Discussion of "Misallocation in the Market for Inputs: Enforcement and the Organization of Production" by Johannes Boehm and Ezra Oberfield

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CAFRAL Conference

December 11, 2018

Introductory Remarks

- Great paper with many policy implications.
- Overview.
- Microfoundation: Endogenize enforcement friction.
  - Provide theoretical analogue of empirical findings.
  - Role for government intervention: Should intermediate goods be subsidized?
- Are wedges (to relationship-based inputs) capturing other frictions as well?
  - Misallocation in intermediate inputs and TFP dispersion in a model with financial frictions and adverse selection.

Overview

Main question: Can differences in legal systems account for differences in intermediate good utilization?

Key empirical findings: Firms in regions with more congested courts

1. use lower intermediate inputs,
2. shift towards homogenous inputs, and
3. are more vertically integrated.

Key quantitative finding: Enforcement frictions reduce aggregate productivity by 5% (on average).

Mechanism: Lack of contract enforcement introduces a wedge in price of inputs from a subset of suppliers.

Microfoundation

MICROFOUNDATION

Environment:

- Upstream Firm
  - Risk-averse preferences over single consumption good (c).
  - Initial wealth (y_0).
  - Realises in period 1 stochastic endowment ($\boldsymbol{y}_1 = (y_L, y_H)$ w/p $(1 - \pi(.), \pi(.))$).
- Midstream Firm(s)
  - Risk-neutral (continuum of unit mass).
  - Can purchase one unit of intermediate good (k) at price q which increases expected output ($\mathbb{E}_{\pi(k)}[\boldsymbol{y}_1]$); $\pi', -\pi'' > 0$.
- Downstream Firm
  - Risk-neutral.
  - Can access a technology that converts realized output y_1 into $F(y_1)$.

Timing:

- Midstream Firm offers contract to Upstream Firm stating split of output and investment in intermediate inputs.
- Upstream Firm chooses to accept or reject contract.
- Given output produced by Midstream Firm, Downstream Firm chooses to produce or not.

The Problem of Midstream Firm(s)

Given q,

$$\begin{aligned} \max_{(c_0, \boldsymbol{c}_1, k) \in \mathbb{R}^4_+} \quad & y_0 - c_0 - qk + \mathbb{E}_{\pi(k)}[\boldsymbol{y}_1 - \boldsymbol{c}_1] \\ \text{s.t.} \quad & u(c_0) + \beta \mathbb{E}_{\pi(k)}[u(\boldsymbol{c}_1)] \geq u(y_0) + \beta \mathbb{E}_{\pi(k)}[u(\boldsymbol{y}_1)] \end{aligned}$$

Proposition (Dixit, 2018, JMP): Suppose prices are fixed and the coefficient of relative risk aversion is finite. Then

$$k = \pi'^{-1}\left(\frac{qu'(c_0)}{\Delta y u'(c_0) - \beta[u(y_H) - u(y_L)]}\right) < \pi'^{-1}\left(\frac{q}{\Delta y}\right) = k^{FB}.$$

- Takeaway: Lack of contract enforcement can cause underutilization of intermediate inputs at the Midstream Level.

The Planning Problem

- Pareto weights: Upstream Firm: 0; Midstream Firm: $1-\psi$; Downstream Firm: $\psi \in (0,1)$.

Assumption 1: $F : \mathbb{R}_+ \mapsto \mathbb{R}_+$.

- Under Assumption 1, the Downstream Firm chooses to enter and produces $F(\mathbb{E}_{\pi(k)}[\boldsymbol{y}_1]) > 0$ units.

$$
\begin{aligned}
\max_{(c_0,c_1,c^U,k)\in\mathbb{R}^4_+} \quad & (1-\psi)\{y_0 - c_0 - qk + \mathbb{E}_{\pi(k)}[\boldsymbol{y}_1] - c_1\} + \psi c^U \\
\text{s.t.} \quad & u(c_0) + \beta u(c_1) = u(y_0) + \mathbb{E}_{\pi(k)}[u(\boldsymbol{y}_1)], \\
& u'(c_0) = \beta u'(c_1), \\
& \pi'(k) = \frac{q u'(c_0)}{\Delta y u'(c_0) - \beta[u(y_H) - u(y_L)]}, \\
& c^U = F(\mathbb{E}_{\pi(k)}[\boldsymbol{y}_1]).
\end{aligned}
$$

MICROFOUNDATION

Assumption 2: $\beta = 1$.

- Assumption 2 ensures that the Upstream Firm has a constant consumption path $\bar{c} \equiv c_0 = c_L = c_H = u^{-1}\left(\frac{1}{2}\{u(y_0) + \mathbb{E}_{\pi(k)}[u(\boldsymbol{y}_1)]\}\right)$ in equilibrium.

This simplifies the planning problem:

$$\max_{(\bar{c},k)\in\mathbb{R}^2_+} \quad (1-\psi)\{y_0 - 2\bar{c} - qk + \mathbb{E}_{\pi(k)}[\boldsymbol{y}_1]\} + \psi F(\mathbb{E}_{\pi(k)}[\boldsymbol{y}_1])$$

$$\text{s.t.} \quad \pi'(k) = \frac{qu'(\bar{c})}{\Delta y u'(\bar{c}) - [u(y_H) - u(y_L)]} \quad \dots \quad (\omega^p)$$

Proposition: Under assumption 2, the optimal linear subsidy on intermediate inputs is given by:

$$\tau = 1 - \frac{\{\Delta y u'(\bar{c}) - [u(y_H) - u(y_L)]\}\{(1-\psi)(2\frac{\partial \bar{c}}{\partial k} + q) + \omega^p \Lambda\}}{q\Delta y u'(\bar{c})(1 - \psi + \psi F'(\mathbb{E}_{\pi(k)}[\boldsymbol{y}_1]))},$$

where $\Lambda \equiv \pi''(k)\left[\Delta y + \frac{[u(y_H)-u(y_L)]}{[u'(\bar{c})]^2} u''(\bar{c})\frac{\partial \bar{c}}{\partial k}\right]$.

- Takeaway: The optimal linear subsidy is increasing in the marginal returns to the Downstream Firm's technology.

Are wedges capturing other frictions?

Are wedges capturing:

- Informational frictions: Adverse Selection can unravel the market for capital and endogenously lead to dispersion in TFP (Akerlof, 1970; Fuchs, Green. and Papanikolaou, 2016). ▸ Data
- Financial frictions: Firms whose financing choices are affected by higher borrowing costs have inefficient allocation of inputs and lower TFPs than firms with ready access to capital markets (Gilchrist, Sim, and Zakrajsek, 2012). ▸ Data

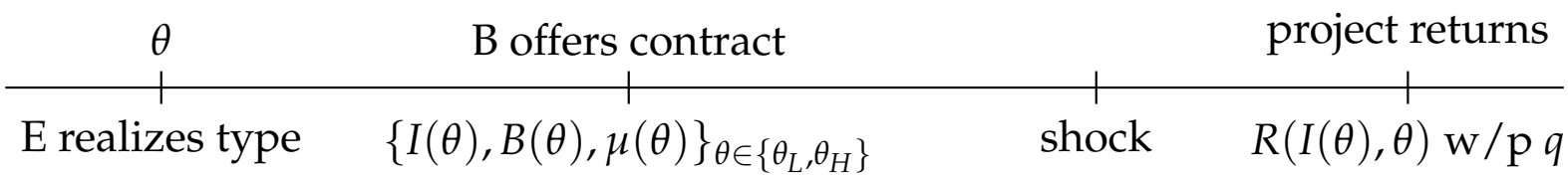
I now propose a novel framework in which equity caps interact with adverse selection to create dispersion in intermediate good utilization and TFP.

- When information is complete, there is no TFP dispersion and this is independent of portfolio allocations.
- Under incomplete information, not only the level of finance, but the **type of finance (i.e. equity-debt ratio) matters** for misallocation.

Environment:

- The economy is populated by heterogenous risk-neutral entrepreneurs that can be of two types, θ_H or θ_L, where $\theta_H > \theta_L$.
- To finance their project, entrepreneurs seek investment for intermediate goods I from a bank, which is also assumed to be risk-neutral.
- The bank does not observe θ but knows the proportion of type θ in the economy $\pi(\theta)$.
- Entrepreneur of type θ has access to a stochastic technology that transforms I goods into $R(I, \theta)$ goods with probability q and returns 0 otherwise.
- The bank offers debt-equity contracts $\{I, B, \mu\}$ to finance investment.

Timing:



Assumption 1 (Supermodularity): $R : \mathbb{R} \times \{\theta_L, \theta_H\} \mapsto \mathbb{R}$ has increasing differences in (I, θ), that is $\forall I' \geq I \quad \forall \theta' \geq \theta \quad R(I', \theta') - R(I, \theta') \geq R(I', \theta) - R(I, \theta)$.

Assumption 2: $R(x, \theta_H) > R(x, \theta_L) \quad \forall x \in \mathbb{R}$.

Assumption 3: $\frac{\partial R}{\partial I} > 0$ and $\frac{\partial^2 R}{\partial I^2} < 0$.

Payoffs

The bank's ex-interim payoff from contracting with type θ who reports $\hat{\theta}$ is

$$U_B(\theta, \hat{\theta}) \equiv -I(\hat{\theta}) + q\big[\mu(\hat{\theta})R(I(\hat{\theta}), \theta) + B(\hat{\theta})\big]$$

Entrepreneur of type θ who reports $\hat{\theta}$ has an ex-interim payoff of

$$U_E(\theta, \hat{\theta}) \equiv q\big[\big(1 - \mu(\hat{\theta})\big)R(I(\hat{\theta}), \theta) - B(\hat{\theta})\big]$$

Incentive Compatibility

Invoking the Revelation Principle, the allocation space is constrained by the following incentive constraints

$$U_E(\theta, \theta) \geq U_E(\theta, \hat{\theta}) \qquad \forall \theta, \hat{\theta} \in \{\theta_L, \theta_H\}$$

Voluntary Participation

$$U_E(\theta, \theta) \geq q\underline{U} \qquad \forall \theta \in \{\theta_L, \theta_H\}$$

Equity Constraints

I proxy incompleteness of financial markets by limits on bank equity holdings. In particular, bank equity cannot exceed an exogenous limit $\bar{\mu} < 1$,

$$\mu(\theta) \leq \bar{\mu} \qquad \forall \theta \in \{\theta_L, \theta_H\}$$

Full Information Benchmark

$$\max_{\{I(\theta)\}_{\theta\in\{\theta_L,\theta_H\}}} \sum_{\{\theta_L,\theta_H\}} \pi(\theta)\{-I(\theta)+q(R(I(\theta),\theta)-\underline{U})\}$$

The first order condition w.r.t. $I(\theta)$ equates marginal rates of transformation across the distribution, that is

$$\frac{\partial R(I(\theta),\theta)}{\partial I} = \frac{1}{q} \qquad \forall\theta\in\{\theta_L,\theta_H\}$$

- The bank reallocates capital in such a way that more productive entrepreneurs get a larger portion of investment.
- Once production takes place, the value of the idiosyncratic autarky outcomes are distributed to firms and the residual is absorbed by banks.
- Takeaways:
  - Full information allocation displays no dispersion in marginal TFP, but may display dispersion in intermediate goods utilization.
  - Full information allocation is independent of level of financial market incompleteness $\bar{\mu}$.

Adverse Selection and Financial Market Incompleteness

- Here I show that hidden information necessarily entails some dispersion in TFP due to separation of types when only pure debt contracts are offered.
- Debt-equity contracts can help eliminate this distortion.
- I consider a subset of contracts where equity holdings are constant across types.

The bank's problem under incomplete information is to solve

$$\max_{\mu,\{I(\theta),B(\theta)\}_{\theta\in\{\theta_L,\theta_H\}}} \sum_{\{\theta_L,\theta_H\}} \pi(\theta)\big\{-I(\theta)+q\big(\mu R(I(\theta),\theta)+B(\theta)\big)\big\} \tag{1}$$

$$\text{s.t.} \quad (1-\mu)R(I(\theta_H),\theta_H)-B(\theta_H)\geq \underline{U} \tag{PC-H}$$

$$(1-\mu)R(I(\theta_L),\theta_L)-B(\theta_L)\geq \underline{U} \tag{PC-L}$$

$$(1-\mu)R(I(\theta_H),\theta_H)-B(\theta_H)\geq (1-\mu)R(I(\theta_L),\theta_H)-B(\theta_L) \tag{IC-H}$$

$$(1-\mu)R(I(\theta_L),\theta_L)-B(\theta_L)\geq (1-\mu)R(I(\theta_H),\theta_L)-B(\theta_H) \tag{IC-L}$$

$$\mu\leq \bar{\mu} \tag{EC}$$

Lemma 1: Under assumption 1 and 2, in any optimal contract (PC-H) and (IC-L) are slack, while (PC-L) and (IC-H) always bind.

Lemma 2: Under assumption 3, (EC) binds in all optimal contracts.

Lemma 1 and 2 imply that it suffices to consider the relaxed problem of maximizing $\sum_{\{\theta_L,\theta_H\}} \pi(\theta) U_B(\theta,\theta)$ subject to (PC-L), (IC-H) and (EC) at equality.

High types are undistorted irrespective of portfolio allocations:

$$\frac{\partial R(I(\theta_H),\theta_H)}{\partial I} = \frac{1}{q}$$

Low type are distorted due interaction b/w adverse selection and portfolio allocation:

$$\frac{\partial R(I(\theta_L),\theta_L)}{\partial I} + \frac{(1-\bar{\mu})\pi(\theta_H)}{\pi(\theta_L)}\left[\frac{\partial R(I(\theta_L),\theta_L)}{\partial I} - \frac{\partial R(I(\theta_L),\theta_H)}{\partial I}\right] = \frac{1}{q}$$

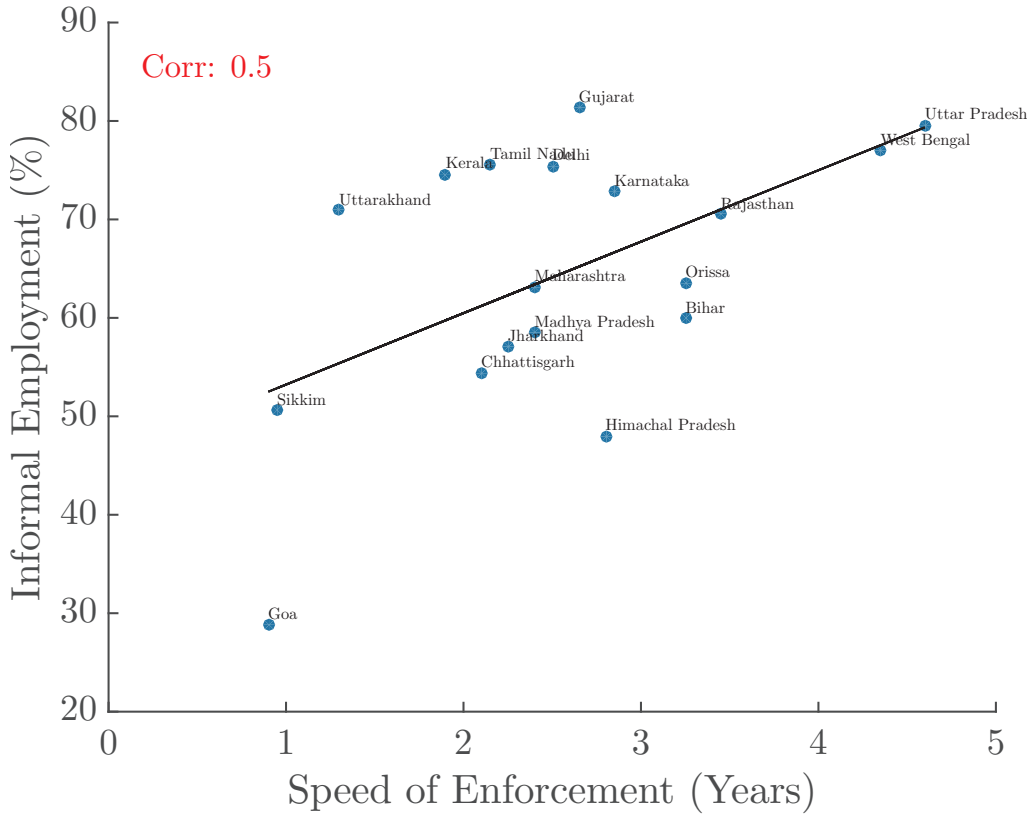
- The optimal pure debt contract exhibits TFP dispersion, i.e. if $\bar{\mu} = 0$ then $\frac{\partial R(I(\theta_L),\theta_L)}{\partial I} > \frac{\partial R(I(\theta_H),\theta_H)}{\partial I}$. First-best can be achieved when equity markets are complete, i.e. if $\bar{\mu} = 1$ then $\frac{\partial R(I(\theta_L),\theta_L)}{\partial I} = \frac{\partial R(I(\theta_H),\theta_H)}{\partial I}$.
- Takeaway: Limiting equity stake of banks involves paying out more informational rents $\implies$ tighter equity constraints generate higher input/TFP dispersion.

Final Remarks

- Model provides rich insights and policy implications.
- Analytical results in a microfounded model where enforcement frictions feature explicitly:
  - Underutilization of intermediate inputs (relative to first-best) when contracts are imperfectly enforced.
  - Intermediate goods should be subsidized as Midstream firms don't internalize effect of their decisions on Downstream Firms.
- Wedges may be capturing informational/financial frictions, which may need to be accounted for when estimating the effect of enforcement on misallocation.

Appendix

A Caveat on the Estimated Effect of Contract Enforcement on Misallocation



Note: Informal sector employment (urban + rural, male + female) is in percent of total employment.

Source: NSSO and Boehm and Oberfield.

- Enforcement frictions may systematically be related to informational frictions.
- Could bias estimates of the effect of enforcement frictions on intermediate good utilization.

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An Example of Equity Caps in Indian Industries

Table: FDI Caps on a Select Group of Indian Industries

Sector	FDI Limit	Entry Route
Petroleum & Natural Gas	49%	Automatic
Defence Manufacturing	100%	Above 49% under Government route
Broadcasting Content Services	49%	Government
Print Media	26%	Government
Civil Aviation	100%	Above 49% under Government route
Private Security Agencies	74%	Above 49% & up to 74% under Government route
Multi Brand Retail Trading	51%	Government
Banking- Private Sector	74%	Above 49% & up to 74% under Government route
Banking- Public Sector	20%	Government
Infrastructure Company in the Securities Market	49%	Automatic
Insurance	49%	Automatic
Pension Sector	49%	Automatic
Power Exchanges	49%	Automatic

Source: Department of Industrial Policy and Promotion Ministry of Commerce and Industry Government of India Consolidated FDI Policy (Effective from August 28, 2017)

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