Endogenous Property Rights, Credit Market, and Economic Development

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Abstract

Empirical evidence suggests that credit market can catalyze property rights reforms. We illustrate this in a theoretical framework where a borrower needs external funding to finance a project and must expend costly effort to protect output from predation. We consider two possible equilibrium loan contracts. In the first, a lender leaves the decision to protect output to a borrower. In the latter, a lender actively sets the standard of property protection as a precondition for lending. The second contracting regime results in a higher level of property rights enforcement. Significantly, the level of economic development determines the equilibrium contracting form and vice versa. Based on this analysis, this paper jointly determines the evolution of property rights and economic development. The analysis also sheds light on the conditions for which a country could remain trapped in a low growth trajectory with poor quality of property rights institutions.

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1 Introduction

There is a general consensus that a system of strong property rights matters for investment, innovation, and entrepreneurship. There also exists a large variation in the quality of property rights institutions across the countries. A dominant strand of literature appeals to differences in exogenous initial conditions facing countries as a plausible source of this variation. This literature stresses that differences in legal traditions formed centuries ago in Europe and spread via conquest and colonization around the world can account for this cross-country differences in property rights [La Porta et al. [1998]; La Porta et al. [1999]]. Likewise, Engerman and Sokoloff [1997], Sokoloff and Engerman [2000], Acemoglu et al. [2001], Acemoglu et al. [2002] suggest that the cross-country variation in the quality of property rights institutions today can be traced back to the differences in endowments in the early stages of colonization.

Despite being valuable in their own rights, the above literature focus primarily on the genesis of property rights laws as they appear in the books. In this paper, we want to draw an important distinction between the *de jure* and *de facto* (effective) property rights. There are reasons to draw this distinction. Take for example, the case of India, Pakistan, and Bangladesh. All the three countries share the same colonial history and their legal codes are strictly drawn from English Common Law. Yet, the three countries vary widely in terms of their property rights status. Their respective ranking in the International Property Rights Index [Levy-Carciente [2018]] are 59, 121, and 122[1]. Likewise, Bubb [2013] documents that Divergent state laws of Ghana (Common Law) and Cote d'Ivorie (French Law) have had little effect on the *de facto* property rights institution. Instead areas that are suitable for growing coca have greater prevalence of property rights. Thus, there exists a difference between the *de jure* and the effective property rights and we view the later as being jointly determined by the laws that exists in the books as well as the initiatives undertaken individually and/or collectively to uphold such laws. This paper focuses on this private initiative and seeks to anchor the basis for such initiatives in the contractual arrangements between the borrowers and the lenders in a financial markets. In particular, we argue that the process of development offers reasons to modify the financial contracts in such a way that it creates more incentives for the agents to secure their property, thus resulting in a more effective property rights system.

Our focus on the financial market is not arbitrary. Over the last few decades, a substantial volume of research has been directed in understanding the existence of linkages between real and financial development of economies. Using cross-country data, some research have drawn lines running from the size and the structure of the financial markets to the long run economic performance of the countries [McKinnon [1973], Bencivenga and Smith [1991], King and Levine [1993a], King and Levine [1993b], Levine et al. [2000]]. Some researchers have postulated that the causality runs in the opposite direction [Gurley and Shaw [1967]; Jung [1986]; Demetriades and

[1] The International Property Rights index serve as a barometer for the status of property rights across the world and is constructed on basis of information on legal and political environment and the protection of physical as well as intellectual property rights.

Hussein [1996]]. Yet, others have strongly argued in favor of the co-evolution of the financial and the economic development [Greenwood and Jovanovic [1990]; Bose and Cothren [1996]; Calderón and Liu [2003]]. Parallel to this, a large body of empirical evidence points to a two-way causal relationship between the structure of the financial sector and the quality of property rights institution. One group of research suggests that the legislation protecting property often encompasses financial contracts [Porta et al. [2002], Claessens and Laeven [2003], Beck et al. [2005]] and improve availability of loan and contracting efficiency by allowing borrowers to pledge collateral [Djankov et al. [2007], De Soto [2000], Feder et al. [1988], Feder and Nishio [1998]]. Here the causality runs from the property rights institutions to the functioning of the financial markets. There is also strong evidence in the data to suggest that the causality runs in the reverse direction[2] [Bose et al. [2014]; Miletkov and Wintoki [2009]]. Collectively, the existing literature then paints the picture that prosperity, financial development and the quality of property rights are intertwined. It is therefore important to consider a single framework that is capable of capturing the joint evolution of all the three variables. Our model seeks to serve that purpose.

To fix the idea, consider a simple economy where firms must access external funds to finance investment. Despite having laws in the book, the right to property is imperfect in the sense that a firm's output may be encroached by a third party unless a firm takes costly initiatives to safeguard the output. Such encroachment has detrimental consequences for the borrowers as well as for the lenders. In such a setting, we consider two types of financial contracts. In the first type, a lender transfers funds to a borrower while leaving the decision to protect the produce at the discretion of the borrower. In the second possible contract, a lender directly sets the standard of property protection as a precondition for lending. Significantly, the second contract allows for a higher initiative to protect property. With this insight, we jointly determine the optimal contracting regime, the development path, and the quality of the property rights regime to show that changes in the lending behavior along the path of development can lead to a more effective property rights institution. However, for this to happen, the level of development must cross a certain threshold level, below which countries may remain saddled with a low level of prosperity and poor quality of effective property rights.

The remainder of the paper is organized as follows. In Section 2 we describe the environment. Section 3 describes the two contracting regimes and their implications for effective property rights within a partial equilibrium framework. In Section 4 we evaluate the impacts of the contracting regimes on the growth path of an economy. Section 5 combines the results from the previous sections and jointly determines the equilibrium financing contract, the path of capital accumulation, and the quality of the property rights within a dynamic general equilibrium

[2]One can easily think of a number of reasons for such reverse causality to hold. For example, engineering an effective property rights institution is a costly affair and for such institution to be viable, the demand for the service offered must cross a certain threshold. A mature financial market helps to meet this prerequisite. A mature financial system also helps to set up an efficient legal and bureaucratic machinery which can significantly lower the cost of setting up and maintaining high quality property rights institutions.

setting. Section 5 concludes with some remarks.

2 The Environment

We consider an economy that consists of an infinite sequence of two-period lived overlapping generations. Agents are divided into three groups of market participants - households, capital-producing firms, and final good producing firms. We suppose that all agents are risk neutral, deriving utility only from old-age consumption[3]. In absence of population growth, we normalize the size of each group to 1 and proceed with a description of circumstances facing each type of agent born at time t.

2.1 Households

Each young household is endowed with one unit of labor which is supplied inelastically to the market for a competitively determined wage rate, w_t. We assume that there exists coalitions of households which serve as financial intermediaries. Each young household deposits his time t wage earnings, w_t, with a financial intermediary in return for output at $t+1$ which is to be consumed during his old age. At time t, financial intermediaries lend deposits to a group of firms who are able to convert time t output into capital that is to be deployed during the next period's output production. A description of the capital-producing firms is furnished below. Finally, we assume that under competition financial intermediaries seek to maximize returns to its depositors.

2.2 Capital-Producing Firms (Borrowers)

Each capital producing firm begins life with zero resources, except for an access to a technology that converts one unit of time t output into $Q > 1$ units of capital to be used during the time $t+1$ output production. Since these firms are not endowed with any resources, external funding is required to utilize this technology and such funding is obtained from financial intermediaries. Without the loss of generality, we assume that the financial intermediaries divide the total deposit, w_t, equally among the firms. Since the number of capital-producing firms is normalized to 1, each capital-producing firm obtains w_t amount of funding. The capital that is produced is sold to the output-producers during $t+1$ at a competitively determined market price. A firm pays the lenders from the proceeds of this sale and consumes the rest during his adulthood.

[3] It is straight-forward to include consumption-savings decision in our model without altering any of the main conclusions. To keep the analysis streamlined, we have chosen to leave this decision out of the model.

2.3 Final Goods-Producing Firms

These firms are active only during adulthood (period $t+1$) when a firm employing l_{t+1} unit of labor and k_{t+1}units of capital is able to produce output according to

$$y_{t+1} = Ak_{t+1}^{\alpha} l_{t+1}^{1-\alpha} \tag{1}$$

where $A > 0$ and $0 < \alpha < 1$. An output-producing firm hires labor from the young cohort of households who are born at $t+1$. Whereas, capital is supplied by those agents who have claim over the capital produced during the previous period. Both capital and labor are sold to an output producer at competitively determined factor prices. In presence of complete factor mobility, all output producers employ equal amounts of labor and capital. Since there are equal number of households and output-producing firms, we have $l_{t+1} = 1$. Accordingly, the competitively-determined wage rate and the rental rate of capital facing each of the producers are given by

$$w_{t+1} = A(1-\alpha)k_{t+1}^{\alpha} \tag{2}$$

and

$$\rho_{t+1} = A\alpha k_{t+1}^{\alpha-1} \tag{3}$$

In the presence of constant returns to scale, the output is used up when the owners of labor and capital are paid according to the above rates.

2.4 Property Rights

In this paper, we posit that effective property rights are shaped by the laws that exist in the books and also by the initiatives that the agents take to uphold such laws. These initiatives are the focus of our analysis. To begin, we assume that the rights to property are imperfect in the sense that a capital-producing firm may lose rights to its produce to a third party[4] unless the firm takes initiatives to protect and exercise rightful claim over the produce. Such initiatives involve costs. To put things in perspective, consider a situation where laws may exist against encroachments on private properties. However, an individual may need to undertake a variety of costly procedures such as surveying the land, drawing up legal deeds, notarizing the deed in court, hiring securities and so on to uphold such a law. Evidently, initiatives such as these help to secure properties but do not eliminate the possibility of predation. To fix these ideas, we assume that with probability h a capital-producing firm is able to exercise full rights over its produce and that the value of h is increasing in the amount of effort and/or resources incurred by the firm in securing its produce. With the remaining probability, $(1-h)$, a firm loses its right over its produce and therefore is forced to declare default on the loan. We also assume that the cost of securing the property is concave in effort and/or resources incurred. We do

[4]To keep the exposition simple, we do not explicitly bring in another group of individuals who will benefit at the expense of others. This can be done with ease provided we treat this group as a separate entity.

not associate this cost to any particular action. Instead we interpret this cost as the price of a variety of initiatives that a firm can undertake to protect its property from predation. To economize on the notations, we bypass the effort variable and represent the expected return of a firm operating the capital project as a simple function of h:

$$h(Q-R)w_t\rho_{t+1} - \Theta\frac{h^2}{2} \tag{4}$$

Here the term $h(Q-R)w_t\rho_{t+1}$ represents a firm's expected profit (net of the interest payments at a gross rate R) evaluated at a competitively determined $t+1$ market price of capital, ρ_{t+1}. The second term captures the cost of protecting property that is increasing and quadratic in the choice of h. The parameter Θ is to be viewed as being determined by efficiency of the existing legal and bureaucratic system that helps to uphold the laws in the book.[5]. A lower value of Θ reduces the costs for an agent to enforce existing laws. It is important to note that a firm's own initiative to protect the property and therefore the choice of h is endogenous in our model and is in part determined by the credit market conditions. In the following section we explore this relationship in detail.

3 Credit Market and Financial Contracts

Central to this paper is the idea that the quality of property rights is not impervious to changes in the economic environment for which financial intermediaries can act as a catalyst. To capture this idea we consider two different types of financial contacts that financial intermediaries can use to transfer funds to the borrowers. Each contract has a different implication for effective property rights. First, consider a contract where a financial intermediary does not take into account property right protection as a precondition for lending and leaves the optimal choice of h to the borrower. In this case, a borrower's choice of h is influenced indirectly by the terms of the lending. We denote this contractual arrangement as C^I where the superscript I indicates an indirect role that a financial intermediary plays in the decision of protecting property. In the second contract, a financial intermediary can take an active role by stipulating a value of h that a borrower must choose before any loan transaction can take place. In this case, the value of h chosen by a financial intermediary becomes an explicit element of the financial contract. We denote this contract by C^D to reflect an intermediary's direct intervention in the decision of h. The primary objective of this section is to determine the elements of the contracts $C^I$and C^D, and to pin down the states under which one contract is preferred by the financial intermediary over the other. For the purpose of a clear exposition, we assume for now that the financial intermediaries decide on the contracting form while taking the capital stock k_t, the loanable fund, w_t, and the time $t+1$ rental rate of capital, ρ_{t+1}, as given. A joint determination of the financial contract and the state of the economy is addressed in the Sections 4 and 5 of this

[5]Some example:How long does it take to resolve legal cases in developing versus in developed countries. Comment on the role of corruption.

paper.

3.1 The Contract Type C^I

As noted earlier, financial intermediaries maximize the utility of their depositors under competition. Also, financial intermediaries divide the loanable deposits, w_t, equally among the borrowers. Since the population size of borrowers is normalized to 1, each firm receives a loan amount of w_t. The contract C^I at time t takes the form of a standard debt contract (R_t^I, q_t^I), where R_t^I and q_t^I refer to the gross interest rate and the loan quantity offered to a borrower. Let V_t^I and U_t^I denote the payoffs to a financial intermediary and a borrower under the contract C^I, respectively. Note that a lender receives $R_t^I q_t^I$ amount of time t capital only when a borrower is able to exercise full rights over his produce, an event that occurs only with a probability h_t. Furthermore, capital at time $t+1$ is valued at a price ρ_{t+1}. Accordingly, the expected payoff to a financial intermediary, V_I, is given by $h_t R_t^I q_t^I \rho_{t+1}$. Similarly, the value of a borrower's share and his net expected payoff under the contract C^I are given by $h_t(Q - R_t^I)q_t^I\rho_{t+1}$ and $h_t(Q - R_t^I)q_t^I\rho_{t+1} - \Theta\frac{h_t^2}{2}$, respectively. The elements of the contract at time t are determined by a financial intermediary by solving the following problem:

$$\max_{R_t^I, q_t^I} V_t^I \equiv h_t R_t^I q_t^I \rho_{t+1} \tag{5}$$

Subject to

$$h_t = \arg\max_{h_t} \left[U_t^I \equiv h_t(Q - R_t^I)q_t^I\rho_{t+1} - \Theta\frac{h_t^2}{2} \right] \tag{6}$$

and subject to a set of feasibility constraints: $0 < h_t < 1$, $U_t^I \geq 0$ and $q_t^I \leq w_t$. It is straightforward to see from equation (6) that the choice of h depends on the terms of the contract. The solution to the above problem is easy to obtain and is given by

$$q_t^I = w_t; R_t^I = \frac{Q}{2}; h_t^I = \frac{Q}{2\Theta} w_t \rho_{t+1}; U_t^I = \frac{[Q w_t \rho_{t+1}]^2}{8\Theta} > 0; V_t^I = \frac{[Q w_t \rho_{t+1}]^2}{4\Theta} \tag{7}$$

For now, we assume that the ratio of Q and Θ is small enough to bound h_t^I in the $(0,1)$ interval. Of course, since h also depends on the value of w_t and ρ_{t+1} a more detailed restriction is warranted to ensure $h \in (0,1)$. We discuss this after we find values of w_t and ρ_{t+1}that are consistent with the contracts being offered in the market. Finally note that, under the contract C^I a borrower's individual-rationality constraint does not bind and a borrower receives $U_t^I > 0$. The reason for this is straight-forward. A a borrower's choice of h is inversely related to a lender's choice of R_t^I. Therefore an attempt by a lender to push U_t^I to 0 by increasing the value of R_t^I could in fact diminish a lender's expected payoff due to a borrower's low incentive to secure property. Of course, a lender could consider a different contracting form where the choice of h is not left to the borrower and a lender is not constrained in increasing his/her share. We discuss such a contract below.

3.2 The Contract Type C^D

Here we consider an alternative contracting form in which a lender decides on the value of h_t. In other words, the lender sets a level initiative to be undertaken by a borrower to protect property as a precondition for lending. We denote this contract as $C^D \equiv (q_t^D, R_t^D, h_t^D)$. As before, q_t^D and R_t^Ddenote the loan quantity and the interest rate associated with the contract. The term h_t^Drepresents the quality of the property rights that a lender requires a borrower to implement before the loan can be disbursed. Of course, in the absence of any verification, a borrower faces the incentive to misrepresent the effort level and to set $h_t \neq h_t^D$. Therefore some monitoring is necessary. We assume that a lender verifies $h_t = h_t^D$ at a fixed[6] cost δ. Under this arrangement, a lender sets the terms of the contract as a solution to the following problem:

$$\max_{R_t^D, q_t^D, h_t^D} h_t^D R_t^D q_t^D \rho_{t+1} - \delta \tag{8}$$

subject to

$$h_t^D (Q - R_t^D) q_t^D \rho_{t+1} - \Theta \frac{(h_t^D)^2}{2} \geq 0 \tag{9}$$

The solution to the above problem is given by

$$q_t^D = w_t; R_t^D = \frac{Q}{2}; h_t^D = \frac{Q}{\Theta} w_t \rho_{t+1}; U_t^D = 0; V_t^D = \frac{[Q w_t \rho_{t+1}]^2}{2\Theta} - \delta \tag{10}$$

A few points worth noting here. First, h_t being the lender's choice, a lender is now able to reduce a borrower's share to its minimum (i.e., $U_D = 0$.) Second, $h_t^D > h_t^I$. Thus, the rights to property are more secure when financial intermediaries exercise their control over the choice of h. Finally, a direct comparison of V_I and V_D, from equations (7) and (10) yields that a lender would prefer the contract C^D over the contract C^I when

$$w_t \rho_{t+1} > \frac{2\sqrt{\Theta \delta}}{Q} \equiv \Omega \tag{11}$$

Equation (11) has a straight-forward interpretation. Since the contract C^D requires a cost to implement, a larger scale of operation as represented by a higher value of $Q w_t \rho_{t+1}$ makes the contract C^D a viable option for an intermediary. Also, it is worth noting that the choice of contract depends on the value of $w_t \rho_{t+1}$. At the same time, the variable ρ_{t+1} is likely to be influenced by the time t contracting regime. It is this feed-back loop that we analyze in the next two sections to fully characterize the joint evolution of effective property rights, financial market and the economic development.

[6]The cost of monitoring need not be fixed in our case and could increase with the loan amount. Our results remain unchanged as long as there remains a scale effect causing the cost of monitoring to increase with the loan amount at a decreasing rate.

4 Contracting Regimes and Capital Dynamics

The primary goal of this section is to evaluate the effects of a contracting regime on the price of capital as well as on the capital dynamics. First recall that capital available for $t+1$ output production originates from a group of time t capital-producing firms who are able to protect their rights. The use of the Law of Large Numbers then implies $k_{t+1} = h_t Q w_t$, where h_t can take the value either h_t^I or h_t^D (as defined by equation 7 and 10) depending on the nature of the contract that prevailed at time t. Suppose that the contract C^I is in place at time period t so that $k_{t+1} = k_{t+1}^I = h_t^I Q w_t$. After substituting the values for h_t^I and w_t from equations (7) and (2) respectively and after recognizing that $\rho_{t+1} = A\alpha k_{t+1}^{\alpha-1}$ (from equation (3)), we rewrite k_{t+1}^I as

$$k_{t+1}^I = \left[\frac{Q^2}{2\Theta}\right]^{\frac{1}{2-\alpha}} A^{\frac{3}{2-\alpha}} \alpha^{\frac{1}{2-\alpha}} (1-\alpha)^{\frac{2}{2-\alpha}} k_t^{\frac{2\alpha}{2-\alpha}} \equiv \Psi_1 k_t^{\beta} \tag{12}$$

It is easy to verify that $\beta \equiv \frac{2\alpha}{2-\alpha} < 1$ when the share of capital is within an acceptable range. In our case, the value of α must lie in the interval $0 < \alpha < \frac{2}{3}$, which we assume to be true throughout the analysis. Now suppose that the contract C_D is in place at time t, and as a result, the $t+1$ capital is given by $k_{t+1} = k_{t+1}^D = h_t^D Q w_t$ where h_t^D is given by equation (10). As before, using equations (2), (3) and (10), we express the capital dynamics consistent with the contract C^D as

$$k_{t+1}^D = \left[\frac{Q^2}{\Theta}\right]^{\frac{1}{2-\alpha}} A^{\frac{3}{2-\alpha}} \alpha^{\frac{1}{2-\alpha}} (1-\alpha)^{\frac{2}{2-\alpha}} k_t^{\frac{2\alpha}{2-\alpha}} \equiv \Psi_2 k_t^{\beta} \tag{13}$$

Let k_{ss}^I and k_{ss}^D denote the steady states associated with the dynamics outlined in equations (12) and (13), respectively. Recall that the initiative to protect property under the contract C^D is higher than under the contract C^I. As a result, $\Psi_2 > \Psi_1$ the capital path is pushed to a higher trajectory under the contract C_D with $k_{ss}^D > k_{ss}^I$. Moreover, for a given k_t, the time $t+1$ price of capital is lower when the contract C^D is in place at time t. In particular, we have

$$\rho_{t+1}^I = A\alpha \left[\Psi_1 k_t^{\beta}\right]^{\alpha-1} > \rho_{t+1}^D = A\alpha \left[\Psi_2 k_t^{\beta}\right]^{\alpha-1} \tag{14}$$

In Figure 1, we summarize the relationships between the contracting regimes, price of capital and the capital dynamics.

We conclude this section with some comments on the restrictions that are necessary to bind h in the $[0,1]$ interval for the entire analysis. Since $h^D > h^I$, it is sufficient to focus on the values of h^D. Using equations (10) and (14), we express the value of of h_t^D as $h^D = \frac{Q}{\Theta} w_t \rho_{t+1}^D = \frac{Q}{\Theta} w_t A\alpha \left[\Psi_2 k_t^{\beta}\right]^{\alpha-1}$. After recognizing that $\beta = \frac{2\alpha}{2-\alpha}$ and after substituting the value of w_t from (2), it easy to verify that h^D is increasing in k_t and that h^D attains the highest value, h_{max}^D, when $k_t = k_{ss}^D = \Psi_2^{\frac{1}{1-\beta}}$ (as derived from equation (13)). Finally, after substituting the value of Ψ_2 it is verifiable that $h_{max}^D = g(Q, \Theta, A)$ with $g_Q > 0; g_\Theta < 0$ and $g_A > 0$. Therefore,

if the values of Q and/or A are not too large or if the value of Θ is not too small the a wide array of parameter constellations admits h to remain bounded in the interval $(0, 1)$ for the entire analysis.

5 Joint Determination of Property Rights and Economic Development

The analysis presented in the Section 3 suggests that the choice of the contracting regime at time t is influenced by the values of the current and the future state variables such as w_t and ρ_{t+1}. Whereas, the results in the Section 4 highlight the fact that the capital dynamics as well as the $t+1$ price of capital, ρ_{t+1}, depend on the choice of the financial contract at the time period t. Therefore the relationship between the contracting regimes and the state economy represents two-way causality and both should be determined jointly to capture the endogenous evolution of financial contract and effective property rights along the path of development. In this section we seek to achieve this goal with the help of the following set of results.

Lemma 1: *Let $\chi^I(k_t) \equiv w_t\rho^I_{t+1}$ and $\chi^D(k_t) \equiv w_t\rho^D_{t+1}$, where ρ^I_{t+1} and $\rho^D_{t+1}$are given by equation (14). $\chi^I(k_t)$ and $\chi^D(k_t)$ are both increasing in k_t. Consider the value of Ω as defined in equation (11), and define k^c_I and k^c_D to be the values of k_t for which $\chi^I(k_t) = \Omega$ and $\chi^D(k_t) = \Omega$, respectively. Then $k^c_D > k^c_I$.*

Proof: After substituting the values of w_t, ρ^I_{t+1}, and ρ^D_{t+1} from equations (2) and (14), and after recalling that $\beta = \frac{2\alpha}{2-\alpha}$, it is straight-forward to verify that both $\chi^I(k_t)$ and $\chi^D(k_t)$ are increasing in k_t and are given by $\chi^I(k_t) = A^2\alpha(1-\alpha)\Psi_1^{\alpha-1}k_t^{\frac{\alpha^2}{2-\alpha}}$ and $\chi^D(k_t) = A^2\alpha(1-\alpha)\Psi_2^{\alpha-1}k_t^{\frac{\alpha^2}{2-\alpha}}$. Furthermore, $\chi^I(k_t) > \chi^D(k_t)$ since $\Psi_2 > \Psi_1$. Accordingly, $k^c_D > k^c_I$. Please refer to Figure 1 for a diagrammatic representation■

Given $k^c_D > k^c_I$, we are able to characterize the economy into three distinct development regimes based on the relationships of k_t with k^c_D and k^c_I. Our claim is that when k_t is low enough such that the relation $k_t < k^c_I < k^c_D$ holds, the contract C^I is the chosen mode of transferring funds between the borrowers and the lenders. Conversely, when $k^c_I < k^c_D < k_t$ holds for high enough values of k_t, the contract C^D emerges as an equilibrium contract across the economy. Since the measure of property rights, h_t, depends on the values of $w_t\rho_{t+1}$ [through equations 7 and 10] and since $\chi^I(k_t) \equiv w_t\rho^I_{t+1}$ *and* $\chi^D(k_t) \equiv w_t\rho^D_{t+1}$ are both increasing in k_t, the quality of property rights within each regime will improve with capital accumulation. However, the regime $k^c_I < k^c_D < k_t$ is associated with a relatively better protection of property. This is true because for this regime the contract C^D dominates the contract C^I and $h^D > h^I$. We also claim that the equilibrium contract is supported by a mix of the contracts C^I and C^D in the intermediate regime where $k^c_I < k_t < k^c_D$ holds. Moreover, this regime the mix shifts

in the favor of the contract C^D with capital accumulation in the interval $k_I^c < k_t < k_D^c$. We formalize these claims in the Proposition 1.

Proposition 1: Suppose that μ_t represents the fraction of intermediaries who offer the contract C^I at time t, and the rest offer the contract C^D. Then, in equilibrium

(i) $\mu_t = 1$ if $k_t \leq k_I^c < k_D^c$ and $\mu_t = 0$ if $k_I^c < k_D^c \leq k_t$.

(ii) μ_t decreases monotonically with the capital stock k_t in the interval $k_I^c < k_t < k_D^c$ and converges to 0 as k_t converges to k_D^c.

Proof:

(i) Suppose that $k_t \leq k_I^c < k_D^c$. Consider a behavior profile where $\mu_t = 1$ so that at time t all intermediaries offer the contract C^I. Accordingly, $w_t\rho_{t+1} = w_t\rho_{t+1}^I \equiv \chi^I(k_t)$. Since $\chi^I(k_t)$ is increasing in k_t and since k_I^c solves $\chi^I(k_t) = \Omega$, we have $\chi^I(k_t) < \Omega$ for $k_t < k_I^c$. Therefore, according to equation (11), no financial intermediary has any inventive to deviate from this behavior profile. To see that $\mu_t = 1$ represents an unique equilibrium, consider the other extreme where all intermediaries at time t offer the contract C^D so that $\mu_t = 0$ and $w_t\rho_{t+1} = w_t\rho_{t+1}^D \equiv \chi^D(k_t)$. Since $\chi^D(k_t) < \chi^I(k_t)$ and since $\chi^I(k_t) < \Omega$, we have $\chi^D(k_t) < \Omega$. Therefore it is optimal for an intermediary to deviate and offer the contract C^I and the equilibrium is not supported by the behavior profile with $\mu_t = 0$. Similarly, with $k_I^c < k_D^c \leq k_t$ the relation $\chi^I(k_t) > \chi^D(k_t) > \Omega$ holds . Therefore $\mu_t = 0$ emerges as an unique equilibrium behavior.

(ii) Suppose that $k_I^c < k_t < k_D^c$. Neither the behavior profile $\mu_t = 1$ nor the profile $\mu_t = 0$ support an equilibrium since $\chi^I(k_t) > \Omega$ and $\Omega > \chi^D(k_t)$ hold for any values of k_t in this interval. However, there exists an equilibrium that is supported by a mixed behavior profile with $\mu_t \subset (0,1)$. To see this, denote $k_{t+1}^m$and ρ_{t+1}^m as the time $t+1$ capital stock per firm and the price of capital respectively when $\mu_t \subset (0,1)$ fraction of intermediaries offer the contract C^I and the rest offer the contract C^D. It is easy to verify that $k_{t+1}^m = [\mu_t\Psi_1 + (1-\mu_t)\Psi_2]\, k_t^\beta$ and $\rho_{t+1}^m = A\alpha\left[\{\mu_t\Psi_1 + (1-\mu_t)\Psi_2\}\, k_t^\beta\right]^{\alpha-1}$. Further, since $\Psi_2 > \Psi_1$(equations 12 and 13), we have that $k_{t+1}^I < k_{t+1}^m(\mu_t) < k_{t+1}^D$, and $\rho_{t+1}^I > \rho_{t+1}^m(\mu_t) > \rho_{t+1}^D$. As before, define $\chi^m(k_t,\mu_t) = w_t\rho_{t+1}^m = A^2\alpha(1-\alpha)k_t^{\alpha+\beta(\alpha-1)}\left[\{\mu_t\psi_1 + (1-\mu_t)\psi_2\}^{\alpha-1}\right]$ with $\beta = \frac{2\alpha}{2-\alpha}$. Since $\rho_{t+1}^I > \rho_{t+1}^m(\mu_t) > \rho_{t+1}^D$, we have $\chi^I(k_t) > \chi^m(k_t,\mu_t) > \chi^D(k_t)$. Of course, $\chi^m(k_t,\mu_t) \to \chi^I(k_t)$ as $\mu_t \to 1$ and $\chi^m(k_t,\mu_t) \to \chi^D(k_t)$ as $\mu_t \to 0$. Then for a value of $\mu_t \subset (0,1)$ for which $\chi^m(k_t,\mu_t) = \Omega$ holds supports an equilibrium in which μ_t fraction of intermediaries offer the contract C^I and the rest offer C^D. Finally, $\chi^m(k_t,\mu_t)$ is increasing in both k_t and μ_t. Therefore for $\chi^m(k_t,\mu_t) = \Omega$ to hold in the interval, μ_t must decrease as $k_t \to k_D^c$. Again, please refer to Figure 1 for a diagrammatic presentation of the proof. ■

An intuition underlying the above proposition is easy to obtain. The payoff to a financial intermediary depends on the size of the loan, w_t, as well as on the price of capital , ρ_{t+1}. Further, ρ_{t+1} decreases when an increasing number of lenders offer the contract C^D. When $k_t > k_D^c$, the

market is able to accommodate all lenders offering C^D because the size of the loan, w_t, is large enough to compensate for the costs of monitoring as well for the negative effects on the price of capital. The scope of this is missing in the interval $k_I^c < k_t < k_D^c$ due to lower values of w_t. Therefore the equilibrium can only support a fraction of lenders offering C^D and the fraction increases monotonically as $k_t \to k_D^c$.

The results obtained so far imply that the ruling contract will depend on the value of k_t relative to the values of k_D^c and k_I^c. However, the long run dynamics of the economy rest on the relationships of the initial capital stock, k_0, with the two critical values, k_D^c and k_I^c, and the two steady states, k_{ss}^D and k_{ss}^I [as defined by equations 12 and 13]. Of course, the exact relationship will depend on the exogenous parameters. We shed some light on this issue at the end of this section. For now, we consider the two polar cases that are interesting and broadly encompass the possible outcomes. In the first case, the economy makes a smooth transition from a low to a high quality of property rights regime and also from a low to a high level of economic prosperity. In the second case, the economy is destined to remain trapped in a low steady state with poor quality of property rights protection.

Case 1: $k_0 < k_I^c < k_D^c < k_{ss}^I < k_{ss}^D$

In this case, to begin with, the loanable funds will change hands using the contract C^I with little initiatives to protect property and the capital will accumulate according to equation (12). Since $k_I^c < k_D^c < k_{ss}^I$, the capital stock will grow and will enter the interval $[k_I^c, k_D^c]$ before k_{ss}^I is reached. As soon as the capital stock exceeds k_1^c, incentive to offer the contract C^D will emerge for some lenders and the economy will witness an improvement in the average effective property rights. This improvement will continue in the interval (k_I^c, k_D^c) as more and more lenders will resort to the contract C^D. As a result, the capital will accumulate along the path joining k_I^c and k_D^c (please refer to Figure 2). When capital stock will exceed k_D^c, the environment will be suitable for all the lenders to offer the contract C^D. As a result, the economy will make a transition to the higher capital path as described by equation (13) and will be destined for a higher steady state k_{ss}^D with most effective rights to property. Of course, the same end result will transpire if $k_D^c < k_0 < k_{ss}^D$. The only difference in this case is that the economy will begin with the equilibrium contract C^D and will converge to k_{ss}^D along the path described by equation (13).

Case 2: $k_0 < k_{ss}^I < k_I^c < k_D^c < k_{ss}^D$

In this case, the economy will begin with the equilibrium contract C^I and will grow along the lower accumulation path. Since, $k_{ss}^I < k_I^c$, the economy will reach the steady lower steady state, k_{ss}^I, before any incentive to offer the contract C^D can emerge. As a result, the contract C^I will throughout remain as the equilibrium contract and the economy will remain trapped in the low level of prosperity with poor effective property rights.

It is clear from the above discussion fact that the relationship between k_{ss}^I and k_I^c is critical for the long-run outcomes. Therefore, a direct comparison between the two variables should shed

addition insight into the environment that ultimately leads an economy to a better or a worse outcomes. The expression for k^I_{ss} can be obtained from equation (12) and the expression for k^c_I can be solved using $\chi^I(k_t) \equiv w_t \rho^I_{t+1} = \Omega$ in conjunction with equations (2) and (14). It is then straight-forward to establish that when the share of capital, $\alpha < \frac{2}{3}$, the ratio $\frac{k^I_{ss}}{k^c_1} = f(Q, A, \delta, \Theta)$, with $f_A > 0$, $f_Q > 0$, $f_\delta < 0$, and $f_\Theta < 0$. Thus, the relation $\frac{k^I_{ss}}{k^c_I} < 1$ is likely to hold for smaller values of Q and A, and/or for larger values of δ and Θ. This essentially describes an environment that is branded by poor technology, higher costs of monitoring and by an inefficient bureaucratic and legal systems for enforcing laws in the books. Conventionally, an improvement in the efficiency of the legal and bureaucratic machinery is seen as the primary tool for combating poor property rights. Significantly though, despite a lower value of Θ, the relation $\frac{k^I_{ss}}{k^c_I} \leq 1$ can continue to hold due poor technology and/or a high monitoring costs in the financial sector. Thus, to be effective any institutional and legal reforms should seriously consider the complex relationship between institutional, legal and other variables defining the structure of an economy.

6 Conclusion

There may exist a law that makes encroachment upon privately held land illegal. Yet, putting a fence up around the property or taking other costly measures to prevent trespassing is a common and an effective initiative among land owners to per-emptively protect against encroachment and uphold the law in the books[7]. There are also many examples where individuals as a group spend sizable amount of resource to shape the property rights law and to oversee its implementation. For example, in the recent years, international organizations and financial institutions have come together in setting up publicly accessible collateral registries in many developing countries [Love et al. [2016]]. In addition to reducing information friction in the loan transactions, such actions are instrumental in creating private incentives to eliminate ambiguity about the ownership of property. The Motion Pictures Association of America (MPAA) which represents the interests of six major Hollywood studios has long advocated for the motion picture and television industry through lobbying to protect creative content from piracy and curb copyright infringement. Thus, private initiatives do shape the effectiveness and the quality of property rights institutions and whatever the *de jure* condition of property right protection may be, it is the *de facto* outcome that we are interested in this paper. Further, we argue that the quality of property rights institution is not impervious to changes in prevailing economic and social conditions [Demsetz [1967], North [1971], North [1991]] despite being influenced by a cluster of exogenous initial conditions. This is true because changing economic and/or social environment alters the costs and the benefits of protecting property and creates initiatives to uphold the law. In our context it is the economic prosperity that alters the lending behaviors in such a way that the society adopts a more effective property rights system. Despite being simple, our analysis captures

[7] In fact, a large population in the world live in properties without formal legal rights despite the risk of appropriation. according to one estimate De Soto [2000], the poor around the world have amassed U.S. $9.3 trillion in real estate without proper legal ownership.

the joint evolution of all the three relevant variables and admits to a richer set of possibilities, including the one where a country may remain trapped with low level of prosperity and weaker property rights. Our analysis also brings to the surface an additional role of financial sectors in shaping the trajectory of real economic development.

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