous credit frictions: limited enforcement.

Model: Plant Technology

- Lucas (1978), Rossi-Hansberg and Wright (2006)
- Fixed cost $\kappa_S < \kappa_M$ (in units of sector output)
- Period technology: $f(z, k, l) = z k^\alpha l^\theta$
    - z: entrepreneurial productivity
    - k: capital input
    - l: labor input
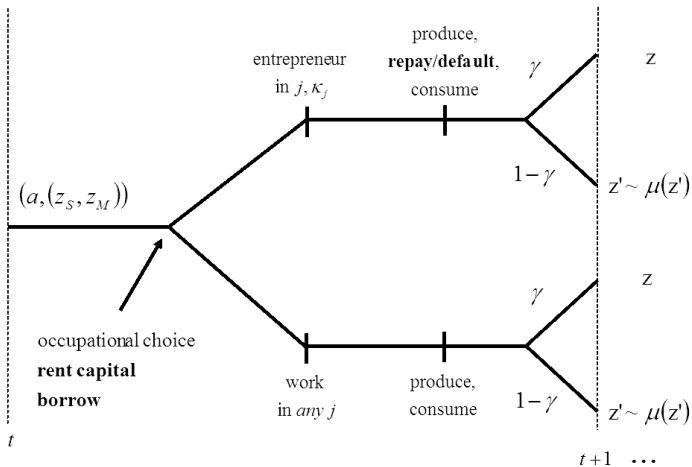   - $\alpha + \theta < 1$

Model: Preferences

Households maximize

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

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

Model: Timing
Sector and Occupation Choice

Model: Individual Problem
Workers' Bellman Equation

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

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

Model: Individual Problem

Entrepreneurs' Bellman Equation

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

$$pc + a' \leq p_j f(z_j, k, l) \ \square \ Rk \ \square \ wl \ \square \ (1+r)p_j \kappa_j + (1+r)\, a$$

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

Model: Endogenous Rental Limits

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

where

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

$$pc + a' \leq \left(1 \Box \phi\right)\left[p_j f\left(z_j, k, l\right) \Box wl + (1 \Box \delta)k\right]$$

Model: Endogenous Rental Limits

$$\max\ u\left(c\right) + \beta\mathbb{E}_z v\left(a', z'\right) \geq v^{j,def}$$
$$\Updownarrow$$
$$p_j f\left(z_j, k, l\right) - Rk - wl - (1+r)p_j\kappa_j + (1+r)a$$
$$\geq (1-\phi)\left[p_j f\left(z_j, k, l\right) - wl + (1-\delta)k\right]$$
$$\Updownarrow$$
$$k \leq \overline{k}^j(a, z; \phi)$$

Stationary Competitive Equilibria

$G(a, z)$, policies $o(a, z)$, $c(a, z)$, $a'(a, z)$, $k(a, z)$, $l(a, z)$ and prices w, r, p such that:

- Allocations solve individuals' problems given prices;
- Labor, credit and goods markets clear;
- $G(a, z)$ satisfies

$$G(a, z) = \Box_{(w, r, p)} [G(a, z)]$$

Pareto Distribution of Productivity

$$z_j \sim \eta z_j^{\square(\eta+1)}, \ z_S \perp z_M$$

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

First Best Benchmark: Results

Size Distribution of Establishments

- Sector j:

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

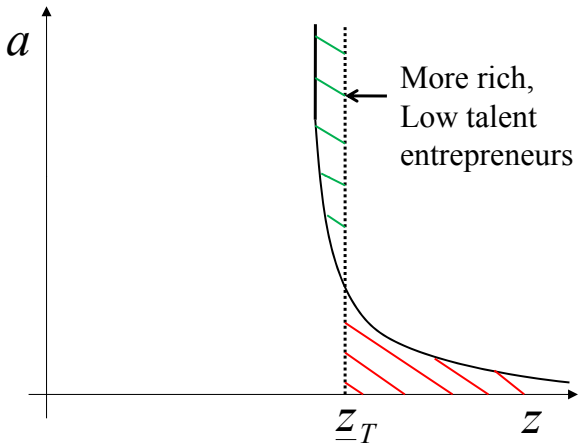- Average employment per establishment $\bar{l}_j$:

$$\frac{\bar{l}_M}{\bar{l}_S} = \frac{p_M\kappa_M + w}{p_{S'}\kappa_S + w}$$
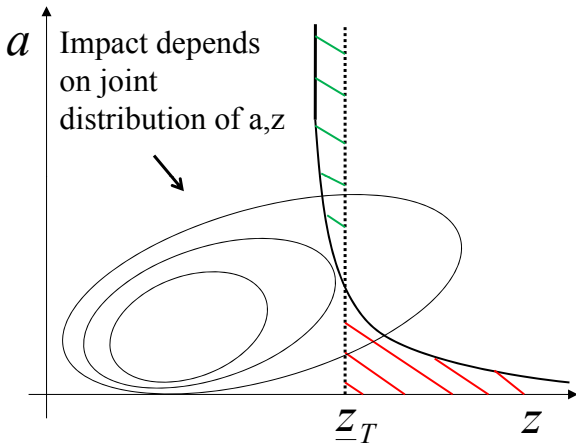
Perfect Credit Benchmark: Results

Sectoral (Net) Production Function

$$Y_j\left(K_j, L_j; N\right) \approx A_j N^{\frac{1/\eta}{\alpha+\theta+1/\eta}} K_j^{\frac{\alpha}{\alpha+\theta+1/\eta}} L_j^{\frac{\theta}{\alpha+\theta+1/\eta}}$$

General Equilibrium Effects

Importance of Credit Frictions

Impact depends on joint distribution of a,z

Empirical Strategy

1. Choose technology $(\alpha, \theta, \kappa_j)$ and productivity process $(\eta, \ )$ to match US data on the size distribution and dynamics of establishments and income concentration.
2. Choose financial frictions (ϕ) to match cross-country variation in external finance to GDP.
3. Use cross-country data on the size distribution of establishments to test additional implications of theory.

:][i fY˙fYa cj YX˙Xi Y˙hc˙Wcdmf][\ h˙fYghf]W|cbg"˙J]Yk ˙¨:]bUbW˙
UbX˙8Yj Y˙cda Ybh ˙5˙HU˙Y˙cZ Hk c˙GYW|cfg"˙hc˙gYY˙h\ Y˙Z|[i fYg"˙

Additional Testable Implications

- Significant scale differences across sectors
- Sector-level scales are differentially affected by financial frictions.

Scale Differences: US v. Mexico

- Comparable industry classification (NAICS), at least for manufacturing.
- US: Economic Census 2002
- Mexico:
  - 2004 Economic Census (non-fixed establishments/firms not included)
  - ENAMIN 2002 (all small establishments)

Conclusions

- Financial frictions are quantitatively important (factor of 2) for GDP/capita
- Scale differences help understand the impact of financial frictions on sectoral productivity.
    - biggest TFP effects on large scale/manufacturing sector
    - distorts relative prices and capital accumulation
    - entry and self-finance are quantitatively important
- Size distribution varies systematically across countries and across sectors.

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