Financing Development: The Role of Information Costs

Jeremy Greenwood, Juan M. Sanchez and Cheng Wang

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1 Introduction

1.1 Goldsmith (1969)

- Hypothesis: Financial development “accelerates economic growth and improves economic performance to the extent that it facilitates the migration of funds to the best user, i.e. to the place in the economic system where the funds will earn the highest social return.”
Evidence:

- Scale of financial intermediation increases with development.

- More efficient intermediation should imply:
  
  * Lower interest-rate spreads.

  * Higher capital/output ratios.
Financial institutions' assets to GNP
Trends in financial intermediation
Capital deepening, 1947-2002
Cross-country capital-output ratios and interest-rate spreads.
1.2 The Analysis

Four main ingredients:

1. *Output is produced by firms using capital and labor.*

   (a) Capital must be raised externally.

   (b) Distribution of idiosyncratic returns for each firm.

       • Realized state is private information.

   (c) There is a distribution over firms of these distributions in returns.
2. *Production is governed by constant returns to scale.*

(a) No informational frictions.

   i. No rents will be earned.

   ii. Only projects with the highest expected return will be funded.

(b) With informational frictions.

   i. Inefficient projects are funded.

   ii. Rents are earned.
3. *Competitive intermediation.*

(a) Lending contracts between intermediaries and firms.

- Value of firms maximized–intermediaries earn zero profits.

(b) Intermediaries monitor firms.

- Costly state verification model.

- Degree of vigilance is flexible.
  - Loan size is determinate.
  - Simple threshold rule for funding.
  - Funding increasing in expected return, decreasing in variance.
4. Technological improvement in the monitoring technology.

(a) Intermediation becomes more efficient.

(b) Rents are squeezed.

(c) Funds redirected toward more efficient firms.
2 Firms

- Produce output,
  \[ o = \theta k^\alpha l^{1-\alpha} \].

- \( \theta \in \{\theta_1, \theta_2\} \), with \( \theta_2 > \theta_1 \).

- \( \pi_1 = \Pr(\theta = \theta_1) \) and \( \pi_2 = 1 - \pi_1 = \Pr(\theta = \theta_2) \).

- realization is private information.

- \( \tau = (\theta_1, \theta_2) \), is the firm’s publicly observable type.

- \( \mathcal{T} \), space of firm types.

- \( \tau \sim F : \mathcal{T} \rightarrow [0, 1] \).
The $F$ distribution – in mean/variance space
3 Intermediaries

Borrow from consumers and lend to firms.

- $k$, size of loan to firm (capital).

- $p$'s, payments from firm to intermediary.

- $\theta_j$, state reported by firm.

- $\theta_i$, true state realized by firm.

- $m_j$, resources devoted to monitoring a claim of state $j$. 
3.1 Monitoring Technology

- $P_{ij}(m_j/k)$, probability that the firm is caught cheating (for $i \neq j$) when:
  
  - true realization of productivity is $\theta_i$;
  
  - firm makes a false report of $\theta_j \neq \theta_i$;
  
  - $P_{ij}$ is increasing in $m_j/k$. 
- $C(m/z; w)$, cost function associated with monitoring

\[ C(m/z; w) = w(m/z)^\gamma, \text{ with } \gamma > 1. \]

- $w$, wage rate for labor.

- $z$, productivity.
4 Contracting Problem

4.1 Notation

- \( v \), outside value of the firm.
- \( \tilde{r} \), cost of capital for the intermediary.
  - return to savers plus capital consumption.
- \( r_i \), internal return on firm’s capital in state \( i \).

\[
r_i = R(\theta, w)k \equiv \max_l \{\theta k^{\alpha}l^{1-\alpha} - wl\}.
\]
4.2 Problem

\[ I(\tau, v) \equiv \max_{p_1, p_2, p_{12}, p_{21}, m_1, m_2, k} \{ \pi_1 p_1 + \pi_2 p_2 - \tilde{r} k - \pi_1 w(m_1/z) - \pi_2 w(m_2/z) \}, \]

subject to

\[ p_1 \leq r_1 k, \quad p_2 \leq r_2 k, \quad p_{12} \leq r_1 k, \quad p_{21} \leq r_2 k, \quad \text{(limited liability)} \]

\[ \left( 1 - P_{21}(m_1/k) \right) (r_2 k - p_1) + P_{21}(m_1/k) (r_2 k - p_{21}) \leq r_2 k - p_2, \quad \text{(incentive constraint - good state, 2)} \]

\[ \pi_1 (r_1 k - p_1) + \pi_2 (r_2 k - p_2) = v. \quad \text{(promise keeping)} \]
4.3 The Contract

1. Payment schedule

(a) take everything upon report of bad state or when caught cheating

\[ p_1 = r_1k \]  \hspace{1cm} \text{(not caught cheating)},

\[ p_{21} = r_2k \]  \hspace{1cm} \text{(caught cheating)}.

(b) payment in good state yields expected return of \( v \)

\[ p_2 = r_2k - \frac{v}{\pi_2}. \]

\[ \pi_2(r_2k - p_2) = v. \]

\[ \text{expected rents, good state} \hspace{1cm} \text{outside option} \]
2. Loan size, $k$

\[
\frac{\pi_2 (r_2 - r_1) [1 - P_{21}(m_1/k)]}{2 \pi_1} \times k = v
\]

value of cheating = value of telling truth

outside option

3. Monitoring – only in bad state

\[
I(\tau, v) \equiv \max_{m_1/k} \left\{ \pi_1 r_1 + \pi_2 r_2 - \tau \right\} k - \frac{\pi_1 w}{z^\gamma} k^\gamma \left( \frac{m_1}{k} \right)^\gamma - v
\]

net return on capital

monitoring cost

payment to firm

where $k$ is given above.
5 Competitive Intermediation

- Perfect competition among intermediaries
  - Contract maximizes value of the firm, $v$.
  - Intermediary makes zero profits, for each type of loan $\tau$.

- Intermediary’s profit function is $\cap$-shaped in $v$.

- Threshold rule for project funding
  \[
  \underbrace{A(w)}_{\text{set of funded projects}} = \{ \tau : w < \underbrace{W(\tau)}_{\text{threshold wage}} \}.
  \]
Figure 1: The profit function, $I(\tau, v)$
Impact of an increase in $w$ and $z$ on profits
6 Technological Progress

Proposition. (Efficient finance). Let $z \to \infty$. Then,

1. $\lim_{z \to \infty} m_1/k = \infty$ and $\lim_{z \to \infty} P_{21}(m_i/k) = 1$,

2. $\lim_{z \to \infty} p_2 = r_2 k$ and $\lim_{z \to \infty} v = 0$,

3. $\lim_{z \to \infty} A(w) = A^* \equiv \arg \max_{\tau = (\theta_1, \theta_2) \in T} [\pi_1(\theta_1)^{1/\alpha} + \pi_2(\theta_2)^{1/\alpha}]$,

4. $\lim_{z \to \infty} \int A(w) k dF = k^*$ \quad ($k^*$, capital stock in the neoclassical growth.)
7 U.S. Economy

7.1 Parameter values

- Standard parameters given standard values.

- Other parameters chosen to match the U.S. firm size distribution for 2000.
Figure 2: Firm Size Distribution, Data and Model
# Impact of Technological Progress in the Financial Sector

<table>
<thead>
<tr>
<th>Technology, ( z )</th>
<th>( z = 40 )</th>
<th>( z = 400 )</th>
<th>( z = 1300 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pr of detecting fraud</td>
<td>0.416</td>
<td>0.673</td>
<td>0.791</td>
</tr>
<tr>
<td>Rents to output</td>
<td>0.126</td>
<td>0.071</td>
<td>0.046</td>
</tr>
<tr>
<td>Internal return (weighted), ( \bar{i} )</td>
<td>0.287</td>
<td>0.146</td>
<td>0.114</td>
</tr>
<tr>
<td>Lending rate, ( \bar{i} )</td>
<td>0.141</td>
<td>0.097</td>
<td>0.087</td>
</tr>
<tr>
<td>Excess return, ( e = i - \bar{i} )</td>
<td>0.146</td>
<td>0.049</td>
<td>0.027</td>
</tr>
<tr>
<td>Interest rate spread, ( s = \bar{i} - \tilde{r} )</td>
<td>0.066</td>
<td>0.022</td>
<td>0.012</td>
</tr>
<tr>
<td>Capital-to-output ratio</td>
<td>0.864</td>
<td>1.456</td>
<td>1.726</td>
</tr>
<tr>
<td>Output relative to first best</td>
<td>0.561</td>
<td>0.778</td>
<td>0.860</td>
</tr>
<tr>
<td>Monitoring cost to output</td>
<td>0.057</td>
<td>0.032</td>
<td>0.021</td>
</tr>
<tr>
<td>Monitoring’s share of labor</td>
<td>0.075</td>
<td>0.044</td>
<td>0.029</td>
</tr>
</tbody>
</table>


8 Cross-Country Analysis

- Output

\[ o = x \theta k^\alpha l^{1-\alpha}, \]

where \( x \) = country-specific level of productivity.

- Model provides mapping between \((o, k/o)\) and \((x, z)\).

\[ \underbrace{(o, k/o)}_{\text{output and capital/output ratio}} = M( \underbrace{(x, z)}_{\text{efficiencies}} ). \]

- Invert mapping:

\[ (x, z) = M^{-1}(o, k/o). \]
• Make an inference about $x$ and $z$ given an observation on $o$ and $k/o$.

• Do this for a sample of 40 countries.

• Three countries are in a credit-rationing equilibrium.
The correlation interest-rate spreads in the data and model.
The correlation between $z$ in the model and the Beck et al measure of financial intermediation
8.1 How much does Financial Development Matter?

- Best financial practice, $\bar{z} = \max\{z_i\}$.
- Best industrial practice, $\bar{x} = \max\{x_i\}$.
- Country $i$'s output (per worker), $o(x_i, z_i)$.
- Country $i$'s output with best financial practice, $o(x_i, \bar{z})$.
- Output with best practice in both sectors, $o(\bar{x}, \bar{z})$.
- Gap in output, $o(\bar{x}, \bar{z}) - o(x_i, z_i)$. 
Figure 3: The impact of a move to financial best practice on GDP per worker
Figure 4: The impact of a move to financial best practice on the gap in GDP per worker
### World-wide move to financial best prac., $\overline{z}$

<table>
<thead>
<tr>
<th>Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in world output (per worker)</td>
<td>21%</td>
</tr>
<tr>
<td>Reduction in gap between actual and potential world output</td>
<td>9%</td>
</tr>
<tr>
<td>Fall in dispersion of output across countries, $\text{std}(\ln o_i)$</td>
<td>13% = (77% - 64%)</td>
</tr>
</tbody>
</table>
9 Conclusions

- **Goal**: Explore the link between financial intermediation and economic development.

- **How**: Embed a costly-state-verification paradigm into the standard growth model.
  
  - Distribution of firm types.
  
  - Ex post return is private information.
  
  - Intermediaries write incentive-compatible contracts with firms.
  
  - State of the auditing technology influences the efficiency of the contract.
– Less than best-practice firms get financed.

• Technological progress in intermediation causes:
  – Rents to get squeezed.
  – Interest rate spreads to narrow.
  – Funds to get redirected to the most profitable firms.
    * Reallocation occurs on the extensive and intensive margins.
  – Capital/output ratios and TFP to rise.

• A numerical example suggests that the mechanism has quantitative significance.
<table>
<thead>
<tr>
<th>Country</th>
<th>Data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GDP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>p.w.</td>
<td>z</td>
</tr>
<tr>
<td>Sri Lanka*</td>
<td>7073</td>
<td>3.4</td>
</tr>
<tr>
<td>India*</td>
<td>5121</td>
<td>2.8</td>
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<tr>
<td>Bolivia*</td>
<td>6779</td>
<td>4.9</td>
</tr>
<tr>
<td>Morocco</td>
<td>11419</td>
<td>9.9</td>
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<tr>
<td>Mauritius</td>
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<td>Costa Rica</td>
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<td>Uruguay</td>
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<td>41.5</td>
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<td>Turkey</td>
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<td>Mexico</td>
<td>22100</td>
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<td>France</td>
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<td>Denmark</td>
<td>44024</td>
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<td>Canada</td>
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