Firm Dynamics in Developing Countries

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1 Based on a joint work with Harun Alp (UPenn) and Michael Peters (Yale)
Background

- Understanding the growth process requires a good understanding of micro players (firms & entrepreneurs) of the macroeconomy.
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Going from micro-to-macro is crucial.
Understanding the growth process requires a good understanding of micro players (firms & entrepreneurs) of the macroeconomy.

Going from micro-to-macro is crucial.

The back-and-forth dialogue between data and theory is important.
What is Our Research Approach?

- Start with empirical regularities in the micro data.
- Motivated by those regularities, construct a general equilibrium theory of firm dynamics and aggregate growth.
- Estimate the structural parameters of the model using micro-level data.
- Conduct counterfactual experiments.
Motivation

Recent literature: Firm dynamics in poor countries show striking differences to those of rich countries
Figure 1: Plant Employment by Age in the Cross-Section

Sources: 1994-1995 ASI-NSS (India), 2003 Economic Census (Mexico), and 2002 Manufacturing Census (U.S.).
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The expanding firms in India

While the average life-cycle is flat, some Indian firms manage to grow:

![Graph showing mean employment and 95% confidence interval by age categories.]
The stagnant firms in India

... but aggregate importance of tiny producers stays stubbornly high
Selection in the US vs India

- Many small firms exist in the US as well....
- ... but they do not matter as much and exit quickly
Selection in the US vs India

**Share of Small Establishments (Count)**

![Graph showing the share of small establishments by age in the US and India.](image)

- **Age Distribution**:
  - 0-5
  - 6-10
  - 11-15
  - 16-20
  - 21-25
  - 26+

- **Share of Establishments**:
  - 0
  - 0.2
  - 0.4
  - 0.6
  - 0.8
  - 1
  - 1.2

- **Legend**:
  - Red: India
  - Gray: US

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Motivation: Entrepreneurial Selection

There are two types of entrepreneurs in the data:
Motivation: Entrepreneurial Selection

There are two types of entrepreneurs in the data:
- Subsistence entrepreneurs:
  - No intention to grow
  - Want to keep the business within the family.
Motivation: Entrepreneurial Selection

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Subsistence entrepreneurs:
- No intention to grow
- Want to keep the business within the family.

Transformative entrepreneurs:
- Create businesses with the intention to innovate and grow
- Create employment for other workers and value added for the economy.
Why are transformative entrepreneurs not growing in India?
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- Why are transformative entrepreneurs not growing in India?
- Credit constraints?
Figure 3: Average Product and Firm Size

Note: Figure shows local linear regressions of log average product on log employment. We subtract the mean of the fitted value at log(employment)=4. Dashed lines represent 95 percent confidence bounds.
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- Why are transformative entrepreneurs not growing in India?
- Credit constraints?
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- Why are transformative entrepreneurs not growing in India?
- Credit constraints?
- Size-dependent Policies?
Labor market regulations at 100 employees.

Data source: Akcigit, Alp, Peters (2014)
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- Why are transformative entrepreneurs not growing in India?
- Credit constraints?
- Size-dependent Policies?
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- Why are transformative entrepreneurs not growing in India?
- Credit constraints?
- Size-dependent Policies?
- An interesting fact: The best predictor of firm size in India is...
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FAMILY SIZE!
Major obstacle to firm growth: Lack of delegation
Stylized Facts from Bloom & Van Reenen et al.’s Work

- Micro-evidence: Limits to managerial delegation important for firm performance in developing countries
- Outside managers misappropriate assets due to weak rule of law.
- Span of control of the owner is a binding constraint in developing countries.
- Family size is one of the best predictors of firm size in India.
- Implication: Limits on managerial time reduce competition so that unproductive firms survive (lack of selection).
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Implication: Limits on managerial time reduce competition so that unproductive firms survive (lack of selection).
Lack of Delegation is a Major Problem

YOU HAVE TO DELEGATE SOME AUTHORITY!
Research Question:
How much of the observed differences across countries can be explained by the lack to delegation?
MODEL
The Model Economy

quality level

$\begin{align*}
q & \\
\text{sector } j & \\
0 & \rightarrow \rightarrow 1
\end{align*}$

US Economy

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The Model Economy

quality level $q$

sector $j$

$GDP = \text{Sectors combined}$
Sector-specific Productivities

quality level $q$

sector $j$

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Example of a Firm

quality level

sector j

0 1

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Example of another Firm

$q$

$0 \quad 1$

sector $j$

quality level

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Productivity Growth: External R&D

quality level

sector j

External R&D
Productivity Growth: External R&D

quality level $q$

sector $j$

External R&D
Reallocation is Taking Place...

![Graph showing quality level and sector allocation with an arrow indicating external R&D](image-url)
Competition Creates Selection

\[ \text{Quality level} \quad q \]

\[ \text{Sector} \quad j \]

External R&D
Eventually Some Firms Exit

![Graph showing quality level vs sector j](image)

- Quality level $q$
- Sector $j$

Exit

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In the Meantime...

![Diagram with captions:
- quality level $q$
- sector $j$
- Two images: Bill Gates with a Windows background and Steve Jobs with an Apple logo]

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Some New Entrants Show Up

new entrants

quality level

$q$

sector $j$

0

1

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And New Entrants Replace Incumbents
Model Details

- Production requires managerial time.
Model Details

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- The owner can run the company by herself.
  - But she has limited amount of time and therefore runs into span of control problem.
Model Details

![Graph showing relationship between the number of product lines and self-payoff](image)

- $V(n)$: payoff function for product line $n$.
- $V_{self}(n)$: self-payoff for product line $n$.

The graph illustrates the increasing relationship between the number of product lines and the payoff. The self-payoff, $V_{self}(n)$, increases as the number of product lines, $n$, increases.
Production requires managerial time.
The owner can run the company by herself.
  But she has limited amount of time and therefore runs into span of control problem.
Or the owner can decide to hire outside managers.
Model Details

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- Or the owner can decide to hire outside managers.
- Managers might steal. Owner has to monitor.
Model Details

- Production requires managerial time.
- The owner can run the company by herself.
  - But she has limited amount of time and therefore runs into **span of control problem**.
- Or the owner can decide to hire outside managers.
- Managers might steal. Owner has to monitor.
- Then the net benefit is
  \[ \xi_c = \text{manager's human capital} - \text{monitoring time} \]

- \( \xi_c \): Country-specific delegation benefit.
Value Function as delegation ($\zeta$) gets easier

![Graph showing the value function $V(n)$ as a function of the number of product lines, $n$. The curve starts at the origin and increases as $n$ increases.]
Value Function as delegation (\(\zeta\)) gets easier

\[ V(n) \]

\[ V_{self}(n) \]

\[ V_{manager}(n) \]

\[ n^*(\zeta_L) \]

# of product lines, \( n \)

0
Value Function as delegation ($\zeta$) gets easier

Remark: Delegation is crucial to fight decreasing returns.
Value Function as delegation ($\xi$) gets easier

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Implications

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3. In better contractual environments (stronger rule of law), firms are more likely to hire managers.
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4. The correlation between firm size and family size is weaker when the contractual environment is stronger.
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4. The correlation between firm size and family size is weaker when the contractual environment is stronger.
5. Firm growth and size relationship is negative, more so when the rule of law gets weaker.
Qualitative Evidence
Prediction: Small firms are less likely to hire outside managers.
Prediction: Entrepreneurs with larger families are less likely to hire managers.
Prediction: In better contractual environments, firms are more likely to hire managers.
Prediction: The correlation between firm size and family size is weaker when the contractual environment is stronger.
Prediction: Firm growth and size relationship is negative, more so when the rule of law gets weaker.
Role of Delegation

- How important is the lack of delegation quantitatively?

Estimate the parameters of the model, especially $\xi_{us}$ and $\xi_{india}$, using firm-level data from India and the US.
Role of Delegation

- How important is the lack of delegation quantitatively?
- How would have the Indian firms behaved if they faced US-level of delegation benefit?
Role of Delegation

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- How would have the Indian firms behaved if they faced US-level of delegation benefit?
- Estimate the parameters of the model, especially $\xi_{us}$ and $\xi_{india}$, using firm-level data from India and the US.
Calibration

<table>
<thead>
<tr>
<th>Parameter</th>
<th>India Value</th>
<th>US Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\zeta$</td>
<td>benefit of delegation</td>
<td>0.02</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>share of high type</td>
<td>0.03</td>
</tr>
</tbody>
</table>

*Table: PARAMETER CALIBRATION FOR INDIAN FIRMS*
Implications for the life-cycle

**Figure: Life Cycle of US Firms**

![Graph showing the mean employment of firms over their life cycle. The graph indicates a steady increase in employment from age 0-5 to +26, with a model line and data points.](image-url)
Implications for the life-cycle

**Figure:** Life Cycle of Indian Firms

<table>
<thead>
<tr>
<th>Age</th>
<th>Mean Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>1</td>
</tr>
<tr>
<td>6-10</td>
<td>1.5</td>
</tr>
<tr>
<td>11-15</td>
<td>2</td>
</tr>
<tr>
<td>16-20</td>
<td>2.5</td>
</tr>
<tr>
<td>21-25</td>
<td>3</td>
</tr>
<tr>
<td>+26</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Data

Model

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Figure: Share of Small Firms, Data & Model

Selection in India (1)
Selection in India (2)

Figure: SHARE OF HIGH-TYPE FIRMS IN INDIA (MODEL)
Selection in India (2)

Figure: SHARE OF HIGH-TYPE FIRMS IN INDIA (MODEL)
Selection in India (2)

Figure: SHARE OF HIGH-TYPE FIRMS IN INDIA (MODEL)
How much of this difference comes from $\zeta_{US}$ vs $\zeta_{IND}$?

1. Give $\zeta_{US}$ to the Indian firms,

2. Give $\zeta_{IND}$ to the US firms.
Indian Firms with $\zeta_{US}$

**Figure:** LIFE CYCLE IN INDIA, US AND INDIA WITH $\zeta_{US}$ (MODEL)
Indian Firms with $\zeta_{US}$

Figure: Life cycle in India, US and India with $\zeta_{US}$ (Model)
Indian Firms with $\xi_{US}$

Figure: Life Cycle in India, US and India with $\xi_{US}$ (Model)

Closes the gap, on average, by 50%!
US Firms with $\xi_{\text{IND}}$

**Figure:** Life cycle in India, US and US with $\xi_{\text{IND}}$ (model)

![Graph showing the life cycle of firms in India and the US with $\xi_{\text{IND}}$ (model).]
US Firms with $\xi_{\text{IND}}$

**Figure:** Life cycle in India, US and US with $\xi_{\text{IND}}$ (model)
**US Firms with $\xi_{IND}$**

**Figure:** *Life Cycle in India, US and US with $\xi_{IND}$ (Model)*

<table>
<thead>
<tr>
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<th>16-20</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Mean Employment</td>
<td>1</td>
<td>1.5</td>
<td>2</td>
<td>2.5</td>
<td>3</td>
<td>3.5</td>
</tr>
</tbody>
</table>

- **India**
- **US**
- **US with India $\xi$**
Decomposing Delegation Benefits $\zeta$

- Try to decompose delegation benefit $\zeta$ into:

  
  $$c = \beta_0 + \beta_1 \times \text{ROL}_c + \beta_2 \times \text{HC}_c + \beta_3 \times \text{FinDev}_c + \phi \times \ln(y) + \epsilon_c$$
Decomposing Delegation Benefits $\zeta$

- Try to decompose delegation benefit $\zeta$ into:
  - rule of law
Decomposing Delegation Benefits $\xi$

- Try to decompose delegation benefit $\xi$ into:
  - rule of law
  - human capital
Try to decompose delegation benefit $\xi$ into:
- rule of law
- human capital
- financial development
Decomposing Delegation Benefits $\zeta$

- Try to decompose delegation benefit $\zeta$ into:
  - rule of law
  - human capital
  - financial development

- Accounting exercise using

$$\zeta_c = \beta_0 + \beta_1 \times ROL_c + \beta_2 \times HC_c + \beta_3 \times FinDev_c + \phi \times \ln(y) + \epsilon_c$$
Decomposing the US life-cycle

![Graph showing mean employment by age categories with two lines: one for US (Fitted) and another for US with India Fitted. The x-axis represents age categories (0-5, 6-10, 11-15, 16-20, 21-25, +26), and the y-axis represents mean employment.]
Decomposing the US life-cycle
Decomposing the US life-cycle

Institution-Age

Rule of Law
30% 31% 29% 28% 27%

Human Capital
40% 38% 41% 38% 38%

Financial Development
15% 14% 15% 17% 16%

Rest
15% 17% 15% 17% 19%

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July 10, 2015
Decomposing the US life-cycle

Institution-Age

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Decomposing the US life-cycle

Institution-Age

<table>
<thead>
<tr>
<th>Institution</th>
<th>6-10</th>
<th>11-15</th>
<th>16-20</th>
<th>21-25</th>
<th>26+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rule of Law</td>
<td>30%</td>
<td>31%</td>
<td>29%</td>
<td>28%</td>
<td>27%</td>
</tr>
<tr>
<td>Human Capital</td>
<td>40%</td>
<td>38%</td>
<td>41%</td>
<td>38%</td>
<td>38%</td>
</tr>
<tr>
<td>Financial Development</td>
<td>15%</td>
<td>14%</td>
<td>15%</td>
<td>17%</td>
<td>16%</td>
</tr>
<tr>
<td>Rest</td>
<td>15%</td>
<td>17%</td>
<td>15%</td>
<td>17%</td>
<td>19%</td>
</tr>
</tbody>
</table>
Conclusions

- Firm selection and factor reallocation are key for economic growth yet they don’t happen in developing countries.
- Not everybody is destined to be a good entrepreneur. (Right allocation of microcredits?)
- Credit constraints and size-dependent distortions are (I am sure) important. Yet there is something else that is fundamentally missing in developing countries.
- Transformative entrepreneurs need a good playground with strong rule of law and trust.