The de Soto Effect*

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Abstract

This paper explores the consequences of creating and improving property rights so that fixed assets can be used as collateral. This has become a *cause célèbre* of Hernando de Soto whose views are influential in debates about policy reform concerning property rights. Hence, we refer to the economic impact of such reforms as the *de Soto effect*. We explore the logic of the argument for credit contracts, both in isolation, and in market equilibrium. We show that the impact will vary with the degree of market competition. Where competition is weak, it is possible that borrowers will be worse off when property rights improve. We discuss the implications for optimal policy and the political economy of policy reform.

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1 Introduction

Supporting the creation of credit markets to foster investment is a key role of the state in promoting economic development. Policies aimed at extending and improving property rights so that assets can be pledged as collateral for loans are an important aspect of this. This has become a *cause célèbre* of Hernando de Soto who has argued that this is a central mechanism for improving the lives of the poor.[1] His view is stated succinctly in the following quote:

> "What the poor lack is easy access to the property mechanisms that could legally fix the economic potential of their assets so that they could be used to produce, secure, or guarantee greater value in the expanded market...Just as a lake needs hydroelectric plant to produce usable energy, assets need a formal property system to produce significant surplus value." (de Soto, 2001).

This idea has captured the imagination of policy makers and has been taken up all over the world. We refer to the idea that better access to collateral increases credit availability as the *de Soto effect*.[2]

Significant disparities remain across countries in the extent to which property can be registered and hence used as collateral. A feel for this can be found by looking at data from the World Bank doing business project which has collected a three indicators on the ease with which property can be registered on a consistent basis for 93 countries. We use the number of procedures (between 1 and 16) which are needed in order to register property.[3] Figure

[1] See, for example, de Soto (2000, 2001).

[2] It is arguable that this should really be called the Bauer-de Soto effect since this link was also spotted by Peter Bauer in his perceptive account of West African trade wherein he argues that:

> "Both in Nigeria and in the Gold Coast family and tribal rights in rural land is unsatisfactory for loans. This obstructs the flow and application of capital to certain uses of high return, which retards the growth of income and hence accumulation." (Bauer, 1954 p. 9).

[3] The data for this and other indicators including the time to register and the cost of registering property are available at: http://www.doingbusiness.org/MethodologySurveys/RegisteringProperty.aspx

1 shows that, in line with de Soto's claim, countries where fewer procedures are required have higher credit to GDP ratios.

But reduced form relationships like the regression line in Figure 1 say little about the mechanism at work. While de Soto's ideas have immense intuitive appeal, there have been few efforts to examine the economic logic of the de Soto effect in detail.

There is an obvious aspect of the de Soto effect which presumably most advocates have in mind. This is that enhancing collateral potential will lead to either bigger loans and/or lower interest rates. However, there is more to it than this. In some of his writings, it is clear that de Soto also has in mind that reforms that secure property rights will enhance competition in the credit markets and change the nature of interaction between formal and informal sectors. To study this clearly requires a more sophisticated model.

This paper lays out a simple, but tractable, framework that allows us to identify a number of facets of the de Soto effect. Some of these require considering how the market equilibrium responds while others are visible without these consequences being taken into consideration. We will show that in the logic of the de Soto effect a crucial role is played by assumptions about how competitively the credit market operates and hence how the gains from improving property rights are allocated between lenders and borrowers.

Another feature of Figure 1 is how the ability to register property remains weak in many countries in spite of the well-known arguments for the importance of assets as collateral. This could, of course, reflect sheer incompetence of some states which is certainly plausible. However, there is a more interesting possibility – that it may not actually be optimal to improve property registration under all conditions.

We characterize under what conditions it is optimal to undertake property rights reform. We show that this rests on a particular kind of second-best reasoning related to the absence of competition in the credit market. In the presence of extreme poverty and little competition, increasing property rights registration can actually lead only to greater exploitation in the credit market because lenders can foreclose on defaulting borrowers more easily, without any efficiency gains. If the state is unwilling to act to reduce such market power, the validity of the argument that property registration is a win-win for borrowers and lenders is thus called into question.

Our paper is related to the large literature on credit markets in developing countries. The functioning of capital markets is now appreciated to be a key determinant of the development process (see Banerjee, 2004, and

Mookherjee, Ghosh and Ray, 2000 for reviews). Within this, the issue of how legal systems support trade in credit, labour, and land markets is a major topic. For example, Kranton and Swamy (1999) show how the introduction of civil courts in colonial India increased competition among lenders while undermining long-term relationships among borrowers and lenders by making it easier for borrowers to switch lenders. Genicot (2002) shows how banning bonded labour generates greater competition between landlords and moneylenders thereby improving the welfare of poor farmers.

Our work is also related to the macro-economic literature which studies how aspects of legal systems affect the development of financial markets. One distinctive view is the legal origins approach associated with La Porta et al (1998). They argue that whether a country has a civil or common law tradition is strongly correlated with the form and extent of subsequent financial development with common law countries having more developed financial systems. In similar vein, Djankov et al. (2007) find that improvements in rights which affect the ability of borrowers to use collateral are strongly positively correlated with credit market development in a cross-section of countries.

The micro-economic literature on property rights has focused to a significant degree on empirically estimating the effects of titling programs on farm productivity and other household allocation decisions.[4] This literature offers some support to the idea that strengthening land titles improves productivity by reducing insecurity, and (to a more limited extent) by improving credit market access.[5] A number of papers have empirically explored the effect that collateral improvement has on credit contracts (see, for example, Liberti and Mian, 2009).

Our paper is also closely related to the emerging literature that looks at the political economy of institutional reform. For example, Pagano and Volpin (2005), Caselli and Gennaioli (2008), and Perotti and Volpin (2007) study the political economy of improvements in investor protection. Both emphasize the possibility that weak legal systems can limit competition and hence may lead those who earn rents to block reforms. Biais and Mariotti (2008) study the choice between soft and hard bankruptcy rules and focus on the general equilibrium interactions between the credit and labour market.

[4]Contributions include Besley (2005), Field (2005, 2007), Field and Torero (2006), Galiani and Schargrodsky (2005), Goldstein and Udry (2008), Hornbeck (2008), and Johnson, McMillan, and Woodruff (2002).

[5] This is part of a wider literature on the importance of property rights discussed in Besley and Ghatak (2009).

The focus on rent protection as a source of underdevelopment supports the general thrust of arguments in Rajan (2007). Related also is the study of debt bondage by von-Lilienfeld-Toal and Mookherjee (2008) who argue that the elimination of debt bondage (something which can improve the enforcement of contracts) can be explained by the general equilibrium effects on the allocation of rents.

The remainder of the paper is organized as follows. The next section introduces our core model of credit market contracting. In section three, we use this to study second-best efficient credit contracts. This section also characterizes the market equilibrium where lenders compete to serve borrowers. Section four extends the model to include an informal sector that uses "social collateral". This allows us to explore when reforms increase market depth. Section five uses the model to study policy issues. It looks at optimal policy towards creating collateral and implications of the framework for the political economy of reform. Section six offers some concluding comments.

2 The Model

The model studies contracting between borrowers and lenders. We use a variant of a fairly standard agency model (see Innes, 1990) that is frequently used to analyze contractual issues in development.[6] The borrower's effort is subject to moral hazard and in addition, he has limited pledgeable wealth creating a limited liability problem. Our focus here is on the way that contract enforcement is limited due to imperfections in property rights protection which reduce the collateralizability of wealth.

Borrowers There are n identical potential borrower-entrepreneurs whose projects can be enhanced by access to working capital provided by lenders. Each borrower is assumed to be endowed with the same level of illiquid wealth w (e.g., a house or a piece of land).

We assume that property rights are poorly defined which affects the borrowers' ability to pledge his wealth as collateral. We introduce a parameter τ that captures this. Specifically, we assume that if a borrower has wealth w then its collateral value is only $(1-\tau)w$. So $\tau = 0$ corresponds to perfect

[6] See, for example, Mookherjee and Ray (2002), and Banerjee, Gertler, and Ghatak (2002).

property rights whereas $\tau = 1$ corresponds to the case where property rights are completely absent. We will refer to $(1-\tau)\,w$ as a borrower's *effective wealth*.

Each borrower supplies effort $e \in [0, \overline{e}]$ and uses working capital $x \in [0, \overline{x}]$ 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 one and the marginal cost of x is γ. Expected "surplus" is therefore:

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

Throughout the analysis we make the following regularity assumption which ensures a well-behaved maximization problem with interior solutions.

Assumption 1 *The following conditions hold for the functions $p(e)$ and $q(x)$:*

(i) Both $p(e)$ and $q(x)$ are twice continuously differentiable, strictly increasing and strictly concave for all $e \in [0, \overline{e}], x \in [0, \overline{x}]$.

(ii) $p(0) \geq 0$, $p(\overline{e}) < 1$, $q(0) = 0$, and $q(\overline{x}) \leq \overline{q}$ where $\overline{q}$ is a finite positive real number.

(iii) The Inada endpoint condition holds for both $p(e)$ and $q(x)$ as $e \to 0$ and $x \to 0$.

(iv) $p(e)q(x)$ is strictly concave for all $e \in [0, \overline{e}], x \in [0, \overline{x}]$.

These assumptions are all fairly standard. They hold, for example, if $p(e) = e^{\alpha}$ and $q(x) = x^{\beta}$ where $\overline{e} < 1$, $\overline{x} < 1, \alpha \in (0,1)$, $\beta \in (0,1)$, and $\alpha + \beta < 1$.

Lenders We assume that there are two lenders ($j = 1, 2$) who borrow funds from depositors or in wholesale markets to fund their lending. We assume that the more efficient lender has marginal cost of funds $\underline{\gamma}$ while the less efficient lender has marginal cost $\bar{\gamma}$ with $\bar{\gamma} \geq \underline{\gamma}$. We assume that each lender has unlimited capacity to supply the market.[7]

In the case where $\bar{\gamma} = \underline{\gamma}$, these market lenders are equally efficient and we are effectively in the case of Bertrand competition with identical costs.

[7]The assumption of two lenders is without loss of generality given these assumptions by applying the standard logic of Bertrand-competition.

To the extent that $\bar{\gamma}$ is greater than $\underline{\gamma}$ the low cost lender may be able to earn a rent relative to the outside option of borrowers of borrowing from the less efficient lender. Thus $\bar{\gamma} - \underline{\gamma}$ will effectively be a measure of market competitiveness.

We can interpret this set up as one where lenders are financial intermediaries which borrow money from risk neutral depositors whose discount factor is β. Financial intermediary j repays depositors with probability μ_j. This could reflect intrinsic trustworthiness or the state of the intermediary's balance sheet, e.g. its wealth. In this case $\gamma_j = 1/\left(\beta\mu_j\right)$ is intermediary j's cost of funds which is lower for more trustworthy intermediaries. Naturally, $1/\beta$ sets a natural lower bound for the marginal cost of capital.

3 Contracting

We assume e is not contractible. This would not be a problem if a borrower had sufficient wealth to act as a bond against non-repayment. However, limits on the amount of wealth on this will be an important friction preventing the first-best outcome being realized. Even if the borrower's liquid wealth is sufficient for this purpose, poorly defined property rights, as argued by de Soto (2001) may place a further limit.

A credit contract is a triple $\{r, c, x\}$ where r is the payment that he 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.[8] It will be useful to think of r as the repayment and c as collateral. The payoff of a typical borrower is:

$$p(e)\left\{q(x) - r\right\} - (1 - p(e))\, c - e$$

and of a lender is:

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

A borrower's outside option is $u \geq 0$. This will be determined endogenously once we permit lenders to compete to serve borrowers.[9] Since we have assumed that $q(0) = 0$, the autarky payoff is 0. We also assume that lenders must make non-negative profits.

[8] As Innes (1990) shows, even if output took multiple values or was continuous, the optimal contract has a two part debt-like structure as here.

[9] Observe that we are defining borrower payoffs net of any consumption value that he gets from his wealth which may, for example, be held in the form of housing.

3.1 The First Best

As a benchmark, consider the allocation that will emerge in the absence of any informational or contractual frictions, i.e. if effort is contractible, the borrower has sufficient wealth and there are no binding problems of contract enforceability. In that case the level of effort and the level of lending will be chosen to maximize joint surplus.

Consider first a borrower who is borrowing from a lender with marginal cost γ. The first-best $(e^*(\gamma), x^*(\gamma))$ is characterized by the following first-order conditions:

$$\begin{aligned} p'(e^*(\gamma))q(x^*(\gamma)) &= 1 && (1) \\ p(e^*(\gamma))q'(x^*(\gamma)) &= \gamma. && (2) \end{aligned}$$

Assumption 1 implies that these are interior solutions. Effort and credit are complementary inputs in this framework. Therefore, a fall in γ or any parametric shift that raises the marginal product of effort or capital will raise the use of *both* inputs.

The first-best surplus is denoted by

$$S^*(\gamma) = p(e^*(\gamma))q(x^*(\gamma)) - e^*(\gamma) - \gamma x^*(\gamma) \tag{3}$$

which is decreasing in γ. By Assumption 1, so long as γ is finite, an interior solution exists such that $S^*(\gamma) > 0$. Naturally, all borrowers will borrow from the lender with the lower marginal cost of funds, $\underline{\gamma}$. The lender will earn $\pi = \max\left\{S^*\left(\underline{\gamma}\right) - u, 0\right\}$ which respects his outside option of zero. Notice that since the borrower's outside option is to go to the other lender, and therefore, $u = S^*(\overline{\gamma})$.

3.2 Second Best Contracts

The main case of interest is the second best where contracts are constrained by information and limited claims to wealth that can serve as collateral. If effort is not contractible, then there is an agency problem leading to too little effort being supplied. Given the contract (r, c, x) the borrower's choice of effort e is the solution to:

$$\max_e p(e)\{q(x) - r\} - (1 - p(e))\, c - e.$$

The first-order condition yields the **incentive compatibility constraint (ICC)** on effort by the borrower.

$$p'(e)\{q(x) - (r - c)\} = 1 \tag{4}$$

defining e implicitly as $e(r, c, x)$.

Efficient contracts between a lender and a borrower now solve the following problem:

$$Max_{\{r,c,x\}}\pi(r, c, x) = \ p(e)\, r + (1 - p(e))\, c - \gamma x. \tag{5}$$

subject to:
(i) the **participation constraint (PC)** of the borrower

$$p(e)\{q(x) - r\} - (1 - p(e))\, c - e \geq u. \tag{6}$$

(ii) the **ICC**:

$$e = e(r, c, x). \tag{7}$$

(iii) the **limited liability constraint (LLC)**

$$[1 - \tau]\, w \geq c. \tag{8}$$

We describe the optimal contract in two parts. First, we consider when the first best can be achieved (Proposition 1). We then consider what happens when this is not the case (Proposition 2). It is useful to define

$$v \equiv u + (1 - \tau)\, w. \tag{9}$$

as the sum of the borrower's outside option and his effective wealth.

Intuitively, we would expect the first best to be achievable when the borrower has sufficient effective wealth to pledge as collateral. To be precise about this, define

$$\bar{v}(\gamma) \equiv S^*(\gamma) + \gamma x^*(\gamma).$$

as the level of v equal to the first best surplus plus the cost of credit. Using this, we have our first result:[10]

[10] The proof of this and all subsequent results is in the Appendix.

Proposition 1 *Suppose that Assumption 1 holds. Then for $v \geq \bar{v}(\gamma)$ the first-best outcome is achieved with*

$$
\begin{aligned}
e &= e^{*}(\gamma) \\
x &= x^{*}(\gamma) \\
r &= c = \max\left\{S^{*}(\gamma) + \gamma x^{*}(\gamma) - u, 0\right\}.
\end{aligned}
$$

It is straightforward to check that the condition stated in Proposition 1 that $v \geq \bar{v}(\gamma)$ is equivalent to $(1-\tau)w \geq \pi + \gamma x^{*}(\gamma)$. This says that the borrower's effective wealth must be greater than the cost of credit plus the lender's rent. In this case, it is possible for the borrower to make a fixed payment to the lender by a pledging a portion of his wealth against default. He then becomes a full residual claimant on the returns to effort, a requirement for the first-best effort level to be chosen by the borrower. The fact that the wealth threshold includes a payment for rent to the lender implies that the first best will be easier to achieve in competitive credit markets.

Now consider what happens when $v < \bar{v}(\gamma)$. Our result for this case is given by:

Proposition 2 *Suppose that Assumption 1 holds. Then there exists $\underline{v}(\gamma) < \bar{v}(\gamma)$, such that for $v < \bar{v}(\gamma)$ the optimal contract is as follows*:

$$
\begin{aligned}
e &= \begin{cases} f(v) & v \in [\underline{v}(\gamma), \bar{v}(\gamma)] \\ f(\underline{v}(\gamma)) & v < \underline{v}(\gamma) \end{cases} \quad \text{where } f(\cdot) \text{ is strictly increasing.} \\
x &= \begin{cases} g(v,\gamma) & v \in [\underline{v}(\gamma), \bar{v}(\gamma)] \\ g(\underline{v}(\gamma),\gamma) & v < \underline{v}(\gamma) \end{cases} \quad \text{where } g(\cdot,\gamma) \text{ is strictly increasing.} \\
r &= \begin{cases} \rho(v,\gamma) + (1-\tau)w & v \in [\underline{v}(\gamma), \bar{v}(\gamma)] \\ \rho(\underline{v}(\gamma),\gamma) + (1-\tau)w & v < \underline{v}(\gamma) \end{cases} \quad > c = (1-\tau)w,
\end{aligned}
$$

where $\rho(v,\gamma) = q(g(v,\gamma)) - \frac{1}{p'(f(v))}$.

Since $v < \bar{v}(\gamma)$, the level of wealth is insufficient to achieve the first best – both effort and credit granted below their first best levels. All effective wealth is pledged as collateral and the repayment made when the project is successful exceeds that when it fails. The level of that payment reflects the standard trade-off between extracting more rent from the borrower by raising and r and reducing the borrower's effort as a consequence.

Within this second-best, there are two sub-cases. In the first of these $v \in [\underline{v}(\gamma), \bar{v}(\gamma)]$. Over this range both the incentive compatibility and participation constraints are binding. A higher level of effective wealth or a better outside option increase effort and credit supplied.

For $v \leq \underline{v}(\gamma)$, the participation constraint ceases to bind, i.e. the lender finds it worthwhile to offer the borrower an "efficiency utility" level, analogous to an efficiency wage in the literature on labor markets, i.e. the lender keeps the borrower at utility level $\underline{v}(\gamma)$. This reflects the fact that the lender does not want the borrower's effort to fall below a threshold which is defined precisely in the proof. This case applies when either outside options are very poor and/or the effective wealth of borrowers is extremely low. For example, take the extreme case of $u = w = 0$. In this case the participation constraint clearly cannot bind as that would require giving no loans to the borrower or, setting $r = q(x)$ both of which will yield the lender zero profits. In this case, the lender's optimal strategy should be to offer a small-sized loan, and charging a high interest rate. The borrower will put in low effort but the lender will make a large profit from the high interest rate. Also, the borrower will get a strictly positive payoff even though his reservation payoff is zero.

We would expect this situation to apply to extremely poor borrowers in weakly institutionalized settings, a case where the de Soto effect logic is frequently applied. As we shall see below, this is an important case when considering welfare effects from improving property rights protection,

3.3 The Constrained Pareto Frontier

We now state useful corollary of the results above which are useful in studying the implications of the model. First, let

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

be the total surplus of the lender and the borrower with the contract described in Propositions 1 and 2. A key property of this function is stated as:

Corollary 1: *Total surplus $S(v, \gamma)$ is strictly increasing in v for $v \in [\underline{v}(\gamma), \overline{v}(\gamma)]$. For $v \leq \underline{v}(\gamma)$ it is constant at $S(\underline{v}(\gamma), \gamma)$ and for $v \geq \overline{v}(\gamma)$ it is constant at $S^*(\gamma)$. $S(v, \gamma)$ is everywhere strictly decreasing in γ.*

The first part of this says that a higher reservation payoff or effective wealth increases total surplus while the second part says that surplus is higher when the cost of funds is lower.

The payoffs of the borrower and lender add up to total surplus so that the constrained Pareto frontier is implicitly defined by:

$$S(u + (1-\tau)w, \gamma) = \pi + u. \tag{10}$$

This equation can be solved to yield:

$$\hat{u} = \hat{u}(\pi, w(1-\tau), \gamma). \tag{11}$$

This is the expected utility of the borrower given a particular value of the lender's profit and the contract described in Propositions 1 and 2. The following additional result notes a property of (11) that is useful later when we study the market equilibrium of the model where borrowers chose which lender to contract with.

Corollary 2: *The borrower's payoff in a optimal contract $\hat{u}(\pi, w(1-\tau), \gamma)$ is strictly decreasing in γ, and π for $v \in [\underline{v}(\gamma), \overline{v}(\gamma)]$. It is also strictly increasing in $w(1-\tau)$ for $v \in [\underline{v}(\gamma), \overline{v}(\gamma)]$.*

This says that, all else equal, the lender's payoff is higher when he contracts with a more efficient lender.

Using this fact, the constrained Pareto-frontier for the contracting problem and is displayed graphically in Figure 2.[11] The 45^0 line represents the unconstrained Pareto frontier. In this figure we depict the case where the borrower has an intermediate level of wealth. For such a borrower, there is a critical wealth level for above which the first-best is achievable. On the other hand, this borrower is not wealthy enough and so if the market is very uncompetitive, his participation constraint does not bind.

3.4 Market Equilibrium

We now consider how lenders compete to attract borrowers. We suppose that they do so by posting contractual terms: $\{e, x, r, c\}$ with borrower's

[11] In the figure, we draw the surplus function as being concave. It is straightforward to show that this will be the case if $1 + \frac{p'''(e)p'(e)}{\{p''(e)\}^2} \geq 0$ for all $e \in E$, i.e. the degree of concavity of the function $p(e)$ does not decrease too sharply. This ensures that, in the second best, the marginal cost of eliciting effort is increasing in effort.

picking the lender that gives them the best level of expected utility. This market game resembles a model of Bertrand competition. These terms will be selected from the set of second-best Pareto efficient contracts described in Propositions 1 and 2. If not, then by deviating the lender can make a greater profit without the borrower being worse off.

Suppose now that the less efficient lender earns a profit of $\tilde{\pi}$. Then a borrower that signs a contract with that lender will earn $\hat{u}\left(\tilde{\pi},(1-\tau)\,w,\bar{\gamma}\right)$. Then since $\hat{u}\left(\tilde{\pi},(1-\tau)\,w,\underline{\gamma}\right) > \hat{u}\left(\tilde{\pi},(1-\tau)\,w,\bar{\gamma}\right)$, the more efficient lender can offer a strictly higher utility level to the borrower and make a profit. The less efficient lender must then respond by offering a contract which lowers his profit below $\tilde{\pi}$. This logic can be iterated until $\tilde{\pi}=0$ at which point the less efficient lender cannot improve his contractual terms further to attract a borrower. Thus the zero profit contract of the less efficient lender provides the outside option to each borrower against which the more efficient lender optimizes.

This implies that the borrower's reservation utility will be:

$$\bar{u} = \hat{u}\left(0,(1-\tau)\,w,\bar{\gamma}\right).$$

The contract that is offered by the efficient lender is then determined by applying Propositions 1 and 2 where $v = \bar{u} + (1-\tau)\,w$. Given $\bar{u}$, the profit made by the efficient lender is determined from:

$$\pi = S(\bar{u} + (1-\tau)w, \underline{\gamma}) - \bar{u} \geq 0.$$

Given the role of outside options, the way that market competition allocates surplus depends, not surprisingly, on how intense is market competition. This depends in this model on how close is $\bar{\gamma}$ to $\underline{\gamma}$. If $\bar{\gamma}-\underline{\gamma}$ is large, then the participation constraint of borrowers may not bind, i.e., they may earn an "efficiency utility" – $\underline{v}\left(\underline{\gamma}\right)$. In contrast if $\bar{\gamma}$ is close to $\underline{\gamma}$, then competition between the market lenders is intense and all of the surplus accrues to the borrowers with the lenders making close to zero profits.

3.5 Comparative Statics

The model enables us to make a number of predictions about what happens as τ is lowered thereby increasing the fraction of wealth that can be collateralized. From the analysis of the optimal contracting problem, it directly follows that there are two effects to consider. The first is due to the relaxation of the limited liability constraint. The second comes from changing the outside option of the borrower. We begin by studying the case where the outside option of the borrower is binding. For this case, we have:

Proposition 3 *(The Efficiency Effect) Suppose that the outside option is binding for borrowers ($v \geq \underline{v}(\gamma)$). Then holding u constant, the borrower's utility is unchanged while the payoff of lender is strictly greater. There is an efficiency improvement from reducing τ with more lending (higher x) and an increase in the borrower's unobserved effort e.*

This mirrors precisely the route for property rights that secure collateral to affect the economy emphasized in de Soto (2000). A fall in the transactions cost τ raises the collateral value of a given amount of wealth. This allows the lenders to offer a more efficient loan by reducing the spread between the repayment demanded from a successful project and the collateral offered. This, in turn, leads to an increase in effort and, given the complementarity between x and e, the loan size will rise as as well. Thus expected output increases too.

If the outside option of the borrower is not binding, we have:

Proposition 4 *(The Predatory Effect). Suppose that the outside option is not binding on the borrower before τ is reduced ($v < \underline{v}(\gamma)$). Then the borrower is strictly worse off if τ falls while the lender gains.*

The intuition is for this result is straightforward. When the outside option is not binding, the lender is offering the borrower an "efficiency utility" which exceeds his outside option. Imperfect property rights protect the borrower, in effect protecting his wealth. Thus, it increases his efficiency utility. When property rights to assets are improved, the power of the lender is increased and he can force the borrower to put up more of his wealth as collateral. But this makes him worse off.

It is often pointed out that under informal contracting arrangements there are some accepted norms of subsistence which are sometimes undermined by the impersonal legal system enforced by the state (see, for example, Bardhan, 2007). Our model formalizes this effect and shows why one cannot be Panglossian about the impact of property rights improvements and there is a need to examine these effects in a context where outside options are determined endogenously.

In both of these cases, we would expect the benefits of improved legally enforced property rights that allow greater use of collateral to accrue to lenders rather than borrowers. However, this ignores a second (and potentially important) market equilibrium effect whereby the set of trading opportunities are enhanced for borrowers via an improvement in their outside option as trading with another lender becomes more attractive. This is stated in:

Proposition 5 *(The Outside-Option Effect) Suppose that the outside option is $\hat{u}(0, (1-\tau)w, \bar{\gamma})$ and hence increases when τ is reduced. This will increase effort and the loan size and reduce the repayment net of collateral $(r-c)$.*

The fact that trading with the less efficient lender is now more desirable results in the borrower being able to capture more surplus when he trades with the efficient lender. This changes the contract that he is offered and creates more surplus in the lending relationship.

This last result shows that unlike the more equivocal contracting results in Proposition 4, the outside-option effect generally benefits borrowers and increases expected output. To the extent that this kind of market equilibrium effects are observed, the improvement of property rights will tend to increase efficiency.

4 Social Collateral

The basic model assumes that all trade is in a market where contracts are enforced using a common legal technology. But an important feature of economies where property rights to assets are poorly developed is the use of informal alternatives to the legal system. We will refer to this here as the use of *social collateral* – the idea that the ability to pledge assets may be enforced by social networks.[12]

To operationalize this idea in the context of our model, we suppose that the collateral value of a borrower's assets is match-specific, i.e. depends on the lender with whom he trades. We assume that each borrower has access to an informal lender who belongs, for example, to the same social network such as an ethnic group or village location.

In particular, let $i \in \mathcal{N}$ denote the network to which each borrower and $j \in \mathcal{N}$ denote the network to which each lender belongs. Suppose that, if a

[12] See Besley and Coate (1995), and Mobius and Szeidl (2007).

borrower in network i borrowers from a lender in network j then $(1 - t_{ij})w$ is the value of the social collateral that can be pledged. For simplicity, we assume that:

$$t_{ii} < \tau \text{ and } t_{ij} = 1 \text{ for } i \neq j. \tag{12}$$

This says that members of the same network have access to more effective social collateral, while outside of the network, the formal level of enforcement, τ, is at least as good as trading with any other informal lender.

To focus on the role of social collateral, we imagine that the ability to collateralize assets in a way that is superior to market trades is the *only* potential advantage of informal lending, i.e. informal lenders are subject to the same moral hazard problem as formal lenders. In this case, the surplus created in a lender-borrower relationship, whether it is formally or informally enforced, is given by $S\left(u_i + \left(1 - \tau_{ij}\right) w, \gamma\right)$ where $\tau_{ij} = \min\left\{\tau, t_{ij}\right\}$ and u_i is the outside option of a borrower in network i.

This set-up now allows us to consider a richer market equilibrium picture where borrowers can match with either a formal or an informal lender. Suppose that any informal lender can only access high cost funds, i.e. $\gamma = \bar{\gamma}$. In this case, superior social collateral is the only reason why informality survives. Specifically, trading informally will be viable only if:

$$S\left(\hat{u}(0, w(1-\tau), \underline{\gamma}) + \left(1 - t_{ii}\right) w, \bar{\gamma}\right) > \hat{u}(0, w(1-\tau), \underline{\gamma}). \tag{13}$$

This implies that $t_{ij} < \tau$ since $S\left(v, \gamma\right)$ is decreasing γ. Thus, given (12), the only informal trades that can possibly dominate trading in the market with an efficient lender will be those between lenders and borrowers in the same network who have access to better social collateral. Whether this will indeed be the case depends on the strength of social ties across networks which is captured by different values of t_{ii} for $i \in \mathcal{N}$.

Suppose that there some borrowers for whom (13) holds. Now consider what happens when τ falls in this world. This yields:

Proposition 6 *(The Market Depth Effect) A fall in τ may lead some borrowers to switch from the informal to formal sector thus increasing the extent of the market. For borrowers who switch sectors, effort and loan size increase.*

To see this, observe that switching is desirable only when (13) does not hold at the new τ. The informal sector then becomes the outside option for these borrowers. However, they get to trade with a lender who has a lower cost of accessing funds.

This additional feature of the model captures the notion that in the development process less and less use is made of social collateral as τ falls since fewer and fewer trades based on social ties will be viable.[13] Improvements in the formal legal system lead to less fragmentation and more anonymous (arms-length) trade backed by formal collateral enforced by the legal system.

This view of financial development squares well with Rajan and Zingales (1998) who point out that a financial system has two main roles: first, to channel resources to the most productive use; and second, to make sure that an adequate portion of the returns accrue to the financier. Our model captures the idea in an arm's length system the financier is protected by an explicit contract enforceable in a court of law. Relationship based systems tend to work when legal transactions are poorly enforced. The precise sense in which this leads to a misallocation of capital comes out very clearly from this analysis – the marginal product of capital will differ cross-sectionally according to in τ_{ij}.[14]

5 Policy Implications

We now turn to consider the implications of the model for policy aimed at improving property rights over assets so that they can be used as collateral. An advantage of having a micro-founded model of contracting with limited collateral lies in making it transparent how borrowers and lenders gain or lose from changing τ.

Much of the discussion of property rights improvement proceeds as if it is an obvious win-win policy, i.e. is bound to generate a Pareto improvement. We will explore this issue here and will show that the extent of market competition is a crucial determinant of the welfare effects. We will use this insight to discuss the political economy of reform.

[13] This mechanism is similar to that invoked in Kumar and Matsusaka (2005).

[14] This is consistent with a growing body of evidence. For example, Banerjee, Duflo and Munshi (2003) review studies from India which confirm this.

5.1 Optimal Policy

In this section, we take the perspective of a social planner choosing whether or not to improve property rights. We revert to the baseline model where there are two market lenders each able to capture $(1-\tau)$ of the borrower's wealth. To keep things simple, we consider a world where there are two possible levels of property rights that can be chosen $\tau \in \{0, 1\}$. With $\tau = 0$, there is full registration of titles to property and hence all wealth can be collateralized. If $\tau = 1$, the opposite is true and it is as if the borrower has no pledgeable wealth. We assume that both values of τ can be achieved costlessly. While this is artificial, it allows us to abstract away from the issue of how any reform is financed. The possibility that a costless improvement in property rights may not be optimal is then a much more striking result. We will return to the issue of costly reform and how the form of financing such improvements may matter.

We consider a policy objective which allows the weight on the welfare of borrowers and lenders to vary and use λ to denote the relative weight on the welfare of borrowers. We focus on the case where there is a (weak) preference for borrower welfare, i.e. $\lambda \geq 1$. The policy objective is therefore:

$$(\lambda - 1)\, u + S(u + (1-\tau)w, \gamma).$$

If $\lambda = 1$, the objective of policy is maximizing total surplus.

To characterize optimal policy, there are two cases to consider depending on how intense is market competition. Our first result is:

Proposition 7 *For $\bar{\gamma}$ close enough to $\underline{\gamma}$, the optimal policy is $\tau = 0$ for all λ.*

The proof of the result shows that with sufficient market competition, improving the legal system creates a Pareto improvement in line with our intuitions about policy reforms to improve property rights. The reasoning is clear. The surplus generated by trading with any lender in the market increases. And with sufficient market competition, most of this surplus goes to borrowers who are therefore strictly better off. The efficient market lender is also better off in this case.

We now consider happens when market competition is limited. For this case we have:

Proposition 8 *For $\bar{\gamma}$ far above $\underline{\gamma}$, the outside option is not binding and for all $\lambda > 1$, the optimal policy is to set $\tau = 1$.*

In this case, the more efficient lender has a large amount of market power and borrowers receive an efficiency utility. When property rights to assets improve, the lender is able to demand more wealth as collateral. However, this is a pure transfer – 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 underdeveloped. Improving them only increases the prospect of exploitation of borrowers by lenders.

This is, of course, a second-best result. We are taking the distortion through the absence of competition as given. The fact markets are imperfect is then responsible for another distortion being optimal. Whether the result is of practical significance is moot. But it is a reminder that the welfare consequences of such reforms are context specific. It may not be enough that an economy uses markets to allocate resources – these have to be sufficiently competitive for reform to make sense. This has been a constant refrain in lessons from the transition process in Eastern Europe.

The issue highlighted in Proposition 8 arises even if the government has access to lump-sum taxes and transfers. In that case the government could maximize social surplus and compensate any losers. However, since surplus is constant, there is no strict welfare improvement from improving property rights. Moreover, if there is even a tiny cost of lowering τ, it would (strictly) not make sense for the government to do it.

The assumption that property rights improvements are costless is patently an abstraction. Were this not the case, the costs of reform would also have to be distributed between lenders, borrowers, and others in the economy. The result in Proposition 8 is then potentially sensitive to the method of finance that is used.

In practice, many property registries are funded by user fees that fall on who registers the asset, which would be the borrower in our model. Whether these fees are worth paying if they are set to cover the marginal cost of running a property registration scheme would then depend on how much of the gain from registration accrues to the borrower. Imperfect competition that generates an increase in social surplus (net of costs) may not be sufficient to guarantee that it is optimal for a borrower to register his property. However as $\bar{\gamma} \to \underline{\gamma}$ all of the surplus will accrue to the borrower and hence he will choose to register if charged the marginal cost of doing so only when the surplus created exceeds the cost. Thus, imperfect competition in this case can serve as an impediment to having borrowers register their property even when such institutional arrangements exist, unless registration is subsidized.

5.2 Political Economy

One of the striking features of the data presented in Figure is how so many countries still place significant impediments to registering property thereby making it difficult to use them as collateral. Proposition 8 offers one interpretation of this in terms of the possibility that it is not optimal to improve property rights when market competition is lacking. However, this would happen only when the government puts more weight on borrower welfare compared to that of lenders. One way to think of social weights is arising in political equilibrium reflecting voting, lobbying and bargaining power of different interests as articulated, for example, in Persson and Tabellini (2000).

The results in Propositions 7 and 8 motivate the reason why we would observe different arrangements for registering property based on interests of specific economic groups rather than state competence. Our model predicts that the economic interests of those who earn rents as lenders (such as large banks) should unambiguously favor a reform that increases the availability of collateral. Resistance to reform would, if anything, come from borrowers who would tend to lose if competition is weak as illustrated in Proposition 8.

Our analysis of social collateral suggests that informal lenders who thrive on personalized trade and earn a rent from such trade may try to resist improvements in property rights that enhance market participation. They would tend to lose from the market depth effect identified in Proposition 6. We would therefore expect this group, if political organized, to lobby against reforms which allow more universal access to credit markets and extend the scope of arms-length trade. Thus, poorly developed systems of property registration may reflect the interests of these traditional elites.

Taken together, this discussion makes clear that we should not expect any simple relationship between political institutions and policy reform in this context. It will depend on complementary factors, such as the extent of competition in credit markets. It will also depend upon how political institutions distribute power across the groups who gain and lose.[15]

6 Concluding Comments

This paper has set up a theoretical framework to explore the consequences of extending the use of collateral to support trade in credit markets. This has strong resonance in policy debates and is associated, in particular, with the views advocated forcefully by Hernando de Soto. The analysis is broadly supportive of the idea that creating collateral is likely to have beneficial productivity effects. However, it has emphasized that within reduced form correlations lie a host of particular mechanisms which, in principle, could be explored empirically.

The analysis has also emphasized the possibility that when borrowers are poor and market competition is weak then creating collateral by improving claims to property need to not have a beneficial effect for borrowers. This kind of second-best reasoning suggests a potentially important caveat which does not appear to be widely recognized. Whether this is empirically relevant remains to be seen. However, the fact that property rights reforms are often being contemplated in situations of fragmented markets and extreme poverty certainly gives pause for thought.

[15] This discussion is related to other recent studies of the political economy of institutional reform, e.g, Pagano and Volpin (2005), Caselli and Gennaioli (2008), Perotti and Volpin (2007), Rajan (2007), Biais and Mariotti (2008), and von-Lilienfeld-Toal and Mookherjee (2008).

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7 Appendix: Proofs

Proof of Proposition 1: First of all, we show that if w is high enough then the first-best can be achieved. Suppose we set $r = c$ and $x = x^*(\gamma)$. Then from the ICC (4) $e = e^*(\gamma)$ and the lender's profit is $r - \gamma x^*(\gamma)$. From the borrower's PC (6) we get $p(e^*(\gamma))\, q(x^*(\gamma)) - r - e^*(\gamma) = u$ and using (3) this allows us to solve for $r = S^*(\gamma) + \gamma x^*(\gamma) - u$. As $r = c$ by assumption, so long as $S^*(\gamma) + \gamma x^*(\gamma) - u \geq (1-\tau)\, w$ the first-best allocation is feasible. It will in fact be chosen by the lender as he gets the first-best surplus minus the reservation payoff of the borrower, and he cannot do better than that.■

Proof of Proposition 2:

As $p(e)$ is strictly concave (Assumption 1(i)), $p(e) > ep'(e))$ for all $e > 0$ and so, rearranging terms, $p(e)/p'(e) - e > 0$ for all $e > 0$. Also, due to strict concavity of $p(e)$, it follows directly upon differentiation that $p(e)/p'(e) - e$ is strictly increasing for $e > 0$ (its slope is $\varepsilon(e) > 0$ for all $e > 0$). Therefore, $f(v)$ is monotonically increasing in v.

Given that e is determined by the binding PC, the lender's choice of x is given by

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

It is readily verified that: $\frac{dx}{de} = \frac{\gamma p'(e)}{\{p(e)\}^2\{-q''(x)\}} > 0$. As $\frac{dx}{de} > 0$, $g_v = \frac{dx}{de} f'(v) > 0$.

From the ICC, $r = q(x) - \frac{1}{p'(e)} + (1-\tau)\, w$. Since at the first-best $q(x) - \frac{1}{p'(e)} = 0$ and $e < e^*(\gamma)$ and $x < x^*(\gamma)$ it follows directly that $\rho(v, \gamma) > 0$. Next we show that for $v \in [0, \underline{v}(\gamma)]$, under the optimal contract $e = e_0 < e^*(\gamma), x = x_0 < x^*(\gamma), r = r_0 > c = (1-\tau)w$.Using the ICC and assuming that (8) binds, so that $c = (1-\tau)\, w$, the optimal contracting problem between the lender and borrower can now be written in the following modified form:

$$\max_{\{x,r\}} p(e)(q(x) - \frac{1}{p'(e)}) + (1-\tau)\, w - \gamma x \tag{14}$$

subject to

$$\frac{p(e)}{p'(e)} - e \geq v. \tag{15}$$

Then, using the incentive compatibility condition (4) we can define the function $f(v)$ from:

$$\frac{p(f(v))}{p'(f(v))} - f(v) = v. \tag{16}$$

As $f(v)$ is increasing, this shows that the participation constraint will not bind for low values of v. Given the definition of $\underline{v}(\gamma)$ from (21), and as $\frac{p(e)}{p'(e)} - e > 0$ for all $e > 0$, it follows that $\underline{v}(\gamma) > 0$. Now let $g(v, \gamma)$ be defined by:

$$p(f(v))q'(g(v,\gamma)) \equiv \gamma. \tag{17}$$

be the level of x which equates the marginal product of the input to its marginal cost, γ, when the effort level is determined by (16).

Suppose the lender maximizes his expected profit given by (5) subject only to the incentive constraint (4) and the collateral constraint (8) holding with equality. The effort level and input supply pair (e_0, x_0) will solve:

$$\begin{aligned} p'(e_0(\gamma))q(x_0(\gamma)) &= 1 + \varepsilon(e_0(\gamma)) && (18) \\ p(e_0(\gamma))q'(x_0(\gamma)) &= \gamma && (19) \end{aligned}$$

where

$$\varepsilon(e) \equiv -p''(e)p(e)/\{p'(e)\}^2 \tag{20}$$

is a measure of the degree of concavity of the function $p(e)$.[16] It is as if, compared to the first best, the marginal cost of effort is increased by a factor $\varepsilon(e)$. This allows us to define $\underline{v}(\gamma)$ formally as the level of v at which:

$$e_0(\gamma) = f(\underline{v}(\gamma)). \tag{21}$$

From the ICC, $r_0 = q(x_0) - \frac{1}{p'(e_0)} + (1-\tau)w$. It immediately follows that

$e_0 < e^*$. Otherwise, if $e_0 = e^*$ from (19), $x = x^*(\gamma)$ but this contradicts

(18). The ICC can be rewritten as, using (18):

$$r_0 = \frac{\varepsilon(e_0)}{p'(e_0)} + (1-\tau)w.$$

As $\varepsilon(e) > 0$ (by Assumption 1), $r_0 > c$. The same result holds for all $v \in$

[16] For example, for $p(e) = e^\alpha$, $\varepsilon(e) = \frac{1-\alpha}{\alpha}$.

$[0, \underline{v}(\gamma)]$, given that the PC will not bind in this interval. Hence the result follows.■

Proof of Corollary 1: To characterize the constrained Pareto-frontier, observe that

$$\frac{\partial S}{\partial v} = \left(p'(v)q(g(v,\gamma)) - 1\right) f'(v).$$

For $v \geq \overline{v}$, $p'(e^*)\, q(x^*(\gamma)) = 1$ and also, $f(v) = f(\overline{v})$. Therefore, $\frac{\partial S}{\partial v} = 0$. For $v < \overline{v}$, $p'(v)q(g(v,\gamma)) > 1$ and as $p(e)/p'(e) - e$ is increasing in e, $f'(v) > 0$ and so $\frac{\partial S}{\partial v} > 0$. In the case where the participation constraint does not bind, we have $p'(e_0)q(x_0) = 1 + \varepsilon(e_0)$. Also, differentiating (16) we obtain $f'(v) = \frac{1}{\varepsilon(e)}$. Therefore, for $v \leq \underline{v}(\gamma)$, $\frac{\partial S}{\partial v} = 1$. To check that $S(v,\gamma)$ is decreasing in γ, differentiate to verify that:

$$\frac{\partial S}{\partial \gamma} = \left(p(f(v))q'(g(v,\gamma)) - \gamma\right) g_2(v,\gamma) - g(v,\gamma) = -g(v,\gamma)$$

by the envelope theorem. This completes the proof. ■

Proof of Corollary 2: From the definition of $\hat{u}$, and using Corollary 1:

$$\begin{aligned}
\frac{\partial \hat{u}}{\partial \gamma} &= \frac{\frac{\partial S}{\partial \gamma}}{1 - \frac{\partial S}{\partial \gamma}} < 0 \\
\frac{\partial \hat{u}}{\partial \pi} &= -\frac{1}{1 - \frac{\partial S}{\partial v}} < 0 \\
\frac{\partial \hat{u}}{\partial \left(w(1-\tau)\right)} &= \frac{\frac{\partial S}{\partial v}}{1 - \frac{\partial S}{\partial v}} > 0.
\end{aligned}$$

■

Proof of Proposition 3: This follows directly from the Corollary 1: $S(v,\gamma)$ is increasing in v and v is increasing in τ. Since the outside option of the producer is unchanged, the supplier receives all the gain in surplus. ■

Proof of Proposition 4: The payoff of a producer in this case is given by:

$$u = \underline{v}\left(\underline{\gamma}\right) - (1-\tau)\, w$$

which is clearly decreasing in τ.■

Proof of Proposition 5: This follows directly from Proposition 2. ■

Proof of Proposition 6: This is formally similar to Proposition 5, and hence the proof follows directly from Proposition 2. ■

Proof of Proposition 7: Suppose that $\tau = 1$. Then for $\bar{\gamma}$ close to $\underline{\gamma}$, the outside option is given by $\hat{u}(0, 0, \bar{\gamma})$. Setting $\tau = 0$ will improve the outside option of borrowers $(\hat{u}(0, w, \bar{\gamma}) > \hat{u}(0, 0, \bar{\gamma}))$ and hence they are better off. We show that the more efficient lender is also strictly better off. Let π be defined by:

$$\hat{u}\left(\pi, (1-\tau)\, w, \underline{\gamma}\right) = \hat{u}\left(0, (1-\tau)\, w, \bar{\gamma}\right) \equiv \hat{u}.$$

This is equivalent to

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

Now observe that:

$$\frac{\partial \pi(z)}{\partial z} = S_1\left(z, \underline{\gamma}\right) - S_1(z, \bar{\gamma})$$

which is positive if $S_{12}(z, \gamma) < 0$. This indeed is the case as using the envelope theorem, we have:

$$\frac{\partial S}{\partial \gamma} = -g(v, \gamma) \text{ and } \frac{\partial^2 S}{\partial \gamma \partial v} = -g_1(v, \gamma) < 0.$$

Therefore, $\partial \pi(z) / \partial z > 0$.

Let π' and π'' be defined by:

$$\hat{u}\left(\pi', 0, \underline{\gamma}\right) = \hat{u}(0, w, \bar{\gamma}) \equiv \hat{u}'$$

and

$$\hat{u}\left(\pi'', w, \underline{\gamma}\right) = \hat{u}\left(0, 0, \bar{\gamma}\right) \equiv \hat{u}''.$$

As $\hat{u}\left(0, w, \bar{\gamma}\right) > \hat{u}\left(0, 0, \bar{\gamma}\right)$, $\hat{u}' < \hat{u}''$. Given $S_{12}\left(v, \gamma\right) < 0$, therefore,

$$\begin{aligned} & S\left(\hat{u}', \underline{\gamma}\right) - S\left(\hat{u}', \bar{\gamma}\right) \\ < \quad & S\left(\hat{u}'' + w, \underline{\gamma}\right) - S\left(\hat{u}'' + w, \bar{\gamma}\right) \end{aligned}$$

i.e., $\pi' < \pi''$.

Finally, since the PC is binding, by Proposition 1, e and x will go up. ■

Proof of Proposition 8: This follows directly from Proposition 4. ■

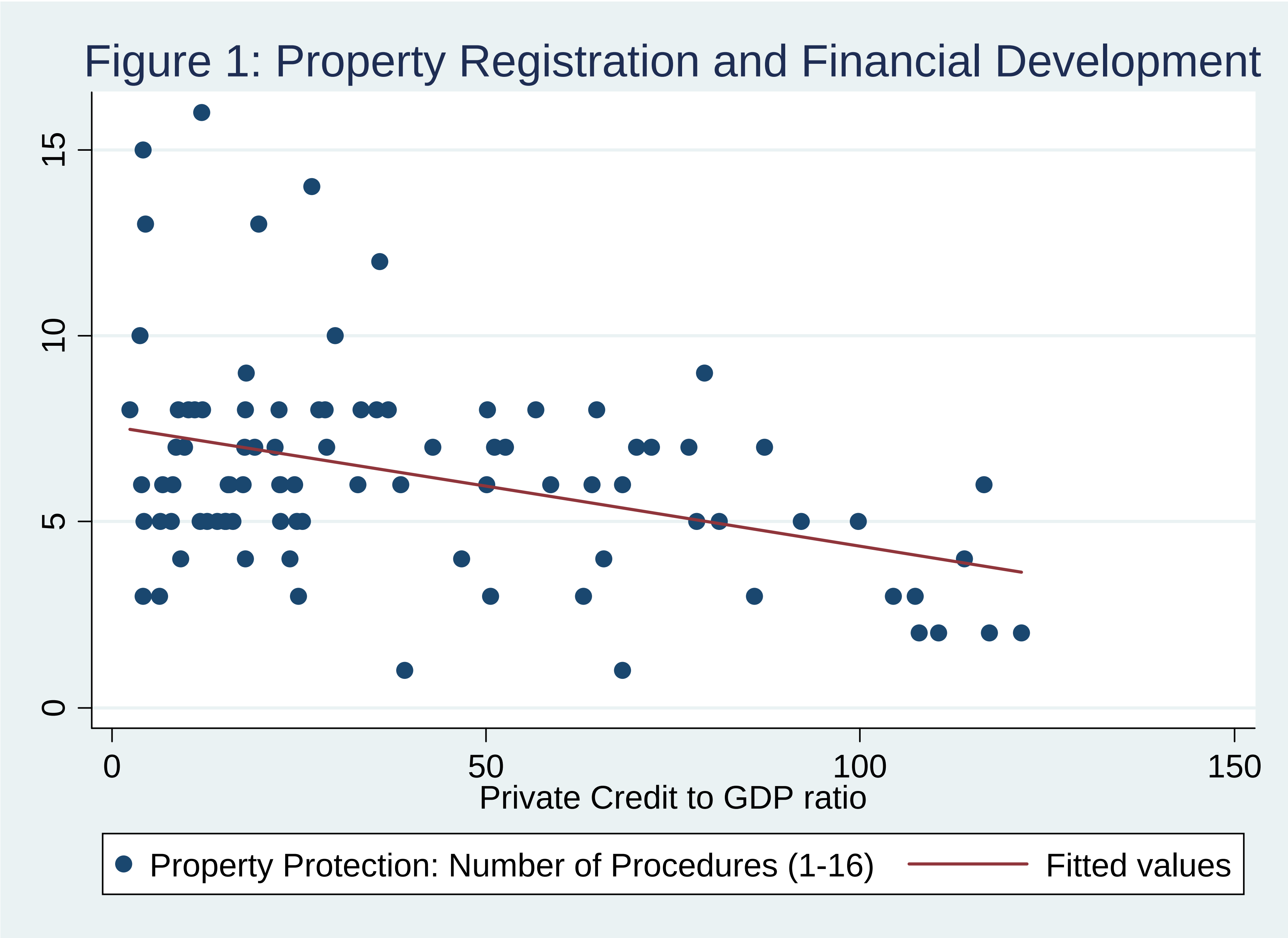
Figure 1: Property Registration and Financial Development
0
5
10
15
0
50
100
150
Private Credit to GDP ratio
Property Protection: Number of Procedures (1-16)
Fitted values

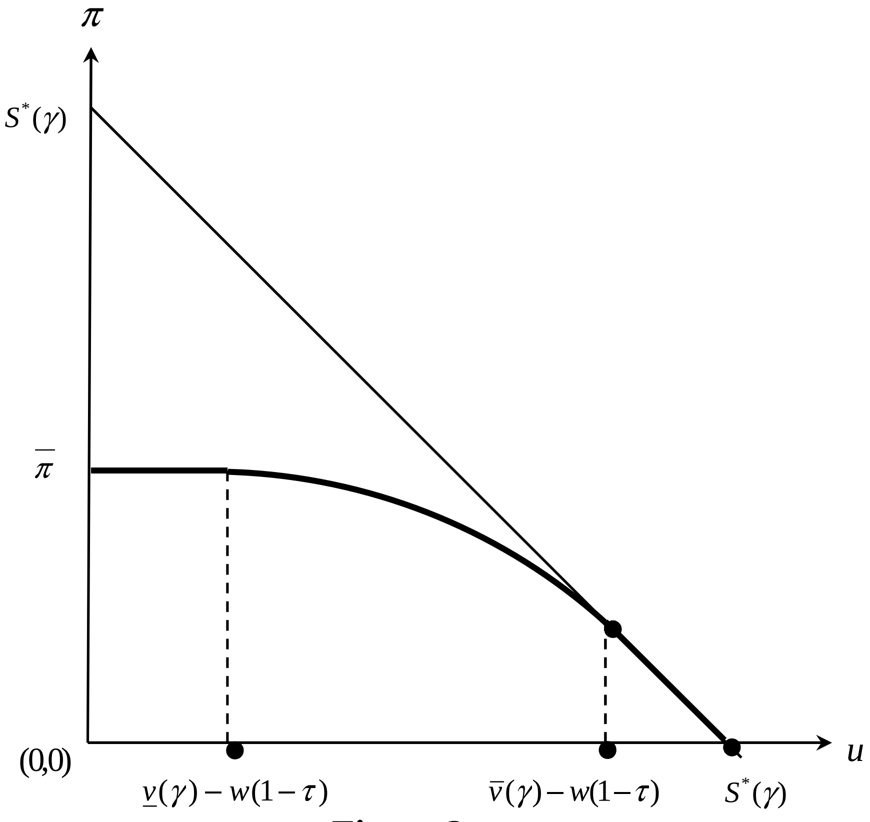
π
$S^*(\gamma)$
$\bar{\pi}$
(0,0)
u
$\underline{v}(\gamma)-w(1-\tau)$
$\bar{v}(\gamma)-w(1-\tau)$
$S^*(\gamma)$

Figure 2