Misallocation, Establishment Size, and Productivity

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November 15, 2014

Motivation

Large Income Differences Across Countries

- consensus: mostly explained by productivity differences
- evidence of resource misallocation across establishments in poor countries (Hsieh & Klenow 2009)
  - explains significant portion (but not most) of variation in aggregate productivity
- establishment-level productivity also varies across countries (Hsieh & Klenow 2009, Pagés-Serra 2010, Gal 2013)
  - not explored much in misallocation literature

What We Do

- in our model, establishments take misallocation into account when investing in productivity
  - Bhattacharya, Guner, & Ventura (2013) and Hsieh & Klenow (2014) include similar mechanism, combined with (several) other extensions
  - simplify, isolate effect of misallocation on investment and entry
  - separated from static effect through distorted output decisions

What We Find

- if distortions are random;
  - no effect of misallocation on investment or establishment size
  - model collapses to Hsieh and Klenow (2009)
- if distortions are correlated with productivity;
  - less investment in productivity
  - larger impact of misallocation on aggregate productivity
  - smaller establishments

Evidence: Establishment Size

Are establishments smaller in poor countries?

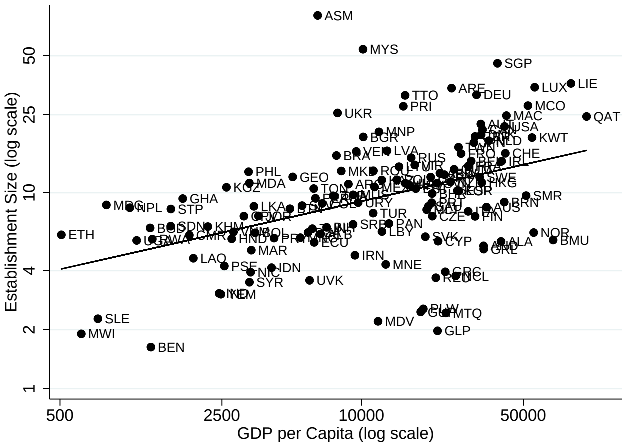
- previous evidence inconclusive
  - no standardized data for large number of countries

Evidence: Establishment Size

Are establishments smaller in poor countries?

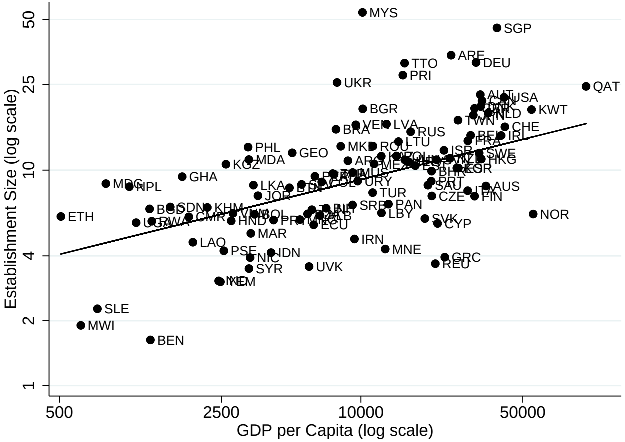
- previous evidence inconclusive
  - no standardized data for large number of countries
- we construct new dataset
- hundreds of sources: census, business registries, ...
- standardized data for 134 economies
- persons engaged per establishment
- representative of *all* manufacturing establishments

Evidence: Establishment Size (134 economies)



- elasticity: 0.27 (0.04)

Evidence: Establishment Size (107 large economies)



- elasticity: 0.33 (0.04), population $>$ 0.5 million

Model: Environment

- standard model of monopolistic competition, but;
  - endogenous entry
  - entrants invest to determine productivity
  - abstract from heterogeneity, establishments identical ex ante

Model: Environment

Final-Good Firm: $Y = \left(\int_0^N y_i^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}}$

- N: number of intermediate-good firms
- y_i: demand for input i
- σ: the constant elasticity of substitution between varieties.

Intermediate Firm: $y_i = s_i \ell_i$

- s_i: productivity, ℓ_i: labor demanded
- upon entry, choose s_i by investing $c_S Y s_i^{\theta}$
- owner forgoes market wage w while running firm
- exogenous probability of firm death λ

Model: Environment

- each firm i faces 'tax' τ_i on output
- assume τ_i depends on productivity s_i

$$(1-\tau_i) = \left(\frac{s_i}{\bar{s}}\right)^{-\gamma}$$

  - $\bar{s}$: average productivity
  - γ: elasticity of distortion w.r.t. productivity

Model: Equilibrium

Steady-State Decentralized EQ: prices and allocations constant

- given prices P_i, final-good firm maximizes profits

$$P_i = Y^{\frac{1}{\sigma}} y_i^{\frac{-1}{\sigma}}$$

- given w, R, Y, ℓ_i maximizes per-period profits

$$\ell_i = \frac{(1-\tau_i)^{\sigma} s_i^{\sigma-1}}{w^{\sigma}} \left(\frac{\sigma-1}{\sigma}\right)^{\sigma} Y, \qquad \pi_i = \frac{w\ell_i}{\sigma-1}$$

- given w, R, Y, s_i maximizes life-time profits
- free-entry: investment = life-time profits – forgone wages
- labor-market clears: $1 = N\left(\mathbb{E}\left[\ell_i\right] + 1\right)$

Model: Equilibrium

labor-market clearing + optimal ℓ_i:

$$Y = N^{\frac{1}{\sigma-1}}(1-N)\frac{\mathbb{E}\left[s^{\sigma-1}(1-\tau)^{\sigma-1}\right]^{\frac{\sigma}{\sigma-1}}}{\mathbb{E}\left[s^{\sigma-1}(1-\tau)^{\sigma}\right]}$$

or

$$Y = N^{\frac{1}{\sigma-1}}(1-N)\ \mathbb{E}\left[s^{\sigma-1}\left(\frac{\overline{MRPL}}{MRPL_i}\right)^{\sigma-1}\right]^{\frac{1}{\sigma-1}}$$

- $MRPL_i = \frac{P_i y_i}{\ell_i} = \left(\frac{\sigma}{\sigma-1}\right)\frac{w}{(1-\tau_i)}$
- if no investment, same as Hsieh & Klenow (2009)
- if distortions random, same as Hsieh & Klenow (2009)

Model: Equilibrium

- now use $(1-\tau_i) = \left(\frac{s_i}{\bar{s}}\right)^{-\gamma}$
- value of entry $= \frac{Y(\sigma-1)^{\sigma-1}}{(1-\rho)w^{\sigma-1}\sigma^{\sigma}} \frac{s_i^{\sigma(1-\gamma)-1}}{\bar{s}^{-\sigma\gamma}} - \frac{w}{1-\rho} - c_S Y s_i^{\theta}$
  - $\rho(\lambda, R)$: discount factor
- optimal investment: $c_S Y s^{\theta} = \frac{\mathbb{E}[\pi]}{(1-\rho)} \frac{[\sigma(1-\gamma)-1]}{\theta}$
- free-entry: $\frac{\mathbb{E}[\pi][\theta+1-\sigma(1-\gamma)]}{\theta} = w$

Model: Results

$$N = \frac{[\theta + 1 - \sigma(1-\gamma)]}{\theta\sigma + 1 - \sigma(1-\gamma)}$$

$$s = \left(\frac{\sigma(1-\gamma)-1}{N}\right)^{\frac{1}{\theta}} \left(\frac{1}{\theta(1-\rho)\sigma c_S}\right)^{\frac{1}{\theta}}$$

$$\text{aggregate investment share} : \frac{\lambda[\sigma(1-\gamma)-1]}{\sigma\theta(1-\rho)}$$

Model: Results

- correlated distortions (γ) discourage productivity investment
- entrants invest lower fraction of profits on productivity
- this *increases* value of entry, so free entry implies number of establishments must increase to lower value of entry to zero

Model: Results

When distortions more correlated with productivity (higher γ):

- higher number of establishments
- lower employment per establishment
- lower establishment-level productivity
- aggregate productivity increasing in both establishment-level productivity and number of establishments
    - could be higher or lower

Calibration

- quantify impact of correlated distortions on average employment and productivity
- calibrate model economy to U.S. manufacturing
- benchmark: $\gamma_{US} = 0.13$ from Hsieh & Klenow (2014)

Quantitative Exercise

Table: Model Results across Hypothetical Correlated Distortions γ

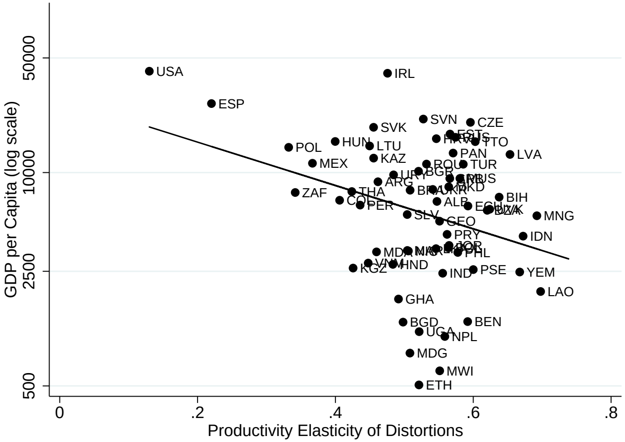
γ	Size	Productivity	Investment	Output
0.13 (γ_{US})	22	1	21%	1
0.2	10	0.61	18%	0.84
0.3	6.2	0.40	14%	0.66
0.4	4.6	0.28	10%	0.50
0.5	3.8	0.19	7%	0.36
0.56 (γ_{India})	3.4	0.14	4%	0.27 (0.17)

Evidence: Correlated Distortions

Do poor countries have higher γ's?

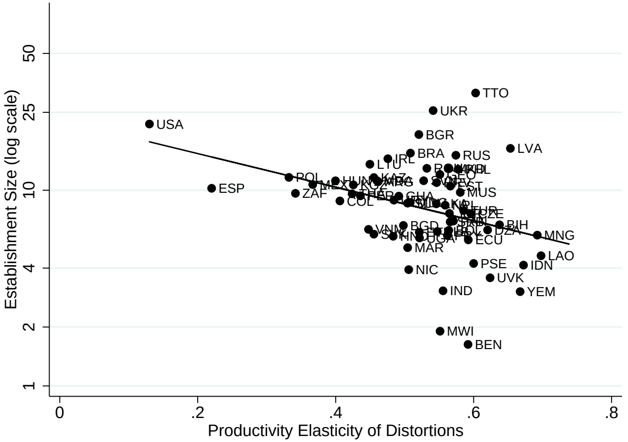
- Hsieh & Klenow (2014): India, Mexico higher γ's than U.S.
- World Bank's Enterprise Surveys: establishment-level data for low- and middle-income countries
  - Hsieh & Klenow (2009) method to back out within-industry distributions of distortions and productivity
  - use regressions to estimate γ's for 62 countries
  - result: γ higher in poorer countries

Evidence: Correlated Distortions and GDP per Capita



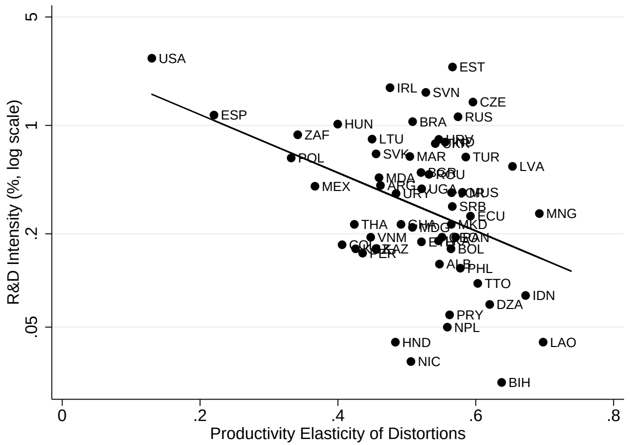
- elasticity: -3.04 (0.86)

Evidence: Correlated Distortions and Average Employment



- elasticity: -1.98 (0.50)

Evidence: Correlated Distortions and R&D Intensity



- elasticity: -4.32 (1.04)

Conclusion

- systematic evidence that poor countries have:
  - smaller establishments
  - less investment in productivity
  - more strongly correlated idiosyncratic distortions
- if establishments take misallocation into account when investing in productivity;
  - model can account for above facts
  - large impact on aggregate productivity
- combined with Hsieh & Klenow (2009), misallocation can explain 6-fold difference in size, establishment-level productivity, and aggregate TFP between U.S. and India