From Micro to Macro: Entry Barriers, Resource Misallocation, and Aggregate Productivity

Roberto N. Fattal Jaef
World Bank
Development Research Group, Macroeconomics and Growth (DECMG)

Policy Research Talk
February 23, 2021

Disclaimer: the views expressed in this presentation are my own and do not necessarily represent those of the World Bank or its member countries
Cross-Country Differences in Income per Worker

Income per worker relative to United States

Source: Penn World Tables v9.0 year 2014

- Kenya 7%, India 13%, Argentina 42%, France 83%
What Explains Differences in Income? Development Accounting

\[ \text{GDP per worker} = TFP \times F(K, H) \]

- **TFP**: total factor productivity
- **\( K \)**: physical capital
- **\( H \)**: human capital

- Relative role of TFP and factors of production?
Development Accounting

TFP gaps and Factor gaps vs GDP gaps

GDP per worker relative to US
Factors or TFP Relative to US
Development Accounting: The Role of TFP

Contribution of TFP gaps to Income gaps?
Development Accounting: The Role of Factors

Contribution of Factors gaps to Income gaps?

![Graph showing the relationship between GDP per worker relative to US and Factors or TFP Relative to US. The graph includes two datasets: Factors (blue dots) and TFP (red dots). The green line represents the 45-degree angle, indicating where Factors and TFP would be equal to GDP per worker relative to US.](image)
What Drives Productivity Differences Across Countries?
Where we are: Macro to Macro

\[
\begin{align*}
\text{K,H} & \quad \downarrow \\
\text{TFP} & \quad \downarrow \\
\text{GDP} &
\end{align*}
\]
Where we are Going: Micro to Macro

\[ \begin{align*}
Z_1 \ast F(k_1, h_1) & \quad Z_3 \ast F(k_3, h_3) \\
Z_2 \ast F(k_2, h_2) & \quad Z_4 \ast F(k_4, h_4)
\end{align*} \]

\[ \text{K,H} \]

\[ \text{GDP} \]
From Micro To Macro

- Allocation of K,H to maximize output?
- Barriers to this allocation?
- Useful to understand TFP
From Micro To Macro: Efficiency

\[ Z_1 \ast F(k_1, h_1) \quad Z_3 \ast F(k_3, h_3) \]
\[ Z_2 \ast F(k_2, h_2) \quad Z_4 \ast F(k_4, h_4) \]

K,H

. Prices mechanism
. Free Entry

GDP
From Micro To Macro: Efficiency

\[ Z_1 \ast F(k_1, h_1) \quad Z_3 \ast F(k_3, h_3) \]
\[ Z_2 \ast F(k_2, h_2) \quad Z_4 \ast F(k_4, h_4) \]

K,H

. Prices mechanism
. Free Entry

Efficient allocation equalizes Marginal Revenue Products across firms

\[ MRP_i = MRP_j \]

Optimal competition & innovation

GDP
From Micro To Macro: Efficiency

\[ MRP_i = MRP_j \]

Production Possibilities Frontier

Size Distribution
From Micro To Macro: Allocative Distortions

\[ Z_3 \ast F(k_3, h_3) \]
\[ Z_4 \ast F(k_4, h_4) \]
\[ Z_1 \ast F(k_1, h_1) \]
\[ Z_2 \ast F(k_2, h_2) \]

. Prices mechanism
. Free Entry
. Market frictions (i.e. financial frictions)
. Government policy (i.e. size-dependent taxation)

GDP
From Micro To Macro: Allocative Distortions

Suppose: \( Z_1 > Z_2 > .. > Z_4 \)

Size dependent distortion: \( \tau_1 > \ldots > \tau_4 \)

\[
MRP_1 \times (1 - \tau_1) = MRP_2 \times (1 - \tau_2)
\]

Misallocate Resources from high to low productivity firms
From Micro To Macro: Allocative Distortions

\[ MRP_i \times (1 - \tau_i) = MRP_j \times (1 - \tau_j) \]
From Micro To Macro: Entry Barriers

Entry Barrier: \( EC_i = EC_{USA} \times (1 + \tau_e) \)

- Prices mechanism
- Free Entry
- Market Frictions
- Government Policy
- Entry Barriers

\( Z_1 \times F(k_1, h_1) \quad Z_3 \times F(k_3, h_3) \)
\( Z_2 \times F(k_2, h_2) \quad Z_4 \times F(k_4, h_4) \)

Lower competition \( \Rightarrow \) fewer and larger firms \( \Rightarrow \) lower TFP
From Micro To Macro: Entry Barriers

$$EC_i = EC_{USA} \times (1 + \tau_e)$$

Production Possibilities Frontier

Size Distribution
• Interaction between firms, frictions, policies → theory of *TFP*
• Frictions and policies manifest on firm size distribution

*Are there differences in size distribution across countries?*
Firm-Level Data

- **Representative firm-level data, manufacturing formal firms**
- **Manufacturing Censuses of 10+ worker firms**
  - Chile, Colombia, El Salvador, Peru
  - Ghana, Ethiopia, Kenya
  - Bangladesh, India, Malaysia, Pakistan
- **Amadeus: countries with representative size distribution**
  - Belgium, Bulgaria, Finland, France, Hungary, Italy, Latvia, Portugal, Romania, Spain
Cross-Country Differences in Average Size?

- Smaller firms in poorer countries
- Promising starting point for distortions as theory of TFP

How large is each type of distortion?

How much of TFP difference they account for?
Firm size distribution contains information about distortions

1. Propose model of size distribution calibrated to USA
2. Introduce entry barriers $\tau^e$ and allocative distortions $\tau(z)$ into model
3. Distortions $\rightarrow$ Model $\rightarrow$ Model based size distribution

Identify distortion pair that matches size distribution in data
Theoretical Underpinnings

- Key Mechanisms connecting distortions with size distribution
  - heterogeneous productivity
  - endogenous innovation
  - entry and exit

- Assumptions:
  - competitive factor markets
Identification Strategy of Idiosyncratic Distortions

- Deviation from output-maximizing rule:
  \[ MRP(z)[1 - \tau(z)] = [1 - \bar{\tau}]M\bar{R}_P \]

- How can I identify \( \tau(z) \)?

- \( MRP(z) \) is proportional to \( \frac{Revenue(z)}{Inputs(z)} \)

- Hsieh and Klenow (2009): revenues and input observable

- Summary statistic: elasticity between \( (1 - \tau_z) \) and \( z \)

- correlated distortions
Evidence of Correlated Distortions Across Countries?
Evidence on Correlated Distortions

Estimate elasticity of $\tau(z)$ and $z$ across firms.
Evidence on Correlated Distortions

Estimate elasticity of $\tau(z)$ and $z$ across firms
• Correlated distortions reduce average size (theory)
• Lower average size in less developed countries (data)
• More correlated distortions in less developed countries (data)

Can idiosyncratic distortions account for average size data? Any role for entry barriers?
Can Idiosyncratic Distortions Account for Average Size Distribution?

- Feed elasticity $\tau_z$ vs $z$ in model. Equilibrium vs data?
Can Idiosyncratic Distortions Account for Average Size Distribution?

- Feed elasticity $\tau_z$ vs $z$ in model. Equilibrium vs data?
Identification Strategy of Entry Barriers

- Countervailing force on size distribution missing

- Exactly what entry barriers accomplish

- Identification strategy of entry Barrier?
- Solve for $\tau^e$ that attains average size in data (450 line)
Model-Based Entry Barriers across Countries

![Graph showing the relationship between log GDP per capita and log(1+TauE) for various countries.]
From Micro to Macro

Aggregate Effects of Entry Barriers and Misallocation
Aggregate Productivity Gains from Removing Distortions
Aggregate Productivity Gains from Removing Distortions

The graph shows the relationship between log GDP per capita (log GDPpc) and the ratio of TFP-efficient to TFP-distorted productivity for various countries. The countries are labeled on the graph and include Belgium, Bulgaria, Chile, Ethiopia, Ghana, India, Kenya, Malaysia, Pakistan, Peru, Portugal, Romania, Salvador, Spain, Colombia, Finland, Hungary, Italy, Latvia, and Bangladesh. The graph indicates that higher log GDPpc values correspond to a greater ratio of TFP-efficient to TFP-distorted productivity.
Aggregate Productivity Gains from Removing Distortions

The graph shows the fraction of the TFP gap closed for various countries. The x-axis represents the ratio of TFP (USA) to TFP (i) minus 1, while the y-axis represents the fraction of the TFP gap closed. Countries such as Belgium, Portugal, Chile, Bulgaria, Peru, Romania, Malaysia, Colombia, Kenya, Chile, Hungary, Malaysia, Salvador, Bangladesh, Ghana, Ethiopia, Hungary, Latvia, India, Spain, Italy, and Finland are plotted on the graph.
POLICY DISCUSSION
What is behind the Model-Based Entry Barriers and the Idiosyncratic Distortions?

- Natural reactions: “all very nice, but….”
  1. What’s behind all these distortions?
  2. How to fix them?
- A discussion coming, but pause to appreciate the progress
  ▶ Development accounting only recently feasible, still improving
  ▶ Opening “black-box” of TFP not trivial:
    ▶ integrate industry dynamics in general equilibrium
    ▶ firm-level data
    ▶ numerical methods
Model-Based Entry Barriers and Idiosyncratic Distortions: Connection with actual policies and frictions?
Model-Based Barriers and Entry Regulation

- Model’s entry barriers vs WB’s Doing Business’ entry cost
Model-Based Barriers and Entry Regulation

- Model’s entry barriers vs WB’s Doing Business’ entry cost
TFP Gains from Removing Model-Based Barriers vs Entry Regulation

- Differential TFP gains model-based barriers vs regulation?
• Extensive literature on causes of idiosyncratic distortions
• Labor regulations (firing costs, size-dependent labor costs)
  ▶ Hopenhayn and Rogerson (1993), Garicano, Lelarge and Van Reenen (2013)
  ▶ Accounts for little misallocation, small aggregate effects
• Size-dependent taxation
  ▶ Bachas, Fattal-Jaef, Jensen (2019)
  ▶ Small productivity losses from size-dependent tax enforcement
• Financial Frictions
  ▶ Small effects on misallocation, large effects on TFP when interacted with technology adoption

Misallocation combines multiple sources, country specific
Useful diagnostic to rank reforms and prioritize
THANK YOU

- Repository for Fattal-Jaef (2021) forthcoming AEJ:macro:
  ▶ https://github.com/rfattaljaef/Misallocation_EntryBarriers

- Repository for Figures and Slides of this Talk
  ▶ https://github.com/rfattaljaef/PolicyResearchTalk
BACK-UP SLIDES
Decomposition TFP Gains: Misallocation vs Entry Barriers

- **Full Reform**
- **Misalloc. Only**
- **Entry Barriers Only**

Countries and their relative to initial SS GDPpc gains are depicted in the scatter plots.
Validation 1: Implications for Life-Cycle Dynamics

![Graph showing employment relative to age for USA, France, Ghana, and India.](gains)
Validation 2: Implications for Top of Size Distribution

Share of firms with more than 250 workers

Model vs Data

Belgium
Bulgaria
Chile
Ethiopia
Finland
France
Ghana
Hungary
Italy
Kenya
Latvia
Peru
Portugal
Romania
Salvador
Spain
Bangladesh
Colombia
Ethiopia
Ghana
India
Pakistan
Peru
Spain
Bulgaria
Belgium
France
Italy
Hungary

0.0
0.1
0.2
0.3

0.0
0.1
0.2
0.3

gains
Measurement of Average Size: Controlling for Production Structure

- Need to control for differences in production structures within manufacturing

\[ \text{AvSize} = \sum_{s=1}^{S} \text{AvSize}_s \times \frac{M_s}{M} \]

- Theory is silent about cross-country differences in \( \frac{M_s}{M} \)

**Strategy:** aggregate according to the U.S.’ distribution of firms

\[ \text{AvSize}^{FD} = \sum_{s=1}^{S} \text{AvSize}_s \times \left( \frac{M_s}{M} \right)^{US} \]