Incentives and The De Soto Effect

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Property Rights

- The term property right refers to an owner's right to use a good or asset for consumption and/or income generation (referred to as use rights).
- A property right also typically conveys the right to contract with other parties by renting, pledging, or mortgaging a good or asset.
- The core welfare results of economics concerning the role of competitive markets assume that property rights are well defined and costlessly enforced.
- The new institutional approach to development economics (North, 1990) has, however, put concerns about effective property rights at the centre of thinking about development, recognizing that this requires an explicit departure from a frictionless world.
- Property rights are not exogenously given, they evolve over time, driven by economic and political forces.

Property Rights and Economics

- By property rights economists typically refer to **private property rights** a key feature of which is being able legally to exclude others from using a good or asset.
- Property rights affect:
  - the distribution of wealth and consumption.
  - the pattern of production by influencing who has use rights to an asset and allowing separation of ownership from control. Thus, the depth and nature of rental markets depend on the development of property rights.
  - the inter-generational evolution of the wealth distribution, by having an impact on whether assets can be transferred from parents to children.
  - the development of markets, particularly credit markets, to the extent assets can be pledged against default.

What are the mechanisms through which property rights affect economic activity?

- Expropriation risk - insecure property rights imply that individuals may fail to realize the fruits of their investment and efforts.
- Insecure property rights lead to costs that individuals have to incur to defend their property which, from the economic point of view, is unproductive.
- Failure to facilitate gains from trade a productive economy requires that assets are used by those who can do so most productively and improvements in property rights facilitate this. In other words, they enable an asset's mobility as a factor of production.
- Use of property in supporting other transactions - Modern market economies rely on collateral to support a variety of financial market transactions and improving property rights may increase productivity by enhancing such possibilities.

Hernando De Soto

- Hernando De Soto is a Peruvian economist who is known for his work on the informal economy and on the importance of business and property rights.
- He pointed out that one of the key sources of poverty in poor countries is the lack of formal property rights.
- In trying to find the answer to Why some countries are rich and others poor, he wrote the following in his 1986 book 'The Other Path',- " The poor of the world five-sixths of humanity have things, but they lack the process to represent their property and create capital. They have houses but not titles; crops but not deeds; businesses but not statutes of incorporation.This explains why people who have adopted every other Western invention, from the paper clip to the nuclear reactor, have not been able to produce sufficient capital to make their domestic capitalism work."

- Giving the poor legal titles will unleash the dead capital so that it can be used as collateral for loans to fund new businesses or expand homes. His team calculated the amount of dead capital in untitled assets held by the world's poor as at least \$9.3*trillion*.
- In his book, The Mystery of Capital, De Soto tries to explain why formal capital markets function poorly in developing countries.He argues that much of the population of developing countries lacks access to credit, not because they lack assets, but because ownership of their property is secured informally, which prevents the use of property as collateral.

Incentives and the De Soto Effect

- The paper explores the consequences of improving property rights to facilitate the use of fixed assets as collateral, in the credit markets, popularly attributed to the influential policy advocate Hernando de Soto.
- An equilibrium model of a credit market with moral hazard is used to characterize the theoretical effects and also develop a quantitative analysis using data from Sri Lanka.
- The results show how the effect of property rights improvement is likely to be non linear, heterogeneous and crucially dependent on the level of wealth and competition in the credit markets.
- The model has also been used to look at the welfare gains from improving property rights.

Literature Review

- Importance of Property Rights:
  - La Porta et al. (1998) argue that whether a country has a civil or common law tradition is strongly correlated with the form and extent of subsequent financial development
  - Djankov, McLiesh, and Shleifer (2007) find that improvements in rights that affect the ability of borrowers to use collateral are strongly positively correlated with credit market development in a cross-section of countries.
  - Acemoglu, Johnson, and Robinson (2001) provided fresh impetus to these ideas and found robust correlations between measures of expropriation risk and income per capita in cross-country data.

- The empirical evidence on the impact of property rights improvements using micro-data is somewhat equivocal in its findings.
- Acemoglu and Johnson (2005) find that contracting institutions appear to do a less good job in explaining income differences.
- A number of papers have empirically explored the effect that collateral improvement has on credit contracts (see, for example,Liberti and Mian 2010).
- Looking at the literature as a whole, the empirical estimates vary widely and are context-specific.
- The theoretical model and the quantitative application aims to help to think about some of the reasons why this might be the case.

Model

- The model studies contracting between borrowers and lenders.
- Borrower's effort is subject to moral hazard and the borrower has limited pledgeable wealth resulting in limited liability.
- Contract enforcement is limited due to imperfections in property rights protection which reduce the collateralizability of wealth.

Borrowers

- There is a group of borrower-entrepreneurs whose projects benefit from access to working capital provided by lenders.
- Each borrower is endowed with a level of illiquid wealth w.
- Property rights are poorly defined in a way that affects the borrower's ability to pledge their wealth as collateral.We assume that if a borrower has wealth w then its collateral value is only $(1 - \tau)w$ where τ can be thought as the fraction of the collateral that cannot be seized or the probability that the collateral cannot be seized.
- $(1 - \tau)w$ is referred to as the borrower's effective wealth.

- Each borrower supplies effort $e \in [0, \bar{e}]$ and uses working capital $x \in [0, \bar{x}]$ to produce an output.
- Output is stochastic and takes the value $q(x)$ with probability $p(e)$ and 0 with probability $(1 - p(e))$.
- The marginal cost of effort is normalized to 1 and the marginal cost of x is γ.
- Expected surplus is

$$p(e)q(x) - e - \gamma x$$

Assumptions

1. Both $p(e)$ and $q(x)$ are twice-continuously differentiable, strictly increasing and strictly concave for all $e \in [0, \bar{e}], x \in [0, \bar{x}]$.
2. $p(0) = 0, p(e) \in (0, 1], and, q(0) \geq 0$.
3. $lim_{e \to 0} p'(e)q(x) > 1$ for all $x > 0$, $lim_{x \to 0} p(e)q'(x) > \gamma$ for all $e > 0$, $p'(\bar{e})q(\bar{x}) < 1$ and $p(\bar{e})q'(\bar{x}) < \gamma$.
4. $p(e)q(x)$ is strictly concave for all $(e, x) \in [0, e] * [0, x]$.
5. $\epsilon(e) \equiv -p''(e)p(e)/\{p'(e)\}^2$ is bounded and continuous for $e \in [0, \bar{e}]$ and $p''' \leq \frac{-p''p'}{p}$

Lenders

- We use the simplest possible setup that will allow for competition in the credit market and assume that there are two lenders ($j = 1, 2$) who borrow funds from depositors or in wholesale markets to fund their lending.
- The more efficient lender has marginal cost of funds $\underline{\gamma}$ and the less efficient lender has marginal cost $\bar{\gamma}$ with $\bar{\gamma} \geq \underline{\gamma}$.
- Each lender has unlimited capacity to supply the market.
- $\bar{\gamma} - \underline{\gamma}$ will be a measure of market competitiveness.

Contracting

- e is not contractible.
- A credit contract is a triple (r, c, x) where r is the payment that the borrower has to make when the project is successful, c is the payment to be made when the project is unsuccessful, and x is the loan size.
- Payoff of the lender is

$$p(e)r + (1 - p(e))c - \gamma x$$

- Lenders must make non negative profits to be active in the credit markets.

- Payoff of the borrower is

$$p(e)[q(x) - r] - (1 - p(e))c - e$$

- The borrower's outside option is $u \geq 0$.
- We solve for the first best and the second best efficient contracts offered by a lender with a cost of funds γ, taking u as exogenous.

The First Best- Maximizing the Joint Surplus

- $$Max_{\{e,x\}} p(e)q(x) - e - \gamma x$$
- FOCs:
  - $p'(e^*(\gamma))q(x^*(\gamma)) = 1$
  - $p(e^*(\gamma))q'(x^*(\gamma)) = \gamma$
- Effort and credit are complementary inputs.
- Denote the first best surplus by $S^*(\gamma)$ which is decreasing in γ (proved after Proposition 2).
- It is efficient to have all the funds issued by the lowest cost lender. The profits of this lender is denoted by $\pi = max\{S^*(\underline{\gamma}) - u, 0\}$.

Second Best Contracts

The lender must choose (r, c, x) which is a solution of the following problem:

$$Max_{\{r,c,x\}} \qquad p(e)r + (1 - p(e))c - \gamma x$$

subject to

- ICC $\qquad argmax_{e \in [0,\bar{e}]} \quad \{p(e)[q(x) - r] - (1 - p(e))c - e\}$
- PC $\qquad \{p(e)[q(x) - r] - (1 - p(e))c - e\} \geq u$
- LLC $\qquad (1 - \tau)w \geq c$

Second Best Contracts

Proposition 1

Suppose that Assumption 1 (i)-(iv) holds. Then for $v \geq \bar{v}(\gamma)$ and $u \leq S^*(\gamma)$, the first best outcome is achieved with

$$
\begin{gathered}
r = c = \gamma x^*(\gamma) + S^*(\gamma) - u \\
x = x^*(\gamma) \\
e = e^*(\gamma)
\end{gathered}
$$

Proposition 2

Suppose that Assumption 1 (i)-(iv) holds. There exists $\underline{v}(\gamma) \in (0, \bar{v}(\gamma))$ such that for $v < \bar{v}(\gamma)$ the optimal contract is as follows:

$$c = (1 - \tau)w$$

$$r = \begin{cases} \rho(\underline{v}(\gamma), \gamma) + (1 - \tau)w, & v < \underline{v}(\gamma) \\ \rho(v, \gamma) + (1 - \tau)w, & v \in [\underline{v}(\gamma), \bar{v}(\gamma)) \end{cases}$$

$$r > c$$

$$x = \begin{cases} g(\underline{v}(\gamma), \gamma), & v < \underline{v}(\gamma) \\ g(v, \gamma), & v \in [\underline{v}(\gamma), \bar{v}(\gamma)) \end{cases}$$

where $\rho(v, \gamma) = q(g(v, \gamma)) - \frac{1}{p'(f(v))}$ and $g(v, \gamma)$ and $f(v)$ are strictly increasing in v while $g(v, \gamma)$ is strictly decreasing in γ.

It implements

$$e = \begin{cases} f(\underline{v}(\gamma)), & v < \underline{v}(\gamma) \\ f(v), & v \in [\underline{v}(\gamma), \bar{v}(\gamma)) \end{cases}$$

1

$$\max_{\{r,c,x\}} \Pi(r,c,x) = p(e)r + (1-p(e))c - \gamma x$$

subject to

ICC $\quad \arg\max_{e\in[0,\bar{e}]} \{p(e)[q(x)-r] - (1-p(e))c - e\}$

PC $\quad p(e)\{q(x)-r\} - (1-p(e))c - e \geq u$

LLC $\quad (1-\tau)w \geq c$

Step 1 Solving the ICC:

$$p'(e)[q(x)-r] + p'(e)\cdot c - 1 = 0$$

$$\Rightarrow \quad p'(e)[q(x)-r+c] = 1$$

$$\Rightarrow \quad (r-c) = q(x) - \frac{1}{p'(e)} \qquad \text{— (1)}$$

Step 2 Transforming the objective function

$\cancel{p(e)[q(x)-r] - (1-p(e))c}$

$$p(e)r + (1-p(e))c - \gamma x = p(e)[r-c] + c - \gamma x$$

From (1)

$$= p(e)q(x) - \frac{p(e)}{p'(e)} + c - \gamma x \qquad \text{— (2)}$$

Step 3 Transforming the PC:

$$p(e)q(x) - p(e)(r-c) - c - e \geq u$$

$$\Rightarrow \quad p(e)q(x) - p(e)\left[q(x) - \frac{1}{p'(e)}\right] - c - e \geq u$$

$$\Rightarrow \quad \frac{p(e)}{p'(e)} - c - e \geq u.$$

Transformed Problem

2

$$\max_{e,x,c} \quad p(e)q(x) - \frac{p(e)}{p'(e)} + c - \gamma x$$

s.t. $$\frac{p(e)}{p'(e)} - c - e \geq u \qquad \text{— (PC)}$$

and $$(1-\tau)w \geq c \qquad \text{— (LLC)}$$

$$\mathcal{L}(e,x,c,\beta,\alpha) = p(e)q(x) - \frac{p(e)}{p'(e)} + c - \gamma x + \alpha\left[\frac{p(e)}{p'(e)} - c - e - u\right] + \beta\left[(1-\tau)w - c\right]$$

First Order Conditions:

(e) $$p'(e)q(x) - \left\{\frac{[p'(e)]^2 - p''(e)p(e)}{[p'(e)]^2}\right\} + \alpha\left[1 - \frac{p''(e)\,p(e)}{[p'(e)]^2} - 1\right] = 0$$

$$\Rightarrow p'(e)q(x) - 1 - \varepsilon(e) + \alpha\,\varepsilon(e) = 0$$

where $$\varepsilon(e) = -\frac{p''(e)\cdot p(e)}{[p'(e)]^2}$$

$$\Rightarrow p'(e)\,q(x) = 1 + (1-\alpha)\,\varepsilon(e)$$

(x) $$p(e)\,q'(x) = \gamma$$

(c) $$1 - \alpha - \beta = 0 \Rightarrow \alpha + \beta = 1$$

FOCs

(3)

(e) $p'(e)\, q(x) = 1 + (1-\alpha)\, \varepsilon(e)$ (3)

(x) $p(e)\, q'(x) = \gamma$ (4)

(c) $\alpha + \beta = 1$ (5)

PC $\alpha \geq 0$, $\alpha\left[\frac{p(e)}{p'(e)} - c - e - u\right] = 0$, $\frac{p(e)}{p'(e)} - c - e \geq u$

LLC $\beta \geq 0$, $\beta\left[(1-\tau)w - c\right] = 0$, $(1-\tau)w \geq c$

Case 1 Both LLC & PC don't bind.

$\Rightarrow$ $\alpha = 0$ & $\beta = 0$ But from (5) $\alpha + \beta = 1$.

$\therefore$ These case is not possible

Case 2 LLC does not bind & PC binds

$\Rightarrow \beta = 0$

From (5) $\alpha = 1$

Substituting in (3)

$p'(e)\, q(x) = 1$

& from (4) $p(e)\, q'(x) = \gamma$

} These two equations also described the first best solution.

$\Rightarrow$ $e = e^*(\gamma)$ and $x = x^*(\gamma)$

Multiplying ~~the~~ (3) & (4)

$p(e^*)\, q(x^*)\; p'(e^*)\, q'(x^*) = \gamma$

$\Rightarrow p(e^*)\, q(x^*) = \frac{\gamma}{p'(e^*)\, q'(x^*)}$ from (4) $\frac{\gamma}{q'(x^*)} = p(e^*)$

$$\Rightarrow \quad p(e^*(\gamma))\, q(x^*(\gamma)) = \frac{p(e^*(\gamma))}{p'(e^*(\gamma))} \quad - (6)$$

The surplus at the first best solution is defined as

$$s^*(\gamma) = \underbrace{\left[p(e^*)\, q(x^*) - \frac{p(e^*)}{p'(e^*)} + c - \gamma x^*\right]}_{\text{lender's profit}} + \underset{\substack{\Downarrow \\ \text{borrower's} \\ \text{utility}}}{u}$$

From (6)

$$s^*(\gamma) = c - \gamma x^* + u$$

$$\Rightarrow c = s^*(\gamma) + \gamma x^* - u$$

From LLC

$$c < (1-z)w$$

$$\Rightarrow s^*(\gamma) + \gamma x^* - u < (1-z)w$$

$$\Rightarrow u + (1-z)w > s^*(\gamma) + \gamma x^*$$

Define $v \equiv u + (1-z)w$ [borrower's effective wealth + outside option]

and define $\bar{v}(\gamma) = s^*(\gamma) + \gamma x^*$

$$\Rightarrow v > \bar{v}(\gamma)$$

Now $r - c = q(x) - \frac{1}{p'(e)} = 0$ from (3) & $\alpha = 1$

$$\Rightarrow r = c = s^*(\gamma) + \gamma x^* - u$$

Also note $s^*(\gamma) \geq u$ i.e the lender's profit must be non negative. Assumption (1) [(i)-(iv)] will ensure a unique interior optimum.

Case 3 PC does not bind and LLC binds

$\Rightarrow$ $\alpha = 0$ and $c = (1-\tau) w$

From (3) & (4)

$$\left.\begin{aligned} p'(e)\, q(x) &= 1 + \varepsilon(e) \\ \cancel{p'(e)}\, p(e)\, q'(x) &= \gamma \end{aligned}\right\} \Rightarrow \text{this will define a solution } e^\circ(\gamma) \text{ and } x^\circ(\gamma).$$

Since PC does not bind

$$\frac{p(e^\circ(\gamma))}{p'(e^\circ(\gamma))} - e^\circ - c > u$$

$$\Rightarrow \frac{p(e^\circ(\gamma))}{p'(e^\circ(\gamma))} - e^\circ > u + c = u + (1-\tau)w$$

Define $\dfrac{p(e^\circ(\gamma))}{p'(e^\circ(\gamma))} - e^\circ = \underline{v}(\gamma)$

$\Rightarrow$ $\underline{v}(\gamma) > v$

By Assumption 1 $e^\circ(\gamma)$ and $x^\circ(\gamma)$ are an interior maximum and are the unique solution to (3) & (4).

$$\varepsilon(e) = -\frac{p''(e)\, p(e)}{[p'(e)]^2} > 0 \quad \text{for } e > 0.$$

Claim: $e^\circ < e^*(\gamma)$ & $x^\circ(\gamma) < x^*(\gamma)$

Write (3) & (4) as

$p'(e)\, \cancel{q'(x)}\, q(x) = a$ $a = 1 + (1-\alpha)\varepsilon(e)$

and $p(e)\, q'(x) = \gamma$ $a \geq 1$

We want to show that as a increases from 1 to ~~$1+(1-\alpha)\varepsilon(e)$~~ $1 + \varepsilon(e^\circ) > 1$ (as $\varepsilon(e^\circ) > 1$)

$\Rightarrow$ the optimal $e(\gamma)$ falls.

Take total derivatives of both the equations:

$$p''(e)\, q(x)\, de + p'(e)\, q'(x)\, dx = da \qquad -(7)$$

$$p'(e)\, q'(x)\, de + p(e)\, q''(x)\, dx = 0 \qquad -(8)$$

Substitute dx from (8) in (7).

$$dx = \frac{-p'(e)\, q'(x)}{p(e)\, q''(x)}\, de$$

$$(7) \Rightarrow \quad \frac{de}{da} = \frac{p\, q''}{p'' q\, q'' p - [p' q']^2} < 0$$

Since $p(e)\, q(x)$ is concave, the denominator > 0 and $q'' < 0$ as $q(x)$ is strictly concave.

$\therefore$ as RHS of (3) increases from 1 to $1 + \varepsilon(e^{\circ})$, the optimal e falls i.e. $e^{\circ}(\gamma) < e^{*}(\gamma)$.

From (4) as $e^{\circ} < e^{*} \Rightarrow p(e^{\circ}) < p(e^{*})$, but RHS is fixed at γ $\therefore$ $q'(x^{\circ}) > q'(x^{*}) \Rightarrow x^{\circ} < x^{*}$ as q is strictly concave.

Now, $\quad r - c = q(x^{\circ}) - \dfrac{1}{p'(e^{\circ})}$

From (3) $\quad q(x^{\circ}) = \dfrac{1}{p'(e^{\circ})} + \dfrac{\varepsilon(e^{\circ})}{p'(e^{\circ})}$

$$\Rightarrow \quad r = \frac{\varepsilon(e^{\circ})}{p'(e^{\circ})} + \cancel{(1-z)w}\, c$$

Since $\varepsilon(e^{\circ}) > 0$ and $p'(e^{\circ}) > 0 \Rightarrow r > c$

Case 4 Both LLC and PC binds.

From LLC $c = (1-z)w$

" PC $\frac{p(e)}{p'(e)} - c - e = u$

$\Rightarrow \frac{p(e)}{p'(e)} - e = u + (1-z)w \equiv v$

$\Rightarrow \frac{p(e)}{p'(e)} - e = v \quad — \quad (9)$

(9) defines e as a function of v which will be the required solution. Denote it by

$\hat{e} = f(v)$

$\hat{e}$ is an increasing function of v i.e $f_v(v) > 0$.

From (9) $\frac{[p'(f(v))]^2 f_v(v) - p(f(v))\, p''(f(v))\, f_v(v)}{[p'(f(v))]^2}$

$- f_v(v) = 1$

$\Rightarrow \left[1 - \frac{p\,p''}{[p']^2} - 1\right] f_v(v) = 1$

$\Rightarrow f_v(v) = \frac{\partial f(v)}{\partial v} = \frac{[p']^2}{p\,p''} > 0$ if $e > 0$.

Now from (4) $p(f(v))\, g'(x) = \gamma \Rightarrow$ will give us a solution of x in terms of γ and v.

i.e $\hat{x} = g(v, \gamma)$

For $g(v,\gamma) \Rightarrow g_v(v,\gamma) > 0$ and $g_\gamma(v,\gamma) < 0$.

Proof:

From (4) $\quad p(f(v))\, q'(g(v,\gamma)) = \gamma$

Differentiating w.r.t. v

$$p'(f(v))\, q'(g(v,\gamma))\, f_v(v) + p(f(v))\, q''(g(v,\gamma))\, g_v(v,\gamma) = 0$$

$$\Rightarrow \quad g_v(v,\gamma) = -\frac{p'\, q'\, f_v(v)}{p\, q''} > 0$$

Differentiating (4) w.r.t γ

$$p(f(v))\, q'(g(v,\gamma))\, g_\gamma(v,\gamma) = 1$$

$$\Rightarrow \quad g_\gamma(v,\gamma) = \frac{1}{p(f(v))\, q''(g(v,\gamma))} < 0.$$

- $\gamma - c = q(\hat{x}) - \dfrac{1}{p'(\hat{e})}$

$$\Rightarrow \gamma = \frac{\varepsilon(\hat{e})}{p'(\hat{e})} + c > c \quad \text{as } \hat{e} > 0.$$

Now note that this case satisfies (3) & (4)

i.e $\quad p'(\hat{e})\, q(\hat{x}) = 1 + (1-\alpha)\, \varepsilon(\hat{e})$

$\quad\quad p(\hat{e})\, q'(\hat{x}) = \gamma$

Since $\alpha \geq 0$ and $\beta \geq 0 \Rightarrow (1-\alpha) \geq 0 \Rightarrow 1 \geq \alpha$.

$\Rightarrow 0 \leq \alpha \leq 1$

when $\alpha = 0$, we are in the Case 3 and $\hat{e}$ as $\begin{matrix}\alpha \to 0 \\ \hat{e} \to e^\circ\end{matrix}$

as $\alpha \to 1$, $\hat{e} \to e^*$.

$\therefore$ ~~for~~ Case 4 corresponds to $\underline{v}(\gamma) \leq v = u + (1-\tau)w \leq \bar{v}(\gamma)$

i.e $v \in [\underline{v}(\gamma), \bar{v}(\gamma)]$.

- The total surplus of the lender and the borrower with the contract described in Propositions 1 and 2 are:

$$S(v,\gamma) \equiv \begin{cases} S^*(\gamma)), & v \geq \bar{v}(\gamma) \\ p(f(v))q(g(v,\gamma)) - f(v) - \gamma g(v,\gamma), & v \in (\underline{v}(\gamma), \bar{v}(\gamma)) \\ p(f(\underline{v}))q(g(\underline{v},\gamma)) - f(\underline{v}) - \gamma g(\underline{v},\gamma), & v \leq \underline{v} \end{cases}$$

- The surplus is increasing in v and $0 < S_v < 1$ for $v \in (\underline{v}(\gamma), \bar{v}(\gamma))$
- The surplus is decreasing in γ.

<u>Claim:</u> $S(v,\gamma)$ is increasing in v and decreasing in γ.

1) $S(v,\gamma)$ is increasing in v.

For $v \geq \bar{v}(\gamma)$ and $v \leq \underline{v}(\gamma)$, $S(v,\gamma)$ is independent of v and thus, a constant.

For $v \in (\underline{v}(\gamma), \bar{v}(\gamma))$, we need $S_v(v,\gamma) \geq 0$

S/ $S(v,\gamma) = p(f(v))q(g(v,\gamma)) - f(v) - \gamma g(v,\gamma)$

$$S_v(v,\gamma) = [p'(f(v))q(g(v,\gamma)) - 1] f_v + [p(f(v))q'(g(v,\gamma)) - \gamma] g_v$$

From the second FOC, we have

$$p(f(v))\,q'(g(v,\gamma)) = \gamma$$

$$\Rightarrow S_v(v,\gamma) = [p'(f(v))\,q(g(v,\gamma)) - 1] f_v \quad -(1)$$

From the first FOC, we have

$$p'(f(v))\,q(g(v,\gamma)) - 1 = (1-\alpha)\,\varepsilon(f(v))$$

Substituting in (1) and also noting that $f_v(v) = \frac{1}{\varepsilon(f(v))} = \frac{-[p'(e)]^2}{p(e)\,p''(e)}$

$$\Rightarrow S_v(v,\gamma) = \frac{(1-\alpha)\,\varepsilon(f(v))}{\varepsilon(f(v))} = (1-\alpha)$$

For $v \in (\underline{v}(\gamma), \bar{v}(\gamma))$, $0<\alpha<1 \Rightarrow 1 > S_v > 0$ i.e $S_v > 0$.

(2) $S(v,\gamma)$ is decreasing in γ.

$$S_\gamma(v,\gamma) = p(f(v))\, q'(g(v,\gamma)) \cdot g_\gamma(v,\gamma) - g(v,\gamma) - \gamma g_\gamma(v,\gamma)$$

By the second FOC $\quad p(f(v))\, q'(g(v,\gamma)) = \gamma$

$\Rightarrow \quad S_\gamma(v,\gamma) = -g(v,\gamma) < 0$

$\therefore$ $S(v,\gamma)$ is strictly decreasing in γ.

Market Equilibrium

- Competition is introduced by allowing lenders to compete to attract borrowers by posting contracts (r, c, x). Borrowers then pick the lender that gives them the highest level of expected utility.
- The outside option is given by the utility received if he were to choose to borrow from the other lender.
- Let the market equilibrium payoffs for the borrower borrowing from the efficient and inefficient lender be denoted by $u_{\underline{\gamma}}$ and $u_{\bar{\gamma}}$ with corresponding profits for the lenders being denoted by $\pi_{\underline{\gamma}}$ and $\pi_{\bar{\gamma}}$.

- The payoffs of the of the borrowers and lenders must exhaust the available surplus in the borrower-lender relationship and hence, solve:
  - $S(u_{\bar{\gamma}} + (1-\tau)w, \underline{\gamma}) = \pi_{\underline{\gamma}} + u_{\underline{\gamma}}$
  - $S(u_{\underline{\gamma}} + (1-\tau)w, \bar{\gamma}) = \pi_{\bar{\gamma}} + u_{\bar{\gamma}}$
- Define $\bar{u}((1-\tau)w, \bar{\gamma})$ from $S(u + (1-\tau)w, \bar{\gamma}) = u$ as the maximum utility that the high cost lender can offer consistent with him making non-negative profits.

Proposition 3

In a market equilibrium, the least efficient lender makes zero profit and the borrower borrows from the efficient lender. For borrower utility, there are two cases:

1. If competition is weak enough, he receives his efficiency utility level from the efficient lender.
2. If competition is intense enough, then the borrower receives his outside option available from the inefficient lender.

- **PROOF:**
  Suppose not i.e. $\pi_{\bar{\gamma}} > 0$. Then since someone must be borrowing from the less efficient lender, $u_{\bar{\gamma}} \geq u_{\underline{\gamma}}$ for this borrower. Now as $S(v, \gamma)$ (the total surplus) is increasing in v and decreasing in γ $\implies S(u_{\bar{\gamma}} + (1-\tau)w, \underline{\gamma}) > S(u_{\underline{\gamma}} + (1-\tau)w, \bar{\gamma})$. This means that the more efficient lender who is currently earning 0 profit from this borrower, can offer him $u_{\bar{\gamma}}$ and make strictly positive profit $\pi_{\underline{\gamma}} > \pi_{\bar{\gamma}} > 0$. Thus, in equilibrium $\pi_{\bar{\gamma}} = 0$. This also implies $u_{\underline{\gamma}} \geq u_{\bar{\gamma}}$.

- Since only the efficient lender is lending, for any borrower the outside option is $\bar{u}$.
- To see what the borrower is getting, we must check whether the participation constraint(PC) of the borrower is binding or not with the low cost lender i.e. compare $LHS = v = \bar{u}((1-\tau)w, \bar{\gamma}) + w(1-\tau)$ with $RHS = \underline{v}(\underline{\gamma})$. The LHS is determined by the cost of the less efficient lender and borrower's wealth. The RHS is determined by the cost of the efficient lender.
- Now we see how a change in $\bar{\gamma}$ affects the borrower's outside option $\bar{u}$ and hence, whether the PC binds or not. Note that $\bar{u}((1-\tau)w, \bar{\gamma})$ which is just the surplus under the less efficient lender is decreasing in γ.
- If $\bar{\gamma}$ is much larger than $\underline{\gamma}$, $\bar{u}$ is relatively small and $v < \underline{v}(\underline{\gamma})$, i.e. the participation constraint is not binding. The borrower's payoff is $\frac{p(e^0)}{p'(e^0)} - e^0 - c = \underline{v}(\underline{\gamma}) - (1-\tau)w = u_{\underline{\gamma}} > \bar{u}$
- If $\bar{\gamma}$ is smaller and closer to $\underline{\gamma}$, $\bar{u}$ will be relatively large, then $v \geq \underline{v}(\underline{\gamma})$ and the PC binds. The borrower gets his outside option i.e. $u_{\bar{\gamma}} = u_{\underline{\gamma}} = \bar{u}((1-\tau)w, \bar{\gamma})$.

Model at Work- Implications for Credit Contracts

- We now see the effect of reducing τ, which will increase the wealth of the borrower that can be used as collateral, on the credit contracts.

Proposition 4

Suppose that property rights improve so that more collateral can be pledged by borrowers. Then the impact depends on which of the following two cases is relevant:

1. If the outside option is binding ($v \geq \underline{v}(\underline{\gamma})$), the limited liability and competition effects operate in the same direction, increasing lending and borrower effort, and reducing interest payments.
2. If the outside option is not binding ($v < \underline{v}(\underline{\gamma})$), then neither the limited liability nor the competition effect is operative. Lending and effort do not increase but the interest payments are higher.

- The limited liability effect comes from the fact that, as τ falls, more wealth can be collateralized and liability of the borrower for losses incurred is greater. The competition effect works through the outside option of the borrower.
- **PROOF:**
  1. For the first part of the proof, when the outside option is binding, the PC is also binding and the effort and loan size are given by ▸ Proposition 2. Note that $x = g(v, \gamma)$ and $e = f(v)$ are both increasing in v as proven earlier and v is increasing in τ. v consists of the borrower's outside option $\bar{u}$ and $(1-\tau)w$ i.e. the effective wealth, both of which are decreasing in τ. The effect of τ decreasing on r is ambiguous as the change in ρ is ambiguous. However, one sufficient condition for r to decrease is for $S(v, \gamma) > v$, which the authors prove in the appendix as a part of Proposition 5.
  2. For the second part of the proof, when the outside option is not binding (PC not binding), the first part of Proposition 2 applies. Note that both x and e are independent of τ and thus, don't change. However, now r is increasing as ρ is constant.

- De Soto had the first part of Proposition 4 in mind.
- In the second case improving property rights now merely increases the power of the lender who can force the borrower to put up more of his wealth as collateral and pay a higher interest rate. Thus the limited liability effect constitutes a purely redistributive gain to the lender with no improvement for the borrower.
- This resonates with a point that is frequently made about informal contracting arrangements, namely, that prevailing subsistence norms can be undermined by the formal legal system.
- There is no competition effect in this case either as long as the borrower's utility continues to exceed that option. If the outside option improves sufficiently, the borrower flips into case 1 of this proposition.

Implications for Welfare

- To evaluate welfare, we need to take a stance on the weight that is attached to the utility of borrowers and lenders.
- Let λ be the relative weight on the welfare of the borrowers and B denote the borrower's payoff. Welfare is measured as:

$$W(\tau;\lambda) = (\lambda - 1)B + S(\bar{u} + (1-\tau)w, \gamma)$$

- $\lambda \geq 1$ where there is a greater concern for the borrowers' welfare compared to the profits made by the lender.
- Note that welfare is nothing but the weighted sum of lender's profits and the borrower's payoff where borrower's payoff gets a relative weight of λ.

Proposition 5

When property rights improve

1. If competition is intense enough, welfare is increasing for all values of λ. Moreover, borrowers and the efficient market lender are both strictly better off.
2. If competition is weak enough, the outside option is not binding and for λ greater than or equal to 1, welfare is decreasing.

- **PROOF:**
  1. If the competition is intense then the participation constraint is binding (Proposition 4 part 1) and the borrower receives his outside option $B = \bar{u}((1-\tau)w, \bar{\gamma})$. If the borrower is better of by an improvement in property rights (reduction in τ) then $\bar{u}$ must be decreasing in τ.Differentiating $S(\bar{u} + (1-\tau)w, \bar{\gamma}) = \bar{u}$ with respect to τ we get, $\frac{d\bar{u}}{d\tau} = \frac{-w}{1-S_v} < 0$ as $0 < S_v < 1$ for $v \in (\underline{v}(\underline{\gamma}), \bar{\gamma})$ (proven earlier).

- The efficient lender is also strictly better off. The profits of the efficient lender is given by

$$\pi(z) = S(z, \underline{\gamma}) - S(z, \bar{\gamma}$$

where $z \equiv \bar{u} + w(1-\tau)$. Observe that $\frac{\partial \pi(z)}{\partial z} = S_1(z, \underline{\gamma}) - S_1(z, \bar{\gamma})$ which is positive if $S_{12} z, \gamma) < 0$. Using envelope theorem we have:

$$\frac{\partial S}{\partial \gamma} = -g(v, \gamma) \text{ and } \frac{\partial^2 S}{\partial \gamma \partial v} = -g_v(v, \gamma) < 0.$$

- For proving the second part of the proposition we use second part of Proposition 4, which says that the borrower is worse off. When the competition is low and the borrower gets his efficiency utility i.e. $B = \underline{v}(\underline{\gamma}) - (1-\tau)w = \frac{p(e^0)}{p'(e^0)} - (1-\tau)w - e^0$. Since e^0 does not change with τ, borrower's utility falls at the rate w. The lender's profits are given by $p(e^0)q(x^0) - \frac{p(e^0)}{p'(e^0)} + (1-\tau)w - \gamma x^0$. These increase one for one with a decrease in the borrower's payoff. Since the borrower has more weight $\lambda > 1$, total welfare falls.

- In the second case of the Proposition 5, a pure transfer is taking place between the borrower and lender, there is no efficiency improvement and total surplus is unchanged. Thus any welfare function which puts more weight (however small) on borrower welfare will register a welfare reduction when property rights improve.

- These results emphasize the complementarity between market competition and market-supporting reforms to improve property rights. In the absence of competition, it may be optimal to keep property rights under-developed. Improving them only increases the prospect of exploitation of borrowers by lenders.

- The analysis identifies two factors that determine which case is more relevant: the wealth level of borrowers (w), and the degree of competitiveness of markets ($\bar{\gamma} - \underline{\gamma}$).

Application

- One must note that
  1. The De Soto effect is likely to depend on the degree of competition in the credit market.
  2. The comparative static results above are local, that is, for a small change in τ . But the starting point may matter a lot a large change in property rights, for example, could lead to a flip from case 2 to case 1 and look quite different from a small change.
  3. The effects described in the proposition are for a specific wealth level. But which case applies depends upon the borrower's wealth.

- This article takes a somewhat different approach compared to the existing literature by generating quantitative predictions from estimated parameter values from data on Sri Lanka.
- The authors estimate the quantitative predictions for three different wealth groups (low, medium, and high, based on percentiles in the data) and look at the impact of changing τ over the whole unit interval.
- The study also explores the effects of whether the outside option is binding.

Strategy

- The following functional forms are assumed: $p(e) = e^{\alpha}$ and $q(x) = Bx^{\beta}$ with $\alpha < 1$, $\beta < 1$.
- This gives rise to the linear structural equation: $\log(\pi) = \log(B) + \alpha \log(e) + \beta \log(x) + \nu$
- The level of e is endogenous and for a borrower who is not borrowing or borrowing under the first best is determined by $p'(e)q(x) = 1$
- This implies the structural equation $\log(e) = \frac{1}{1-\alpha} \log(B\alpha) + \frac{\beta}{1-\alpha} \log(x) + \epsilon$

- Substituting we get,

$$\log(\pi) = \phi_1 + \phi_2 \log(x) + \nu + \alpha\epsilon$$

where $\phi_1 = \frac{1}{1-\alpha}\log(B) + \frac{\alpha}{1-\alpha}\log(\alpha)$ and $\phi_2 = \frac{\beta}{1-\alpha}$.
- ϕ_1 and ϕ_2 are estimated by running above reduced form equation.
- α is calibrated by noting that $p(e)$ is the probability of nondefault and choosing α such that the average non default probability is equal to the empirical fraction of nondefaulted loans in the data.
- Given estimates of ϕ_1, ϕ_2, and α, estimates of both B and β are backed out.

Data

- To derive estimates of the key parameters, data from a study of Sri Lankan microenterprises by De Mel, McKenzie, and Woodruff (2008) (MMW) is used.
- A key innovation of their study is to generate shocks to the capital stock by randomly providing grants. This enables consistent estimation of the parameters in the reduced equation by instrumenting for the capital stock with experimentally provided grants.
- $\hat{\alpha} = 0.076$
- The estimate of ϕ_1 is $\hat{phi}_1 = 0.396$. We back out β and B from $\hat{\phi}_1$ and $\hat{\phi}_2$ as $\hat{B} = 1.754$ and $\beta = 0.526$.
- The reduced form equation holds under the assumption that $r = c$, that is, the individual is not borrowing or borrowing under the first best. When the estimates are found using the subsample of individuals who do not borrow at baseline, they are similar to the earlier result.

- The predictions on the equilibrium contracts for three wealth levels, which correspond to the 5th, 25th, and 50th percentiles of the empirical wealth distribution, have been presented. The $5th$, $25th$, and $50th$ percentiles are $\{4989, 35137, 81915\}$, and normalized by the marginal cost of effort these are $\{0.1090, 0.7679, 1.7901\}$.
- For an estimate of γ a nominal interest rate of 8% is used.

Baseline- No Competition

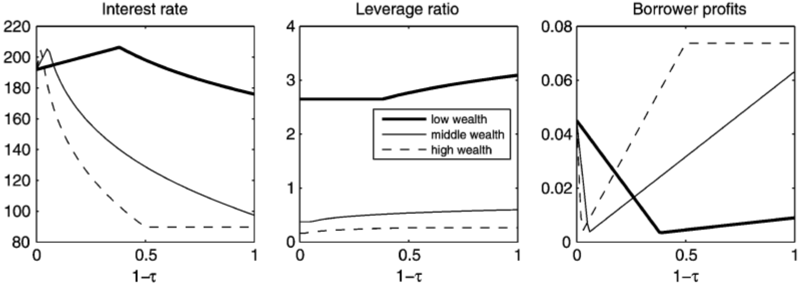


FIGURE II

No Competition (Sri Lanka)

Baseline Results

- The baseline quantitative estimates of the de Soto effect are for the case where the outside option is autarky, that is, $\bar{u} = 0$, corresponding to the case of a monopolistic lender.
- Figure II shows the predicted interest rate $(\frac{r}{x} - 1)/100$, the leverage ratio $(\frac{x}{w})$ and the borrower's profits, $p(e)(q(x) - r) - (1 - p(e))c$ as a function of $(1 - \tau)$
- The predicted interest rates are greater than 80% and generally fall with improvements in property rights. For higher wealth groups, the interest rate is lower for almost all values of τ . For the lowest wealth group these increase from around 190% to nearly 210% for high τ but fall thereafter.
- The increasing range in the left panel of Figure II corresponds to the case in the theoretical model where the borrower is worse off from improvements in property rights.. The reduction in interest rates for the middle and high wealth groups are substantial from above 180% to around 90%.

- The amount borrowed increases in all three wealth groups over most of the range. However, the increases are modest for the middle and low wealth groups with leverage relative to wealth only rising from about 16% to 26% for the high wealth group.
- Average realized profits increase with improvements in property rights throughout the range of τ for the high and middle wealth groups. For the low wealth groups improved property rights lead to higher profits only at low values of τ . Increased profits reflect a compensation for the higher exerted effort.
- In Figure III we assume that the competitor also has a cost of funds of 8%and is subject to the same τ .
- In Figure III, improving property rights is welfare improving throughout the whole range of τ . Moreover, the level of interest rates is dramatically lower compared to Figure II.
- The results suggest that the effects of having competition in the credit market can be dramatic. The effects of property rights reform seem to be strongly complementary with the degree of competitiveness of credit markets.

Competition

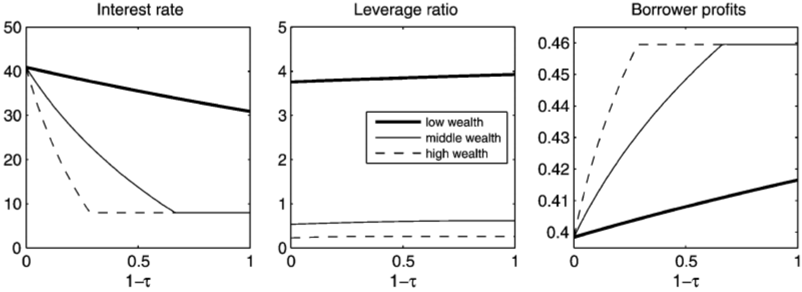


FIGURE III

Competition (Sri Lanka)

Welfare

- Now we see the impact on welfare from changes in property rights. The main difference between these effects and those in the previous section lie in the fact that the cost of effort is taken into account.
- The dashed line in Figure IV represents total surplus for the case where competition is absent, corresponding to Figure II. The solid thick line is the utility of the borrower in this case. The borrower's welfare falls.
- The top line in Figure IV shows the borrowers' utility in the case of high competition. The welfare is higher in this case but improvement is a modest 2% gain in welfare even if property rights move from the worst possibility to the very best.
- The reason that the utility gain is modest even though profits of the borrower are increasing, is that improvements in property rights are inducing an increase in effort rather than an increase in the amount borrowed.

Welfare

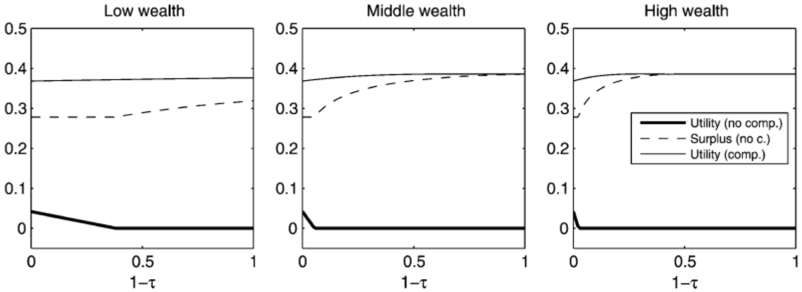


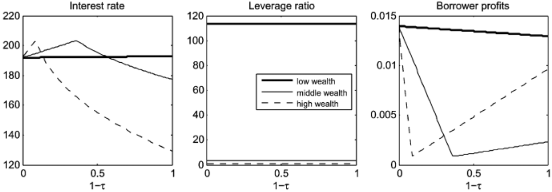
FIGURE IV

Welfare

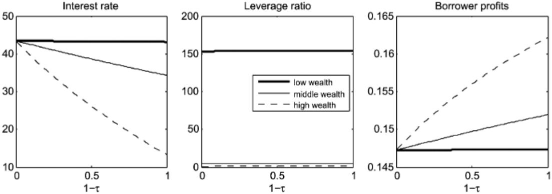
Ghana

- Robustness of the results is checked using data from Ghana.
- The values for α and β are strikingly close to the values we had found for Sri Lanka, while the technology parameter B is somewhat lower than in Sri Lanka.
- The the $33rd$, $50th$, and $66th$ percentile of the distribution of business capital are $\{5.78, 208, 862\}$, and their normalized values are $\{0.0010, 0.0364, 0.1507\}$. The percentiles are lower in Ghana consistent with the average per capita income in Ghana being around a third of the Sri Lankan average per capita income and the technology parameter B also being lower for Ghana.
- Figure VA and VB present the model's predictions in the non-competitive and competitive case for Ghana, corresponding to Figures II and III which use Sri Lankan data, respectively.
- The main difference to the Sri Lankan case is that a substantially bigger group of individuals would not benefit from marginal improvements in property rights.

Ghana



(A) No competition



(B) Competition

Figure V

Main results (Ghana)

Conclusion

- This paper has developed a model to explore the incentive effects associated with extending the use of collateral to support trade in credit markets.
- We found both non-linearities and heterogeneity in the effects. Gains vary by initial wealth, the extent of competition in the credit market and the initial level of effective property rights.
- Both the theory and the evidence support the possibility of significant effects on interest rates and profits from improving property rights.
- However, these appear to come predominantly from increased effort rather than increased levels of borrowing. In other words, the model predicts that moral hazard will be reduced. This explains why an increase in measurable output may not be the same as an increase in economic welfare that would factor in the cost of effort.