Quality Ladders with Financial Frictions

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Motivation

- Hsieh and Klenow (2009) measure resource misallocation across firms in China, India and the US
- Measure misallocation as a wedge between MP and factor price
  - Find large aggregate misallocation in China/India relative to the US
- What is the difference in TFP if China/India exhibited US level of misallocation?
  - India $\approx 40\%$ gain in TFP
  - China $\approx 50\%$ gain in TFP
- What generates these wedges?

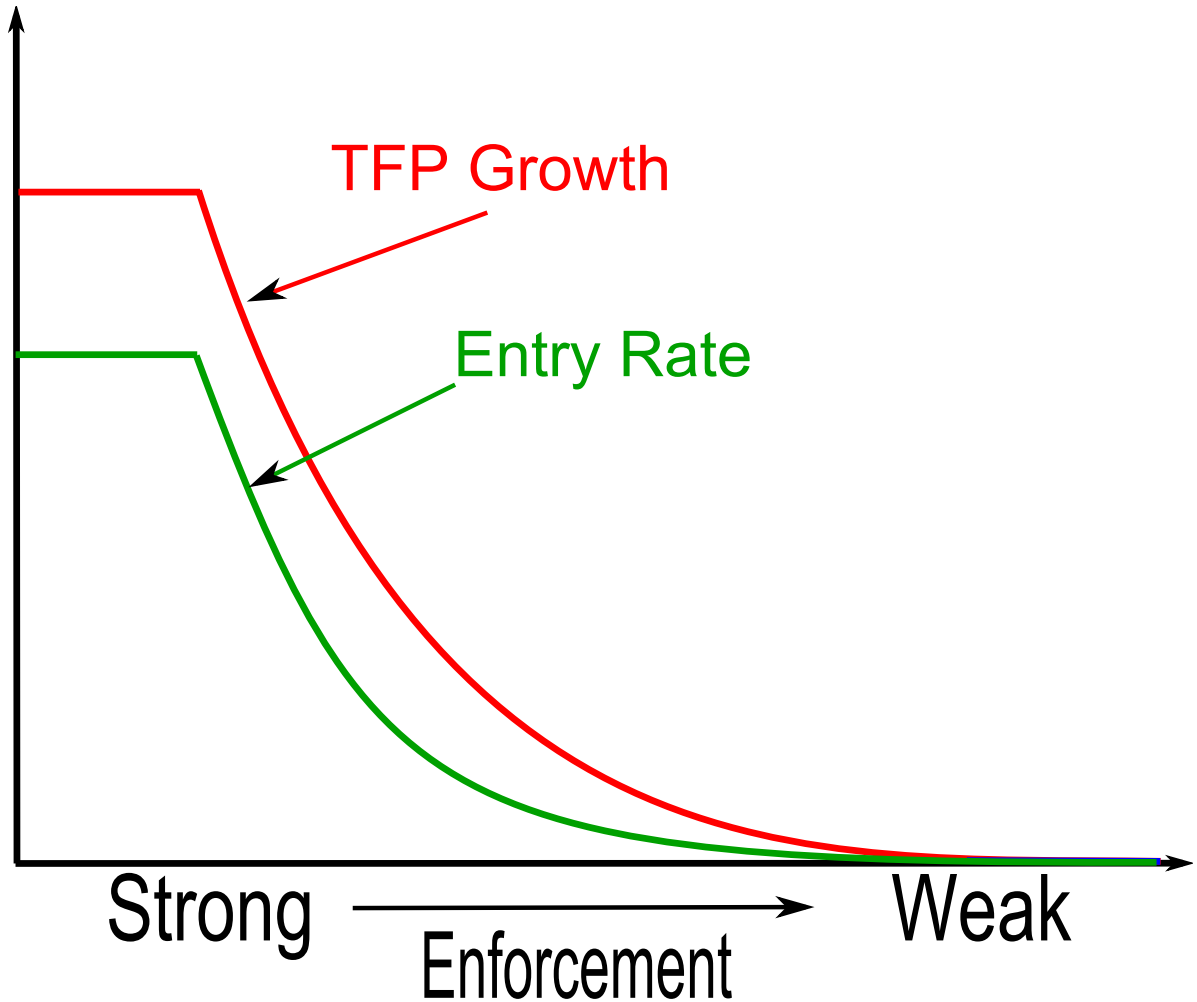
Motivation

- Recent literature: Do **financial frictions** cause large TFP losses by hindering the process of reallocation?
  - Buera, Kaboski, Shin (2011): $\approx 50\%$ TFP losses, large misallocation
  - Moll (2010): $\approx 25\%$ TFP losses, medium misallocation
  - Midrigan and Xu (2010): $\approx 5\%$ TFP losses, small misallocation
- Prediction of this class of models:
  - Positive correlation between average firm size and financial development
  - Looser borrowing constraints allow all firms to grow faster
  - More reallocation from low productivity to high productivity firms
- This correlation is counterfactual:
  - The data exhibit a negative correlation (Alfaro and Charlton, 2010)

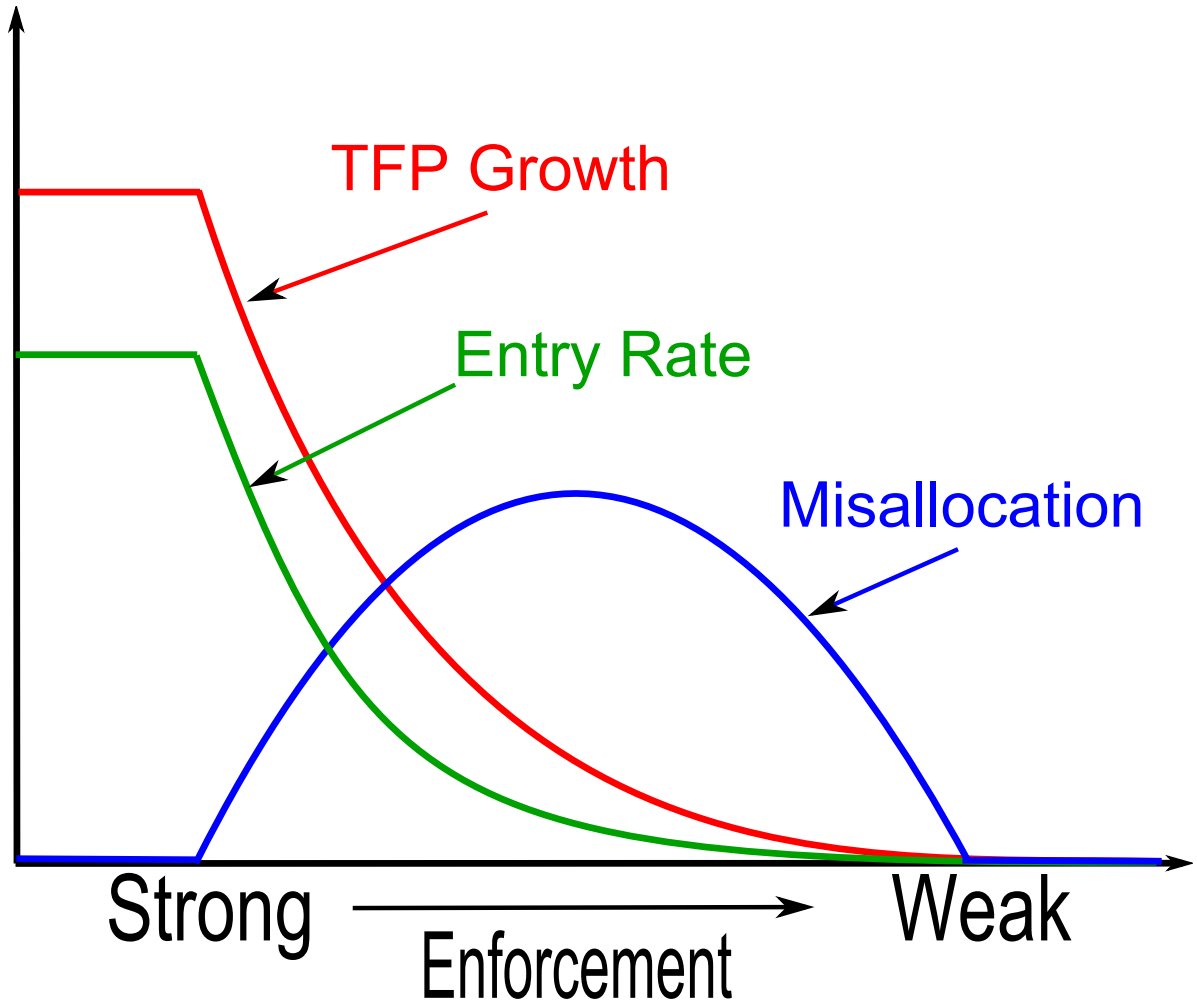
This Paper

- I construct a model with a negative correlation between average firm size and financial development
- I use the model to study misallocation
- I embed financial contracting in an endogenous growth model:
  - Quality Ladders: Grossman & Helpman (1991), Aghion & Howitt (1992)
  - Enforcement Frictions: Albuquerque & Hopenhayn (2004)
  - General Equilibrium: Lucas (1990), Gertler & Karadi (2011)

Preview of Results



Preview of Results



Preview of Results

Point 1: Do financial frictions cause large **TFP** losses by hindering the process of reallocation?

- No.
- Large resource misallocation across firms can indicate high TFP.
- Foregone firm entry directly decreases TFP.

Point 2: Do financial frictions cause large **welfare** losses by hindering the process of reallocation?

- No.
- Welfare costs of misallocation across firms are small compared to losses from foregone entry.

Environment

- $t \in [0, \infty)$
- Agents:
  - Final Good Producers (FPG)
  - Intermediate Good Producers (IGP), unit continuum
  - Financial Intermediaries (FI) - new -
  - Consumers
    - Laborers
    - Researchers
- Goods:
  - Single final consumption good (numeraire)
  - Differentiated intermediate goods, $\omega \in [0, 1]$

Final Good Production

$$\max_{\{x_{jt}(\omega)\}} \; y_t - \int_0^1 \sum_{j=1}^{n_t(\omega)} p_{jt}(\omega) x_{jt}(\omega) d\omega$$

$$\text{s.t.} \quad y_t \quad = \exp\left(\int_0^1 \ln\left(\sum_{j=1}^{n_t(\omega)} x_{jt}(\omega) \right) d\omega \right)$$

- Purchases intermediate inputs $\{x_{jt}(\omega)\}$ at given prices $\{p_{jt}(\omega)\}$
- Sells y_t units of the Final Good to Consumers
- Perfectly competitive market

Intermediate Good Producers

- Vintages:
  - Commodity ω can be produced by multiple IGPs.
  - Over time, new IGPs enter with a new technology for producing ω.
    - Vintages: $j = 1, 2, \ldots, n_t(\omega)$.
- Production:
  - The owner of technology j for producing commodity ω:
    - $x_{jt}(\omega) = \lambda^j L_{jt}(\omega)$, for $\lambda > 1$
  - Labor costs w_t per unit.
- Market Structure:
  - Bertrand competition in each ω-market.
  - IGP j chooses price of output $p_{jt}(\omega)$.

Innovation

- Measure N of consumers
- Each endowed with 1 unit of labor time, inelastically supplied
- At each t, choose between:
  - Wage labor:
    - Receive w_t from IGP
  - Researcher i in market ω:
    - Innovates blueprint for vintage $n_t(\omega)+1$ with Poisson rate Γ
    - If successful, manages intermediate firm with NPV $v_{t,0}(\omega)$
    - If unsuccessful, zero payoff
- Entry Condition: $\Gamma v_{t,0}(\omega) \leq w_t$, (w.e. if $m_t(\omega) > 0$)

Financial Intermediation

- Intermediation:
  - Upon innovating, a firm must pay a fixed entry cost: I_t.
  - Assume: Researcher has zero wealth
    - Researcher cannot pay initial fixed cost
  - Enters into a contract with a Financial Intermediary
- A *recursive contract* is a set of functions $\mathcal{C} = \{L, \delta, \dot{v}\}$
  - $\mathcal{C}$ maps (t, a, n_j, n_t) to:
    - L: firm size / production scale
    - δ: payment to Firm
    - $\dot{v}$: continuation value to Firm

Financial Intermediation

- Timing:
  (I) Age 0 (firm setup):
    - Firm sets price $\{p_{t+s}\}_{s=0}^{\infty}$
    - Competitive Financial Intermediaries offer contracts
    - Firm chooses a contract or none at all
    - If firm accepts, Financial Intermediary pays I_t

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  - (II) Age 0 (stage game):
    - Intermediary transfers $w_t L_{t,0}$ to Firm
    - Firm purchases labor, produces and sells output
    - Firm chooses whether to steal fraction γ of profits
    - If Firm does not steal: keeps payment $\delta_{t,0}$ and pays residual to FI
    - If Firm steals:
    - $\rightarrow$ If undetected, keeps stolen profits and payment $\delta_{t,0}$; pays residual to FI
    - $\rightarrow$ If detected, then FI seizes profits and uses new contract $\{\psi\delta_{t,a}\}_{a=0}^{\infty}$

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  - (III) Age $a > 0$
    - Repeat stage game

Financial Intermediation

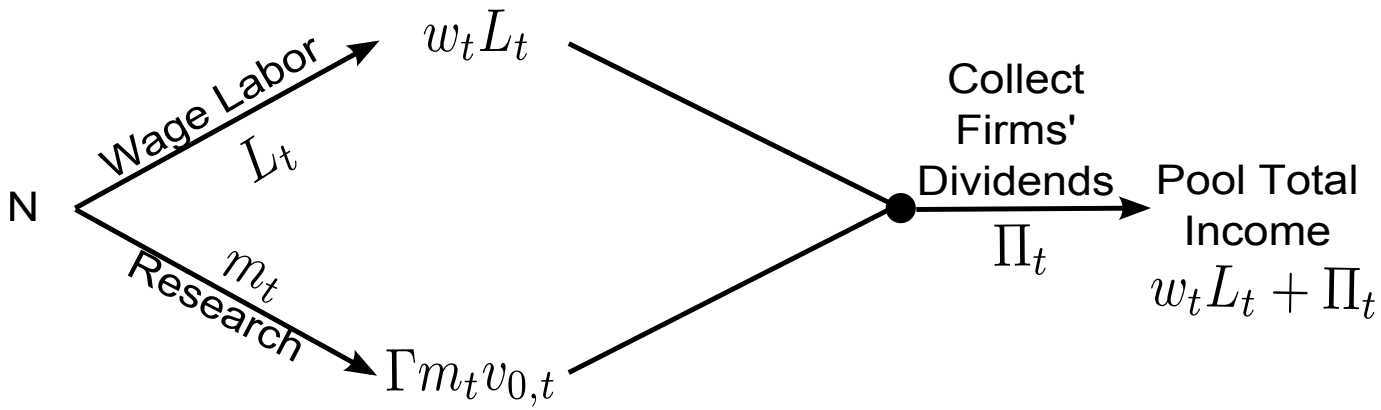
- A contract is *optimal* if it satisfies $\forall(t,a)$:

$$\begin{aligned} r_t b(v_{t,a}) = \max_{\mathcal{C}} \ & \pi_{t,a} - \delta_{t,a} + b'(v_{t,a})\dot{v}_{t,a} - \Gamma m_t b(v_{t,a}) \\ \text{s.t.} \qquad r_t v_{t,a} &= \delta_{t,a} + \dot{v}_{t,a} - \Gamma m_t v_{t,a} \\ \delta_{t,a} + \dot{v}_{t,a} &\geq \theta \pi_{t,a} \\ \delta_{t,a} &\geq 0 \end{aligned}$$

- $\theta \geq 0$: **strength of enforcement**
- Γm_t: probability of entry
- Break-Even Constraint: $b(v_{t,0}) \geq I_t$

Rep. Consumer (Family)

- Individuals solve:



- Family Planner allocates consumption and savings:

$$J(a_0) = \max_{(c_t, \dot{a}_t)} \int_0^\infty e^{-\rho t} \log(c_t) dt$$

$$\text{s.t.} \quad \dot{a}_t = w_t L_t + \Pi_t + r_t a_t - c_t$$

$$c_t^i = c_t^j \ \forall i, j \in [0, N]$$

Equilibrium

Equilibrium:

- Standard competitive equilibrium definition.
- I consider equilibrium allocations along a Balanced Growth Path.

I now characterize the allocation and show:

- Point 1: Large resource misallocation across firms can be indicative of a relatively well functioning economy.
- Point 2: Welfare costs of misallocation across firms are small compared to losses from lack of entry.

Optimal Contract

$$\overset{=0}{\delta_0} + \overset{\uparrow}{\dot{v}_0} \geq \overset{\uparrow}{\theta} \left(p\lambda^n \underset{\downarrow}{L_0} - w\underset{\downarrow}{L_0} \right)$$

To loosen enforcement constraint:

- Decrease initial scale of production: $L_0 \downarrow$
- Push payments to firm into the future:
  - Zero payment until the firm reaches its optimal scale
  - **The intermediary chooses how long the firm is constrained**
  - As enforcement weakens ($\theta \uparrow$), longer length of time constrained

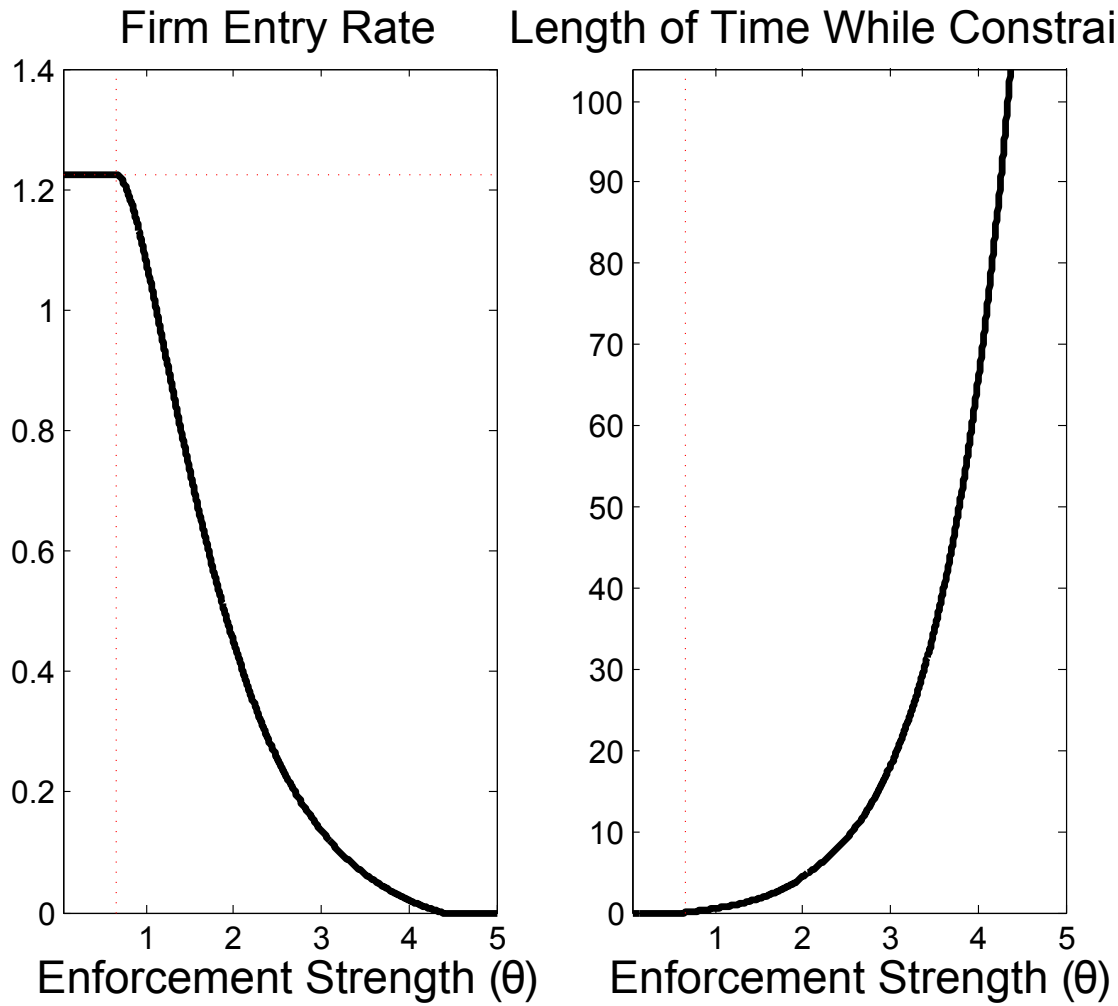
Entry

Profits:

- The most productive firm selling ω receives monopoly rents
- The second most productive firm receives zero profits

Therefore,

- **The longer a firm is constrained the more likely :**
  - a more productive firm enters the market
  - the incumbent firm loses its monopoly before receiving a payment
- **Which discourages entry**


Firm Entry Rate
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1
2
3
4
5
Enforcement Strength (θ)
Length of Time While Constrained
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
Enforcement Strength (θ)

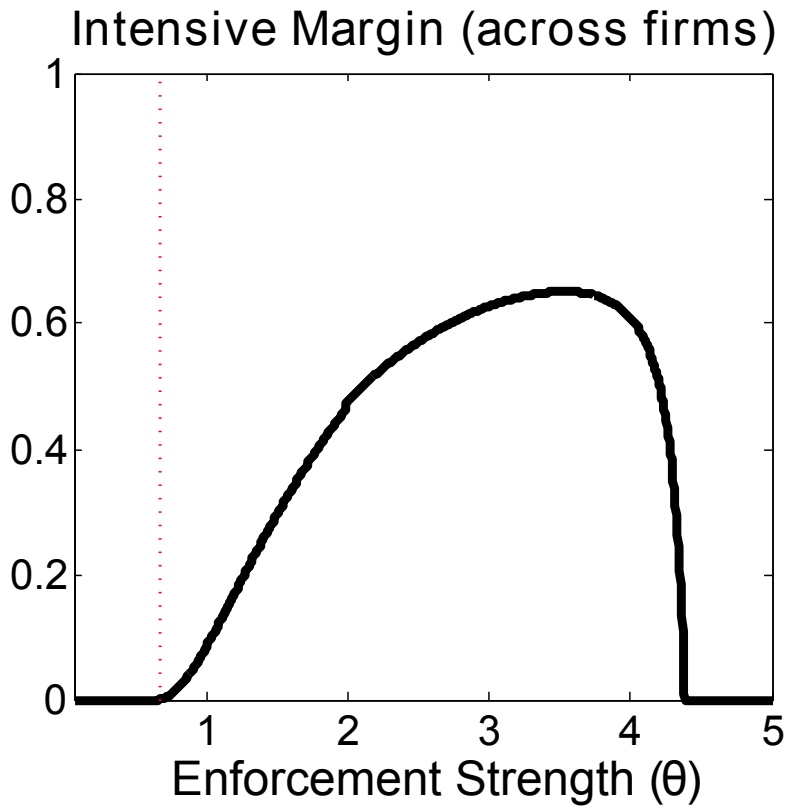
Misallocation

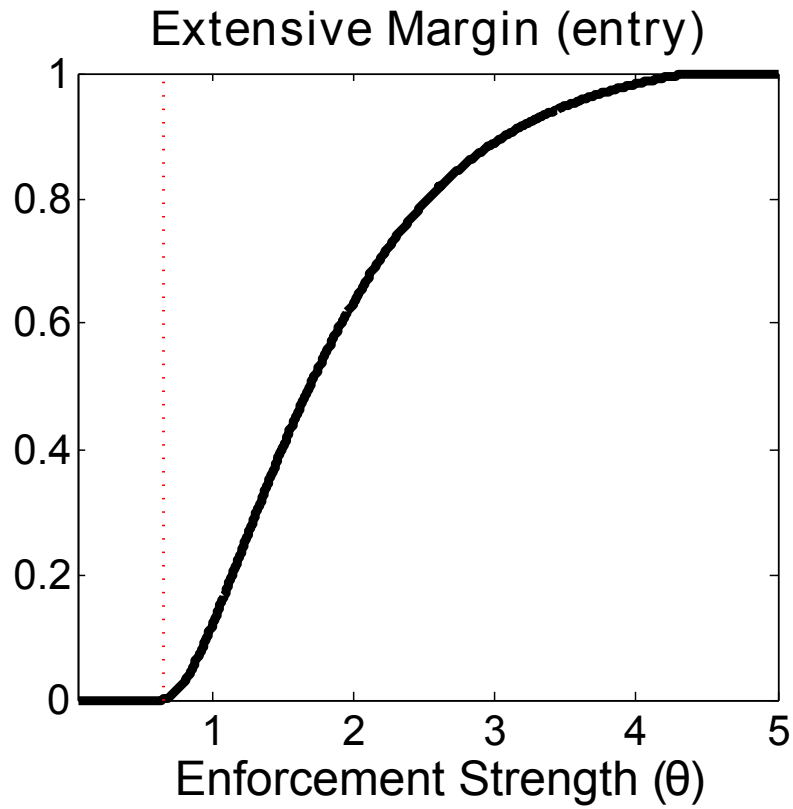
Point 1: Large resource misallocation across firms can be indicative of a relatively well functioning economy.

Define two types of misallocation:

- Intensive Margin Misallocation (across firms)
  - The fraction of total labor that is **not** hired by the most productive firm in each commodity market
- Extensive Margin Misallocation (entry distortion)
  - The decrease in entry relative to "full enforcement" entry rate

Misallocation



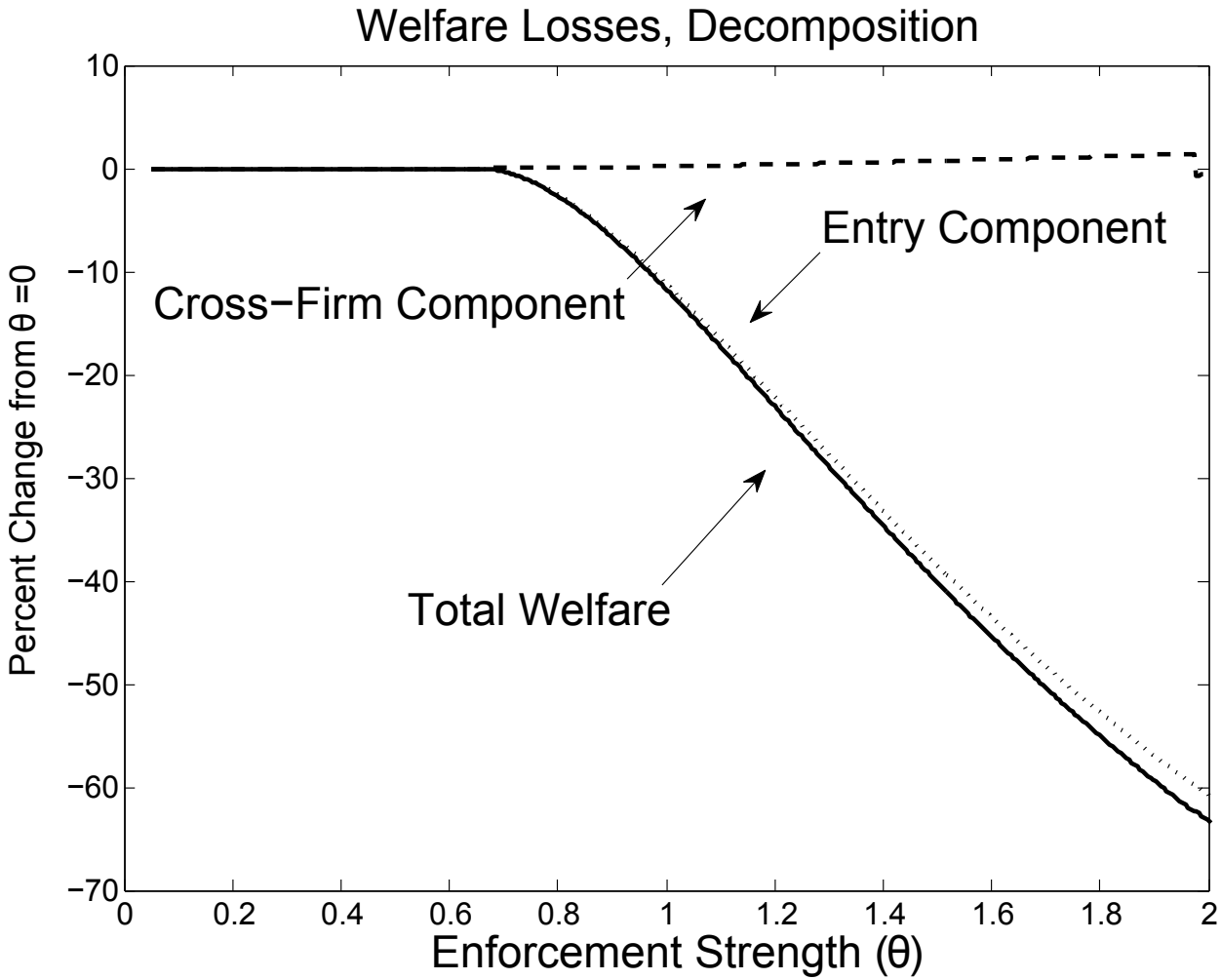


Welfare

Point 2: Welfare costs of misallocation across firms are small compared to losses from lack of entry.

- Compute utility of competitive equilibrium allocation
- Decompose utility into contribution from
  - Intensive Margin Misallocation (across firms)
  - Extensive Margin Misallocation (entry distortions)

Welfare


Welfare Losses, Decomposition
Percent Change from θ =0
Enforcement Strength (θ)
Entry Component
Cross−Firm Component
Total Welfare
10
0
−10
−20
−30
−40
−50
−60
−70
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2

Conclusion

This paper:

- Added financial frictions to a standard Quality Ladder model
- Used the model to study different types of misallocation
- Found:
  - Misallocation across firms is problematic for understanding TFP losses
  - Distortions to entry generate (nearly) all TFP and welfare losses

International Topics:

- The model could be extended to introduce financial frictions in Eaton & Kortum's trade model.