

# Explaining the Effect of Financial Development on the Quality of Property Rights

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## Abstract

Recent empirical evidence suggests that financial development can catalyze property rights reforms, and for an such effect to materialize financial development must cross a threshold. This paper offers a theory of financial markets to explain these facts defining the relationship. The explanation is based on a simple trade-off between the costs and the benefits of securing property. Securing the right to property at a cost allows agents to post collateral against loans. However, the benefits of collateral vary according to the existing credit market conditions, which we take into account in the trade-off between the costs and the benefits of securing property rights along the path of financial development to explain the conditions under which financial development can create incentives for better property rights institutions.

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## 1 Introduction

There is a consensus that property rights encourage investment (Besley, 1995; Knack and Keefer, 1995; Johnson et al., 2002), entrepreneurship (Murphy et al., 1991) and innovation (Furman et al., 2002). Economists have also recognized that a system of strong property rights can enhance efficiency in financial sectors. This is intuitive since legislation protecting property often encompasses financial contracts (Porta et al., 2002; Claessens and Laeven, 2003; Beck et al., 2005), and even when it does not, it can improve contracting efficiency by allowing borrowers to pledge collateral (Djankov et al., 2007; De Soto, 2000; Besley and Ghatak, 2009). Here the direction of causality runs from property rights to financial development. But is it possible that the reverse is also true? There are reasons to believe that this may be the case. For example, certain types of financial reforms, in particular those that relax restrictions on the movement of capital can provide incentives for managers and controlling shareholders to uphold contracts and to better protect minority investors' rights (Stulz, 2005). Alternatively, since engineering institutions that guard the rights of investors is costly, deep financial markets can be a prerequisite for such institutions to be viable (Miletkov and Wintoki, 2009). In a recent work, Bose et al. (2014) use the Gwartney and Lawson index,<sup>1</sup> to formally establish that financial development catalyzes property rights reforms and that the magnitude of such an effect is meaningful.<sup>2</sup> The primary goal of this paper is to offer an insight into this relationship by focusing on a set activities that are closely tied to the operation of a financial market.

We begin by appealing to a broad notion that the quality of institutions is not impervious to the changes in prevailing economic and social conditions despite being influenced by a cluster of exogenous initial conditions such as legal traditions or natural endowments. In fact, institutions do change.<sup>3</sup> Sometimes the proximate triggers for these reforms have

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<sup>1</sup>This index published by Fraser Institute rates countries on a scale 0 to 10 - zero representing the lowest quality of property rights institutions. Data is reported in five year intervals. See Gwartney et al. (2009)

<sup>2</sup>For example, the mean property rights score in 2005 was 5.91 and the standard deviation was 1.85. Depending on the methodology used, a one standard deviation increase in private credit from its average value in 2005 (for a sample of nearly 100 countries) translates into a 0.5 to 1.0 point increase in the property rights index.

<sup>3</sup>In countries adopting market-oriented reforms, this change has been rapid. Based on the 10-point property rights index mentioned above, property rights strengthened in Chile from 1.1 in 1970 to 7.00 in 2006 - a rating comparable to that in Belgium and 0.7 points higher than that in Italy. Based on another indicator of institutional quality - an index assessing constraints on the executive branch of government - Rodrik et al. (2004) report a 40 percent improvement between the 1970s and 1990s in 20 of the 71 countries that composed their sample.

been shifts in ideology - Chile under Augusto Pinochet and China under Deng Xiaoping are good examples. The triggers could also be related to economic conditions. For example, the models of institutional change advocated by Demsetz (1967) and North (1981) suggest that institutions evolve once the economic and/or social gains from institutional change exceed the costs of *not* doing so. Both argue that technological innovation and the development of new economic markets lead to the introduction of new institutional arrangements or the reform of existing arrangements. We build on these ideas and argue that a changing economic environment induced by financial developments can shape the evolution of property rights by altering the tradeoff between the costs and the benefits of protecting property. The next two paragraphs outline these costs and the benefits.

Stronger property rights institutions offer many potential benefits. Since the publication of the seminal research by Feder et al. (1988), Feder and Nishio (1998) and by De Soto (2000), one such benefit has come to the limelight. This benefit accrues through the credit channel and is based on the argument that a well-defined right to property helps to collateralize assets for improved access to credit. Following this argument, many countries have taken the initiative to formalize land titles and land registrations so that land can be collateralized. In this paper, we follow the same line of argument and view an individual benefiting from protecting his/her own property because a well-defined property can be used as collateral to better the terms of borrowing. We also argue that such benefit varies with the existing credit market conditions.

We take the stand that it is costly to put a good property rights institution in place, and that the cost is directly as well as indirectly (e.g. through taxation) borne by individuals in a society. The focus of this paper is on the direct costs. In particular, we view effective property rights as the product of the laws that exist on books and the initiatives of individuals who uphold such laws. Such initiatives involve costs. For example, there may exist a law that make encroachment upon privately held land illegal. Yet, an individual must undertake a variety of costly procedures such as surveying the land, drawing up a legal deed, notarizing the deed in court, etc. to uphold such a law. Similarly, putting a fence up around the property or taking other costly measures to prevent trespassing is a common and an effective private initiative among land owners to pre-emptively protect against encroachment and uphold the law on the books. An individual must also be prepared to incur the legal costs in an event where the law is violated. There are many examples where individuals as a group spend sizable amount of resource to shape the property rights

law and to oversee its implementation.<sup>4</sup> 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. Finally, it is also worth noting that indices that are commonly used to measure the quality of property rights protection (including the Gwartney and Lawson property rights index) are drawn not only on the basis of the laws that exists on books but also on factors that reflect private initiatives undertaken to uphold such laws.<sup>5</sup>

In the analysis that follows, we examine the tradeoff between the above costs and benefits of protecting property along the path of financial development. To fix the idea, we consider a simple model of financial intermediation where individuals must access external funds to operationalize investments and where asymmetric information between borrowers and lenders opens up the possibility of some borrowers being denied loans. Faced with this possibility, borrowers can post assets as collateral to improve the terms and conditions of the loans they receive. However, before they do, the borrowers must safeguard their assets and must establish legal rights over these assets at a cost. The extent to which the borrowers are willing to incur such a cost will determine the quality of the property rights institution.

Clearly, a borrower's decision will depend on the tradeoff between the cost of securing the right to ownership and the expected gain from posting collateral. Our innovation here is to suggest that such gains depend on the existing credit market conditions. There is a large body of evidence to support such a claim. For instance, Feder et al. (1988) and Feder and Nishio (1998) report that the impact of titling on credit access is relatively unimportant in areas where the depth of the formal credit market is shallow and where informal lending is predominant. Carter et al. (1994) and Mushinski (1999) identify a credit impact only for medium and large farm owners who presumably have existing connections to the formal credit market. Deininger and Goyal (2012) show that computerizing the land registry has

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<sup>4</sup>For example, 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. Some of the anti-piracy measures used by them include lobbying for legislature, hosting publicity campaigns against piracy and widespread legal action against entities that engage in such activities.

<sup>5</sup>For example, one of the bases of the Gwartney and Lawson Property Rights Index is the variable *Integrity of the Legal System*, sourced from the International Country Risk Guide's Political Risk Component I for Law and Order. This variable is constructed to assess the "strength and impartiality of the legal system" (law on the books) as well as "popular observance of the law" which depends on initiatives to uphold such law (law in practice). Both these measures receive equal weight in the construction of the variable.

effect on borrowing in the urban area and not in rural areas which typically have relatively poor access to credit. The pattern is also evident in cross-country studies. Djankov et al. (2007) finds that improvements in rights which affect the ability of borrowers to use collateral are strongly and positively correlated with credit market development in a cross-section of countries. Our theoretical construct draws from these stylized facts and argues that the benefit of codifying and protecting property (that can be pledged as collateral) is closely tied to the existing credit conditions and that a more mature financial market could generate additional incentives for individuals to secure their right to ownership.

The argument that we present above draws a line from financial development to the quality of property rights institutions as it has been evidenced in the data. Yet, there is no reason to presume that such a relationship is linear. In fact, the results that we present in Section 2 suggest otherwise and point to a threshold in the relationship on the basis of which we are able to isolate two distinct regimes; one in which the quality of the financial system is poor and where its effect on property rights is weak, and one where the practice of banking has evolved beyond a certain point such that further improvements in access to credit are positively associated with the degree to which countries enforce property rights. Our theoretical construct accounts for this pattern in the data by admitting that an individual's incentive to secure property rights can be affected by the decisions that the others make with regard to their own property. This opens the analysis up to a richer set of possibilities with an implication that only beyond a threshold level of financial development, the average quality of property rights institution increases monotonically with the development of the banking system. Below this threshold, the state of financial development has no effect on the degree to which society secures private property.

In summary, the empirical relationship between the quality of property rights institution and the level of financial development points to two key stylized facts. The first fact points to a causal relationship running from finance to the quality of property rights institutions. The second pattern in the data suggest a non-linear relationship between the two variables. In this paper we seek to offer a theory of financial markets that explains both stylized facts defining the relationship.

The remainder of the paper is organized as follows. Section 2 offers evidence in support of non-linearity in the relationship between property rights and finance. Section 3 describes the economic environment. In Section 4, we describe and solve the financial contract between financial intermediaries and borrowers in an imperfect information setting. Section 5 analyzes the effect of financial development on the incentive to protect property

at both individual and aggregate levels. Section 6 concludes with some comments.

## 2 A Closer Look at the Data

The existing empirical literature suggests that financial development matters for the development of property rights institutions. Yet, there is no reason to presume linearity in their relationship. In this section, we look deeper into the data and offer evidence in support of a non-linear relationship between the two variables. We begin with a cursory look at the data. The Fraser Institute data on property rights cover a large cross-section of countries and are available at a five-year frequency from 1970.<sup>6</sup> Keeping this in mind, we divide 1970-2005 into equal five year intervals so that each interval contains a distribution of property rights index for 106 countries. Next, for each interval, we calculate country-specific average values of private credit to GDP ratio for the same sample of countries.<sup>7</sup> Thus, each interval also contains a distribution of average private credit-to-GDP ratio for countries. Finally, we divide the sample of countries into two-equal sized groups. The first group (i.e., low finance group) contains countries whose (average) private credit-to-GDP ratio never exceeded 30 percent. We refer to the complementary group as the high finance group. As a first pass, we examine whether the two group countries differ significantly in the manner in which the quality of property rights institution and the private credit to GDP ratio have co-moved over time. For this purpose, we plot the medians of the two distributions for each group of countries over the time intervals. Figure 1 suggests that for the low finance group the private credit-GDP ratio and property rights do not appear to co-move. In the high finance group, however, the changes in property rights closely track changes in the ratio of private credit to GDP; suggesting that the existing levels of financial development could be a contributing factor in the way property rights - finance relationship. We take our cue from this cursory evidence and proceed with more formal treatments.

We turn to a more formal analysis by estimating a semiparametric partially linear regression model where the finance variable enters the regression additively, but we do not impose any a-priori restriction on the relationship between finance and property rights.

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<sup>6</sup>Our measure of property rights is an index assembled by James Gwartney and Robert Lawson and published by the Fraser Institute in their Economic Freedom of the World: 2009 Annual Report. According to this index, countries are rated on a scale from 0 to 10 zero being the lowest.

<sup>7</sup>This variable is widely used in the literature as a proxy for financial development (Beck et al., 1999)

Accordingly, our regression equation takes the following form:

$$y_i = x_i'\beta + g(z_i) + e_i \tag{1}$$

where the variables  $y_i$  and  $z_i$  represent the average measure of property rights (Gwartney et al., 2009) and the average private sector credit to GDP ratio<sup>8</sup> for country  $i$ , respectively. The data cover the time period 1970-2005. According to the existing literature, institutions are influenced by a cluster of exogenous initial conditions, such as legal origins (La Porta et al., 1999), settler mortality rates (Acemoglu et al., 2001, 2002), and ethnic compositions (Easterly and Levine, 1997). Accordingly, the vector  $x_i$  consists of a dummy for British legal origin, a country's latitude (which is a proxy for settler mortality), a measure of ethnic fractionalization, and a dummy variable that takes the value of 1 if the country has experienced a crisis in the preceding seven or less years.<sup>9</sup> This serves as our baseline specification.<sup>10</sup>

Our goal here is to learn about relationship between finance and property rights as captured by  $g(\cdot)$ . For this, we use a kernel method with data-driven bandwidth selection that provides a  $\sqrt{n}$ -consistent estimator of  $\beta$  (Robinson, 1988). To be precise, since the data contains categorical variables, the estimation process follows Racine and Liu (2007).<sup>11</sup> Figure 2 displays the local constant partial regression plot of  $g(\cdot)$ . The plot provides evidence in support of non-linearity. In fact, there is no significant relationship between finance and property rights for the sample of countries for whom average logarithm of private credit to GDP is below a threshold of 33%. In the complementary sub-sample, the association between the two variables are strongly positive. Although this evidence does not provide a formal basis for rejecting linearity, it is again suggestive. Below we present evidence which formally tests for the presence of threshold effects in the relationship between finance and property rights.

We apply a method developed by Hansen (2000) to the same set of data in order to identify a threshold level of financial development that meaningfully splits the data into two regimes. Following Hansen (2000), we consider the following specification:

$$y_i = \theta'x_i + \delta_n'x_id_i(\gamma) + e_i \tag{2}$$

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<sup>8</sup>To be precise, our finance variable is the time average of  $\log(1 + \text{private credit to GDP})$

<sup>9</sup>Data sources are outlined in the appendix.

<sup>10</sup>With the exception of including the financial crisis variable and excluding the dummy for Catholicism, the above specification is identical to the one considered by Ayyagari et al. (2008).

<sup>11</sup>The sample consists of 83 countries for which data is fully available. The statistical analysis has used the **np** package in R. See Hayfield and Racine (2008).

As before, the variables  $y_i$  and  $x_i$  represent property right variable and the set of co-variates for country  $i$ , respectively. The model allows regression parameters to vary on the basis of the value of threshold variable  $q_i$ , which in our case is the log of private credit to GDP ratio. This variable is also included in the co-variate vector,  $x_i$ . In this specification, We define  $\gamma$  as the unknown threshold parameter of interest which splits the data into two regimes according to  $d_i(\gamma) = \mathbb{1}\{q_i \leq \gamma\}$ . The specification attaches no cross-regime restrictions on the regression parameters.

We first estimate our baseline model where  $x_i$  includes only institutional and financial crisis variables. In the next specification, we account for political factors by introducing a measure of controls on the executive following North and Weingast (1989), who argue that constraints on the government’s abilities to repeal individuals’ right to ownership are associated with stronger property rights. In the third and final specification, we consider the role of economic factors by including real per capita income of countries in 1970 and it’s square as well as the measure of financial openness as proposed by Lane and Milesi-Ferretti (2007). We include these additional variables since there is a prevalent view that real per-capita incomes and greater openness are associated with stronger property rights (Gradstein, 2004; Wei, 2000).<sup>12</sup>

The results are reported in Table 1. The presence of a threshold is evident in all three specifications. In the first two specifications, the regimes split at  $\hat{\gamma} = 3.39$ . Since our finance variable is defined as  $\log[1+(\text{private credit})/\text{GDP}]$ , the obtained value  $\hat{\gamma}$  is equivalent to a private credit to GDP ratio of 28.67% ( $= \exp(3.39)-1$ ). Whereas, in the third specification, the split occurs at the private credit to GDP ratio of 28.37% ( $= \exp(3.3857)-1$ ). These threshold values are consistent with the turning point that we obtained in our earlier semiparametric exercise<sup>13</sup>. Significantly, all three specifications convey the same message: The finance variable is strongly and significantly associated with property rights only in the higher financial regimes. In other words, a meaningful relationship between the two variables transpires only when the level of financial development surpasses a threshold level. In the next section, we develop a unified theoretical framework that not only draws line from financial development to property rights but also explains why a certain level of financial maturity is needed before financial development can shape incentives to protect property.

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<sup>12</sup>As in the previous case, the sample consists of 83 countries. The code for the statistical package can be found here: [http://www.ssc.wisc.edu/~bhansen/progs/ecnmt\\_00.html](http://www.ssc.wisc.edu/~bhansen/progs/ecnmt_00.html).

<sup>13</sup>To illustrate this, we draw a vertical line at the threshold value of 3.39 in Figure 2



### 3 The Environment

The events unfold in a small open economy over two periods. The economy is populated with a countably infinite number of agents of unit mass. We suppose that these agents are risk neutral, deriving linear utility from consumption which takes place at the end of the second period. Each agent is endowed with an unit of an asset.<sup>14</sup> If rights to property on this asset is fully enforced, then an agent can sell this asset at the end of the second period for a given market value  $v$ . An agent also has an opportunity to partake in a business venture (or project) during the first period of her life. A venture undertaken at time  $t$  requires a fixed investment<sup>15</sup> of  $x$ . The project generates certain amount of output at time  $t + 1$ , each unit of which is sold at a formal market for a price  $\rho_{t+1}$ . We assume that the demand for the product is given and is downward sloping so that the market price  $\rho_{t+1}$  is inversely related to the quantity of product that is available in the market at  $t + 1$ . Since earnings generated from assets are realized at the end of the second period, agents are unable to finance their own projects. Instead they must contract with banks to obtain a loan of quantity  $x$ . We assume that these banks operate in a competitive environment and have access to a perfectly elastic supply of loanable funds which are priced at the exogenously determined world interest rate,  $r$ .

In our economy, the arrangements that ensure full rights to property are absent to some degree. However, the quality of property rights institutions, whether formal or informal, is not exogenously given. Instead it evolves, being driven by the strength of private incentives to invest in property right protection. Though property rights are slack, we assume that an owner of an asset can protect a fraction  $\gamma$ , of the value of her initial endowment by incurring a monetary and/or time cost in the amount of the  $\tau\gamma$ . In practice, this cost can take various forms, such as legal costs, the costs of hiring private security, or contribution to lobbying costs incurred when establishing new case law that strengthens property rights (Lanjouw et al., 1998; Lanjouw and Schankerman, 2001) etc. The property that is secured at a cost can be pledged as collateral in the loan transactions.

Central to our argument is the relationship between the value of collateral and its impact on the access to credit. There are various ways to establish this connection. Our goal here is to consider an environment that will represent some of the key elements of this

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<sup>14</sup>For the purpose of exposition, it is beneficial to think of this asset as a plot of uncultivated land.

<sup>15</sup>Again, one can contextualize  $x$  as the cost of investment (purchase of machinery, fertilizer etc.) that is necessary for making the land fit for cultivation.

relationship as it is evidenced by the data. It is true that credit market information frictions come in various forms and shapes and while collateral mitigates some of the frictions, it does not eliminate frictions altogether. As a result, loans are often denied even when collateral is pledged in the transactions. For example, after surveying lending practices of 91 banks from 45 countries Beck et al. (2008) report that on the average, lenders deny any access to credit to nearly a quarter of the loan applicants in the small and medium enterprise category. This remains true even when 87 percent of banks in a sample of developing countries view collateral as a mandatory requirement of the loan application process. While evaluating the effect of having a land title on the access to credit among a sample of urban population in Peru, Field and Torero (2006) find that the probability of loan approval from a public bank goes up about 9 percentage points if a household has a land title, but the effect is absent in the cases of loans from private banks. Moreover, despite having collateralized assets, nearly 34 percent of the total loans applicants were denied loans and remained “fully quantity rationed”. Similarly, in studying lending practices in Ghana, Domeher and Abdulai (2012) report that only 69 percent of applicants who put up collateral get access to credit. To capture outcomes such as these, we appeal to a friction type where lenders have incomplete information about borrowers’ characteristics, and as a result, some borrowers are denied loans. In this setting, collateral will mitigate the incidence of credit rationing, but it will not eliminate it all together as it is evidenced in practice.<sup>16</sup>

To fix ideas, we assume that the projects owned by individuals can be of two types - low risk (type-L) or high risk (type-H). A type-L project turns  $x$  units of the consumption good into  $Qx$  units of output with probability  $p_L = 1$ , whereas a type-H project converts the same investment  $x$  into  $Qx$  units of output with a probability  $p_H \in (0, 1)$ , and 0 otherwise. We assume the each agent faces an *ex-ante* probability  $\lambda \in (0, 1)$  of owning a type-L project, and this realization is private information.<sup>17</sup> As it will become apparent, some loan applicants may be adversely selected and denied credit since the project type

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<sup>16</sup>An alternative way to model the relationship between collateralizable assets and access to credit is to assume that in the event of a default, banks are able to recover payments only up to the value of the collateral. As a result, the loan size will depend on the value of the collateral (Buera et al., 2012). An approach such as this has strong appeal in terms of its simplicity and tractability. Yet, the approach would imply that some amount of loan is always guaranteed in the presence of collateral, which clearly is not the case in practice.

<sup>17</sup>Alternatively we could assume agents are randomly endowed with different abilities. For example, a fraction  $\lambda$  of agents could be endowed with better skills such that the expected returns to their investments are higher. We simplify matters by assuming that projects with different risk characteristics are randomly allocated across individuals.

associated with any given loan applicant is private information. If an applicant doesn't receive a loan, she scales down the size of her business and produces a *small* amount of output for her own consumption. This outside opportunity generates  $\alpha_H$  and  $\alpha_L$  units of the consumption to the owners of type-H and type-L projects respectively, and we assume  $\alpha_L > \alpha_H$ . For notational convenience we normalize  $\alpha_H = 0$ .<sup>18</sup>

The timing of events in our economy proceeds as follows. Prior to gaining access to a project, agents choose a value of  $\gamma$ , i.e. they decide how much property they want to safeguard from predation. Next agents are randomly and privately assigned a project, such that a fraction  $\lambda$  are assigned to type-L projects and the remaining  $(1 - \lambda)$  are assigned type-H projects. Once projects are assigned, agents seek to operationalize these ventures, by applying for loans from financial intermediaries. The agents post a fraction of the asset in possession (net of predation) as collateral. Hence, the terms and conditions for loans are influenced an agent's choice of  $\gamma$ . In the second period, projects generate incomes with which agents pay off loans and also consume. The outcomes that transpire from these decisions are determined by solving backwards through the sequence of events. In particular, we first determine how the loan contract is influenced by the choice of  $\gamma$ . This information is then used in following sections to pin down the optimal value of  $\gamma$  for an individual and for the economy as a whole.

## 4 Financial Contracts

In the first period, borrowers approach banks for loans to finance investments. The idiosyncratic credit risk associated with each borrower is private information. However, the aggregate *ex-ante* distribution of project types, the project technology, and the outside opportunities faced by type-L versus type-H investors are common knowledge. In addition, loan applicants also reveal the value of their assets (net of predation),  $\gamma v$ , which is costlessly verifiable by financial intermediaries.

We suppose that banks incur a cost when contracting loan agreements. We denote this cost by  $\delta > 0$ . In practice, costs of financial intermediation come in various forms and shapes. Examples include the costs of providing liquidity services and costs that are

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<sup>18</sup>Strictly, it is only necessary to assume that outside opportunities across the two type of borrowers differs. There are various ways to motivate this. For example, it is possible to interpret this difference as a result of skill heterogeneity: individuals with higher skills can not only generate higher expected project output, but the value of their outside opportunity is also greater.

associated with processing information, enforcing contracts, and screening. We assume that these costs decline along the path of financial development. There is certainly an empirical basis for this assumption. Two empirical measures of intermediation costs are banks' overhead expenditure as a proportion of total assets and banks' net interest rate margin. It is well documented that both measures tend to be higher in less developed financial sectors (Demirgüç-Kunt and Huizinga, 2000; Demirguc-Kunt et al., 2003). Accordingly, we interpret *lower* values of  $\delta$  to reflect a *more* developed financial system and we assume that the value of  $\delta$  is known to the financial intermediaries.

Given the above information, a lender offers contracts to borrowers, the acceptance of which implies a binding agreement committing the former to a transfer of funds in the amount  $x$  to a borrower and the latter to a repayment from her future project income. Since financial intermediaries operate in a competitive environment and since the terms and conditions of loan contracts offered in the market is common knowledge, the loan-applicants will only approach financial intermediaries if the contracts offered are not dominated by other contracts available in the market. Thus, in equilibrium, banks earn zero normal profits.

In this imperfect information environment, financial intermediaries exploit the known differences between the type-L and type-H project owners in such a way that the offered contracts induce self-selection. In particular a contract offered by the bank is a pair  $C_i \equiv \{R_i, \pi_i\}$  for  $i \in \{H, L\}$ , where  $R_i$  is the gross lending rate for a contract of type- $i$  and  $\pi_i \in [0, 1]$  is the probability that a type- $i$  applicant is granted a loan. For a contract that is granted at time  $t$ , the type- $i$  borrower receives utility  $U_i \equiv \pi_i[p_i(Q\rho_{t+1} - R_i)x + \gamma v] + (1 - \pi_i)[\alpha_i + \gamma v]$  where  $i \in \{H, L\}$ , with  $p_H < p_L = 1$  and  $\alpha_L > \alpha_H = 0$ . The first term in this expression is the net payoff to a borrower from risky project in the event a loan is granted and the project is successful. The second term is the payoff in the event that the project is not funded. It is easy to see that since  $\alpha_L > \alpha_H$ , the indifference curves of the two types of borrowers satisfy single-crossing property in the contract plane. This enables lenders to separate borrowers according to their risk types by offering a menu of contracts that are individually rational and incentive compatible.<sup>19</sup> The following proposition fully describes the elements of the contract.

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<sup>19</sup>For similar arguments, see Rothschild and Stiglitz (1976), Bencivenga and Smith (1993), and Bose and Cothren (1996).

**Proposition 1** *Let  $r$  denote the cost of funds for financial intermediaries. If  $(Q\rho_{t+1} - R_L)x > \alpha_L$ , then the time  $t$  equilibrium contract given  $\gamma, r, \delta$  is characterized by:*

$$R_L = \frac{xr + \delta}{x} ; R_H = \frac{xr + \delta - (1 - p_H)\gamma v}{p_H x} \quad (3)$$

$$\pi_L = \frac{p_H Q\rho_{t+1}x - xr - \delta + (1 - p_H)\gamma v}{p_H(Q\rho_{t+1}x - xr - \delta)}, \pi_H = 1 \quad (4)$$

**Proof** The banks' zero profit condition on a contract  $\{R_i, \pi_i\}$  is given by:

$$p_i R_i x + (1 - p_i)\gamma v = rx + \delta \quad (5)$$

The expression of the left in (5) is the banks' expected earnings from a loan; it is the sum of the banks' interest earnings in case of no default (when the project is successful) and the amount that the bank can recover by appropriating the collateral posted in case of a default (when the project is unsuccessful). The expression on the right shows the cost of lending, the sum of the cost of acquiring funds and the cost of intermediation.

The expressions for  $R_i$  for  $i \in \{H, L\}$  follows immediately from the banks' zero profit condition (5) where we assume  $p_L = 1$ . We also assume  $\gamma v < rx + \delta$ , i.e. there is risk associated with lending. This implies, from (3) and (4) that  $R_L < R_H$ .

The expression outlined in equation (4) can be understood by appealing to simple intuitions. The lifetime utilities of the type-H and type-L borrowers for the contract  $C_H$  and  $C_L$  are given by  $U_H = \pi_H[p_H(Q\rho_{t+1} - R_H)x + \gamma v]$  and  $U_L = \pi_L[p_L(Q\rho_{t+1} - R_L)x] + (1 - \pi_L)\alpha_L + \gamma v$ , respectively. Suppose that banks are able to distinguish between type-L and type-H individuals. Under full information, the lenders have no need to deny credit to individuals. However, the first best contracts will still earn zero profit for the lenders under competition. Accordingly, we denote the first best contracts as  $C_i^F \equiv \{R_i, \pi_i = 1\}$  where  $R_i$  is given by equation (3) for  $i \in \{H, L\}$ . Since  $R_L < R_H$ , the following inequalities hold:  $U_H(C_H^F) < U_H(C_L^F)$  and  $U_L(C_H^F) < U_L(C_L^F)$ . Therefore, if the first best contracts are being offered, a type-H borrower has an incentive to misrepresent herself as being type-L (pooling on  $C_L^F$ ) but the converse isn't true. Hence, while inducing self-selection through a menu of contract, the lenders will include the first best contract for type-H borrowers,  $C_H^F = \{R_H, \pi_H = 1\}$ , in the menu. Given the expressions for  $R_L$  and  $R_H$ , the other contract ( $C_L$ ) in the menu that is designed keeping a type-L borrower in mind is then determined by solving the following problem:

$$\begin{aligned} \max_{\{\pi_L\}} U_L(C_L) &= \pi_L[(Q\rho_{t+1} - R_L)x] + (1 - \pi_L)\alpha_L + \gamma v; \\ \text{s.t.: } p_H(Q\rho_{t+1} - R_H)x + (1 - \pi_H)\alpha_H &\geq \pi_L[p_H(Q\rho_{t+1} - R_L)x] + (1 - \pi_L)\alpha_H \end{aligned} \quad (6)$$

where equation (6) prevents type-H borrowers from misrepresenting as type-L and  $R_L, R_H$  are given by (3). Given  $(Q\rho_{t+1} - R_L)x > \alpha_L$ , it is easy to verify that the incentive compatibility constraint (6) must bind in equilibrium. Plugging in values of  $R_L, R_H, \pi_H$  from (3), (4) into the constraint (6) we obtain the expression for  $\pi_L$  as in (4). Further,  $\gamma v < rx + \delta$  ensures that  $\pi_L < 1$ . ■

According to the proposition above, the separation of borrowers by types is achieved by rationing credit to a fraction of low-risk borrowers - a result that is well-known in ‘adverse selection’ models. Further notice that  $\frac{\partial \pi_L}{\partial \gamma} > 0$ . The intuition is again straightforward. Higher values of  $\gamma$  (better protection of property) allows borrowers to post more collateral. This reduces lending risk to both type-L and type-H borrowers and banks are able to lower the interest rate they charge to both groups of borrowers. However, note that since  $p_H < p_L = 1$ ,  $R_H$  falls leaving the value of  $R_L$  unchanged.<sup>20</sup> Therefore the contract  $C_L$  becomes less attractive to type-H borrowers and banks are able to increase the value of  $\pi_L$  without violating the incentive compatibility constraint in (6). The argument is exactly the same when cost of intermediation,  $\delta$ , decreases and we obtain  $\frac{\partial \pi_L}{\partial \delta} < 0$ . Accordingly, the financial sector will supply more credit in more financially mature markets and/or in countries with a strong system of property rights.

## 5 The Choice of Property Right Protection

The analysis presented in the previous section suggests that stronger property rights (i.e., a higher value of  $\gamma$ ) allows individuals to post more collateral when applying for loans, thus improving the terms and conditions of the loan contracts they receive. However, from an individual’s perspective, safeguarding property entails a cost,  $\tau\gamma$ , that is proportional to the choice of  $\gamma$ . Solving for  $\gamma$  involves optimizing this trade-off. A borrower agent solves this problem with the knowledge of the contracts and the knowledge of the *ex-ante* probability distribution which determines her chance of being endowed with a project of type-H or type-L, but not knowing what draw she will receive from this distribution *ex-post*. For now, we take the value of  $\rho_{t+1}$  as given. The outcome of the optimization is summarized in the following proposition.

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<sup>20</sup>A similar effect will transpire if one is to assume that  $p_H < p_L < 1$ . In such case,  $R_H$  will fall more than  $R_L$ .

**Proposition 2** *Assume that  $\gamma$  is bounded above and below by  $\gamma_{max}$  and  $\gamma_{min}$  respectively<sup>21</sup>. Further, let  $\Omega(\delta, \rho_{t+1}) \equiv v \left[ 1 + \lambda \left( \frac{1-p_H}{p_H} \right) \frac{Q\rho_{t+1}x-xr-\delta-\alpha_L}{Q\rho_{t+1}x-xr-\delta} \right]$ . Then an individual optimally chooses  $\gamma = \gamma_{max}$  if  $\Omega(\delta, \rho_{t+1}) > \tau$  and  $\gamma = \gamma_{min}$  if  $\Omega(\delta, \rho_{t+1}) < \tau$ .*

**Proof** A type-L borrower receives life time utility  $U_L = \pi_L[p_L(Q\rho_{t+1} - R_L)x + \gamma v] + (1 - \pi_L)[\alpha_L + \gamma v]$  for a contract  $C_L$  offered at time  $t$ . An equivalent expression for a type-H borrower for a contract  $C_H$  is given by  $U_H = \pi_H[p_H(Q\rho_{t+1} - R_H)x + \gamma v] + (1 - \pi_H)[\alpha_H + \gamma v]$  with  $\alpha_H = 0$ . Given the ex-ante probability of being assigned a type-L project  $\lambda$ , a borrower solves the following optimization problem.

$$\max_{\gamma} U \equiv \lambda U_L + (1 - \lambda)U_H - \tau\gamma \quad (7)$$

On substituting the expressions for  $U_H, U_L$  from above and for  $R_L, R_H$  and  $\pi_L, \pi_H$  from (3) and (4), it follows that (7) implies  $\frac{\partial U}{\partial \gamma} = \Omega(\delta, \rho) - \tau$ . Accordingly, an individual sets  $\gamma = \gamma_{max}$  if  $\Omega(\delta, \rho_{t+1}) \geq \tau$  and  $\gamma = \gamma_{min}$  if  $\Omega(\delta, \rho_{t+1}) < \tau$ . ■

The above result is easy to interpret. A higher  $\gamma$  implies both a welfare gain and a welfare loss. The welfare gain,  $\Omega(\delta, \rho_{t+1})$ , results in from an improvement in the terminal value of the land,  $\gamma v$ , as well as from the improvement in the terms and conditions of loan contracts. Whereas,  $\tau$  represents the marginal costs associated with property rights improvement. Since, the objective function in (7) is linear in  $\gamma$ , a borrower sets  $\gamma = \gamma_{max}$  when  $\Omega(\delta, \rho_{t+1}) \geq \tau$  and  $\gamma = \gamma_{min}$  when  $\Omega(\delta, \rho_{t+1}) < \tau$ . Further note that  $\frac{\partial \Omega}{\partial \rho_{t+1}} > 0$  and  $\frac{\partial \Omega}{\partial \delta} < 0$  - a set of results that will play roles in the ensuing analysis.

The above results characterize the precise conditions under which an individual will seek to protect her property. These conditions depend on two economy wide variables  $\delta$  and  $\rho_{t+1}$ . For the purposes of this paper, we treat  $\delta$  as exogenous since focus here is on the causality running from financial development to the quality of property rights. However, we allow  $\rho_{t+1}$  to vary with market conditions by noting that the total production and consequently the market supply of output depend on the extent to which property rights is enforced in the economy. This is true because as more individuals choose to enforce property rights, banks are able to make more loans and borrowers' access to credit improves on the average. As a result the economy becomes more productive. We combine this with the

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<sup>21</sup>In theory,  $\gamma \in [0, 1]$ . We have stated the proposition in terms of  $\gamma_{min}$  and  $\gamma_{max}$  simply to avoid an interpretation that there is a society with absolutely no right to property, or there is a society where property rights are fully enforced. The essence of the analysis remains intact if one were to assume that  $\gamma_{max} = 1$  and  $\gamma_{min} = 0$ .

information that the market demand for output is given and is downward sloping so that the market price for output,  $\rho_{t+1}$ , is inversely related to the market supply that is available at  $t + 1$ . Together they imply that individuals' collective choice of property rights matters for pricing of output. We formalize this by postulating that  $\rho_{t+1} \equiv \rho_{t+1}(\mu_t)$  such that  $\rho'_{t+1}(\mu_t) < 0$ , where we define  $\mu_t \in [0, 1]$  to be the fraction of individuals choosing  $\gamma = \gamma_{max}$  during time  $t$ .

The above argument suggests that the collective choice of the individuals regarding property rights does matter for the value of  $\rho_{t+1}$ . At the same time, Proposition 2 indicates that an individual's time  $t$  choice of property rights is influenced by the value of  $\rho_{t+1}$ . We exploit this feedback loop in the next proposition to demonstrate how economy-wide choice of property rights evolves when  $\delta$  takes a value from high to low representing a transition from a low to a high levels of financial development.

**Proposition 3** *Given that  $\mu_t$  represents the fraction of individuals choosing  $\gamma = \gamma_{max}$  during time  $t$ ;*

- (i) *There exists a critical level of financial development  $\delta_c$  such that when  $\delta > \delta_c$  the equilibrium in this economy at time  $t$  is characterized by the unique behavior profile where all agents set  $\gamma = \gamma_{min}$ , i.e.  $\mu_t = 0$ .*
- (ii) *There exists a level of financial development  $\delta_f < \delta_c$ , such that when  $\delta$  decreases in the interval  $(\delta_f, \delta_c)$   $\mu_t$  increases monotonically to attain the value of 1 at  $\delta_f$ .*

**Proof** Recall that  $\rho'_{t+1}(\mu_t) < 0$  and  $\frac{\partial \Omega}{\partial \rho_{t+1}} > 0$ . Define  $\Omega_1(\delta) \equiv \Omega(\delta, \rho_{t+1}(\mu_t = 1))$  and  $\Omega_0(\delta) \equiv \Omega(\delta, \rho_{t+1}(\mu_t = 0))$ . Given above, we have  $\Omega_1(\delta) < \Omega_0(\delta)$ . Let  $\delta_f$  and  $\delta_c$  solve  $\Omega_1(\delta_f) = \tau$  and  $\Omega_0(\delta_c) = \tau$ , respectively. Since  $\Omega_1(\delta) < \Omega_0(\delta)$  and since  $\frac{\partial \Omega}{\partial \delta} < 0$ , we have  $\delta_f < \delta_c$ . In Figure 3 we offer a clear diagrammatic representation of the above relationships.

Suppose  $\delta > \delta_c$  and consider a behavior profile where all individuals choose  $\gamma = \gamma_{min}$ , i.e.,  $\mu_t = 0$ . Since by definition  $\Omega_0(\delta_c) = \tau$  and  $\frac{\partial \Omega}{\partial \delta} < 0$ , we must have  $\Omega_0(\delta) < \tau$ , and (according to Proposition 2) no agent has an incentive to deviate from this behavior profile. Further, to see that this behavior profile represents an unique equilibrium, consider the behavior at the other extreme, where all agents set  $\gamma = \gamma_{max}$ , i.e.,  $\mu_t = 1$ . Accordingly,  $\Omega = \Omega_1(\delta)$ . Since,  $\Omega_1(\delta) < \Omega_0(\delta)$  and since  $\Omega_0(\delta) < \tau$ , we have  $\Omega_1(\delta) < \tau$ . Thus, it is optimal for an individual to deviate from this behavior profile and set  $\gamma = \gamma_{min}$ . Accordingly, the aggregate outcome is not supported by a behavior profile where  $\mu_t = 1$ .



Suppose that  $\delta \in (\delta_f, \delta_c)$  for which  $\Omega_0(\delta) > \Omega_0(\delta_c) = \tau$ . Consider a pure behavior profile where  $\mu_t = 0$ . Since the marginal benefit from protecting property is greater than the marginal cost, it is optimal for an agent to deviate from this profile and set  $\gamma = \gamma_{max}$ . It is easy to see that since  $\Omega_1(\delta) < \Omega_1(\delta_f) = \tau$  will hold for any  $\delta \in (\delta_f, \delta_c)$ , an aggregate behavior profile with  $\mu_t = 1$  also cannot support an equilibrium. Thus, neither  $\mu_t = 0$  nor  $\mu_t = 1$  support an equilibrium when  $\delta \in (\delta_f, \delta_c)$ . There exists, however, an equilibrium which is supported by a mixed behavior profile with  $\mu_t \in (0, 1)$ . To see this, consider  $\delta = \delta_m \in (\delta_f, \delta_c)$  and a mixed behavior profile where  $\mu_m$  fraction of agents set  $\gamma = \gamma_{max}$  and the rest set  $\gamma = \gamma_{min}$ . Since,  $\rho'_{t+1}(\mu_t) < 0$  and  $\frac{\partial \Omega}{\partial \rho_{t+1}} > 0$ , we have  $\Omega_0(\delta_m) \equiv \Omega(\delta_m, \rho_{t+1}(\mu_t = 0)) > \Omega(\delta_m, \rho_{t+1}(\mu_t = \mu_m)) > \Omega_1(\delta_m, \rho_{t+1}(\mu_t = 1)) \equiv \Omega_1(\delta_m)$ . In this circumstance, any value of  $\mu_m$  for which the relation  $\Omega(\delta_m, \rho_{t+1}(\mu_t = \mu_m)) = \tau$  holds then supports an equilibrium outcome where only  $\mu_m$  fraction of agents choose  $\gamma = \gamma_{max}$  and the remaining choose  $\gamma = \gamma_{min}$ . Further, given that  $\rho'_{t+1}(\mu) < 0$ ,  $\frac{\partial \Omega}{\partial \rho_{t+1}} > 0$ , and  $\frac{\partial \Omega}{\partial \delta} < 0$ , the above equilibrium condition implies  $\frac{d\mu}{d\delta} = -\frac{\partial \Omega / \partial \delta}{(\partial \Omega / \partial \rho) \rho'(\mu)} < 0$  in the interval  $\delta \in (\delta_f, \delta_c)$ . Accordingly, as  $\delta \rightarrow \delta_f$ , more and more individuals will choose  $\gamma = \gamma_{max}$  and  $\mu_m \rightarrow 1$ . ■

The intuition behind the above results is easy to obtain. Note that the benefit of protecting property depends on the level of financial development,  $\delta$ , as well as on the market price for output,  $\rho_{t+1}$ . The benefit increases with the value of  $\rho_{t+1}$ , whereas it is inversely related to the value of  $\delta$ . When  $\delta > \delta_c$ , the benefit from protecting property is so low that it is optimal for an agent not to deviate from a strategy profile where  $\gamma = \gamma_{min}$  even when an agent faces the prospect of fetching a high market price for output. Now, consider when  $\delta$  falls below  $\delta_c$  resulting in an increase in the benefit. In this case, if all agents choose to protect their properties, then the benefit from the fall in  $\delta$  may not be sufficiently large to offset potential negative price effects arising from an increase in the market supply. Accordingly, in the range,  $\delta \in (\delta_f, \delta_c)$ , the equilibrium is supported only by a fraction of agents choosing  $\gamma = \gamma_{max}$ . A further fall in  $\delta \in (\delta_f, \delta_c)$  offers more room to offset the negative price effect and therefore creates a condition for more agents to enforce property rights. Together, these results offer an explanation as to why financial development matters for the quality of property rights institutions and why it is the case that economies must cross a threshold level of financial development before further developments in the financial sector can create incentives to strengthen property rights.

The analysis that we present here is simple, yet flexible enough to include features that one may view as relevant in the present context. For example, throughout the analysis

we have taken the view that the cost of enforcing property,  $\tau$ , is unaffected by individuals' choice. This, however, need not be the case. For example, one could argue that due to high demand, the prices of services that are essential to protect property should rise with more individuals attempting to protect their property, and therefore  $\tau$  should increase with  $\mu$ . It is also reasonable to argue that a higher demand for property rights may enable an economy to offer the necessary services in a more cost effective manner. As a result,  $\tau$  should in fact decrease with  $\mu$ . It is easy to include both possibilities into the analysis while preserving the underlying mechanism and the main results.<sup>22</sup> To keep our exposition simple, streamlined and short, we have chosen not to include these features explicitly in the main presentation.

## 6 Conclusion

In this paper we have put forward an explanation in support of the empirical evidence that the cross-country variation in the development of financial markets can account for international variation in property rights. Our basic argument is simple: stronger property rights enable borrowers to post collateral leading to an improvement of the terms of their financial contracts. This marginal benefit to securing property increases as a financial market matures. This, in turn, creates incentives for individuals and society to incur costs that is necessary for the improvement of property rights institution.

In spite of its simplicity, the model produces a rich variety of outcomes. In particular, we are able to distinguish between two types of financial development regimes. In a low quality regime the effect of finance on the development of property rights is weak. However, when financial development crosses a certain threshold, further reductions in the cost of financial intermediation catalyze institutional reforms leading to more secure property rights.

Finally, the results presented in this paper may also be viewed within the broader context of potential linkages between the real and the financial sector of an economy. Over the past decade a substantial body of research has attempted to identify channels through which financial markets shape growth prospects in countries. There is a general consensus that financial development is conducive to growth because it mobilizes savings for investments, creates an opportunity to pool risks, improves the allocative efficiency, and lowers

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<sup>22</sup>In the case where  $\tau'(\mu) < 0$ , the analysis requires a few restrictions on the parameters to ensure a smooth transition from low to high property rights along the path of financial development. No such restrictions are necessary when  $\tau'(\mu) > 0$ . Both analyses are available upon request

transaction costs. In this paper we point to another, quite different, channel through which financial development may foster economic performance, namely, by creating incentives for countries to strengthen their property rights.

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## Data Appendix

Variable	Description
<i>Dependent Variable</i>	
Fraser Institute Index	Rating of private property ranging from 0 to 10, higher values indicating stronger property rights. Gwartney et al. (2009)
<i>Independent Variables</i>	
Finance	Volume of Private Credit to GDP, credit supplied by financial intermediaries to the private sector divided by nominal GDP at market prices. Beck et al. (1999). <i>Financial Structure Database 2010 Update</i>
UK Legal Origin	Indicator for British legal origin. Easterly (2001)
Latitude	Distance from the equator. Proxy for settler mortality. Easterly (2001)
Ethnic Fractionalization	Probability that two randomly selected individuals fall into different ethnic groups. Alesina et al. (2003)
Crisis	Financial Crisis Indicator. Laeven and Valencia (2008)
Constraints on the Executive	The feasibility of a change in government policy based on the presence of independent branches of government with veto power Henisz (2000).
Income in 1970	Real GDP per capita measured in 1970, adjusted for differences in purchasing power (series <b>rgdpl</b> , Penn World Tables 6.2).
Financial Openness	Sum of foreign assets and foreign liabilities divided by GDP. Lane and Milesi-Ferretti (2007)



## Figures and Tables

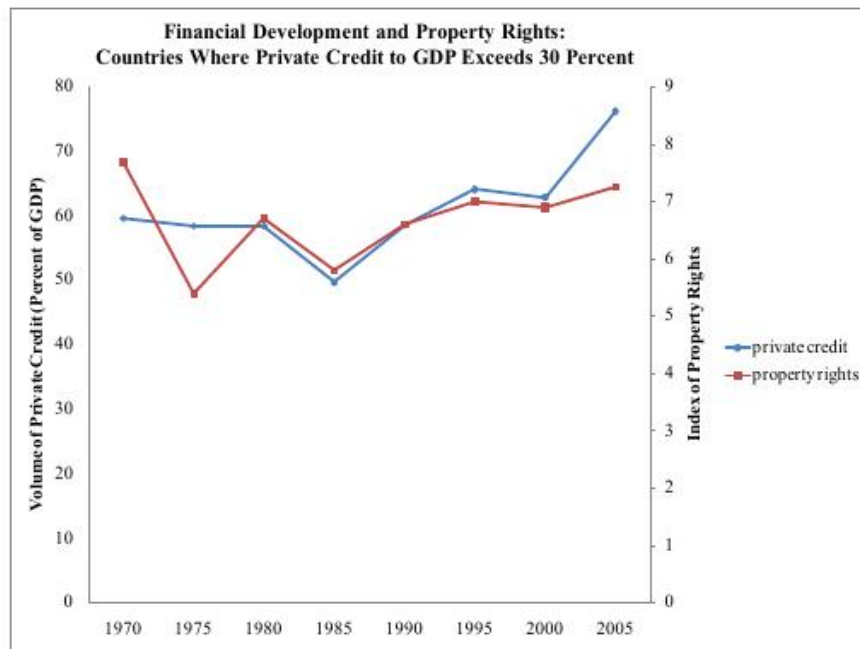
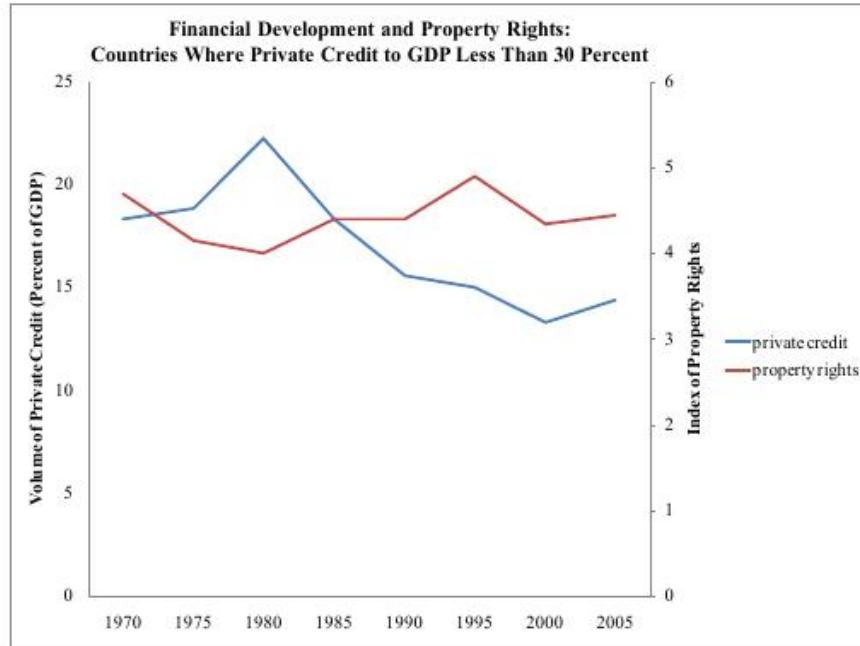


Figure 1: Evolution of Property Rights and Finance Over Time

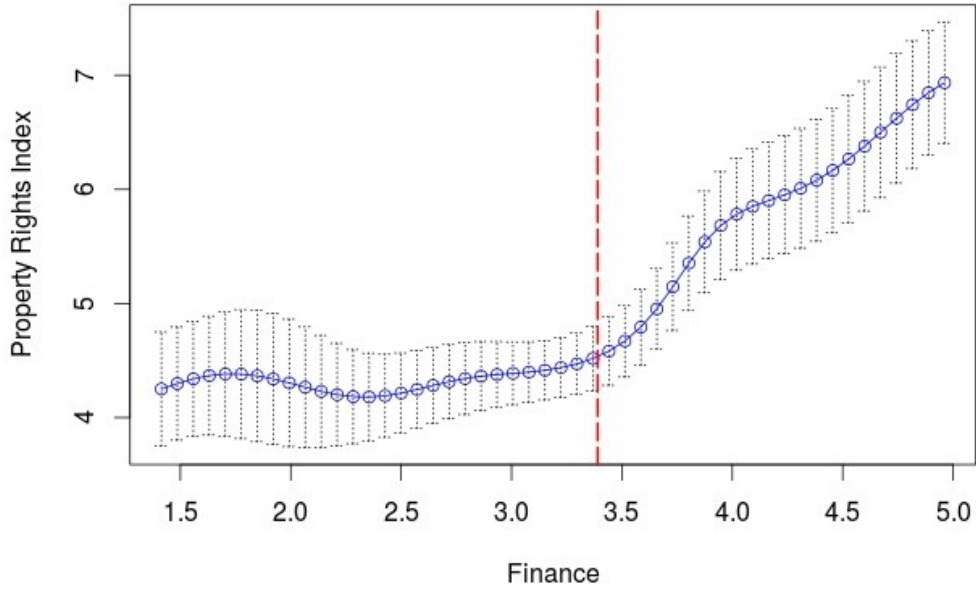


Figure 2: Partial Local Linear Semiparametric Regression Plot with Bootstrapped Pointwise Error Bounds for the Relation Between Property Rights and Finance.

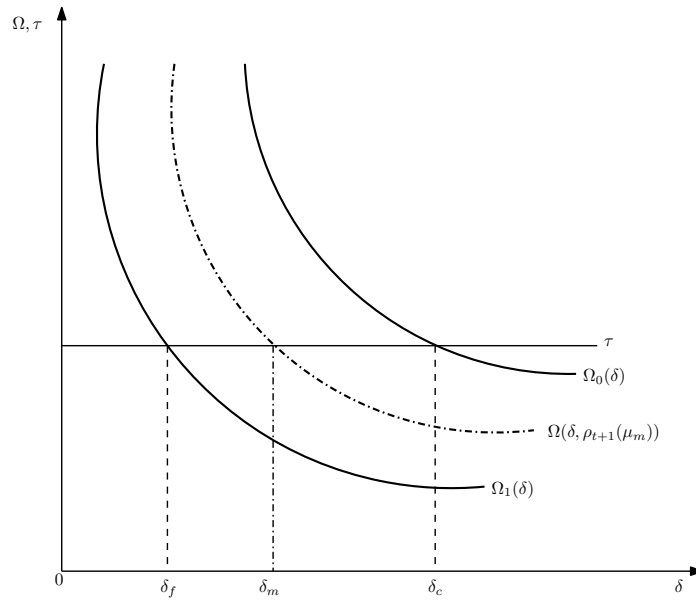


Figure 3: Multiple Equilibria and Threshold Effects in Proposition 3

Table 1: Threshold Regressions

Independent Variables	(1)		(2)		(3)	
	$\hat{\gamma} = 3.3900$		$\hat{\gamma} = 3.3900$		$\hat{\gamma} = 3.3857$	
	Low Regime: Finance $\leq$ 3.39	High Regime: Finance $>$ 3.39	Low Regime: Finance $\leq$ 3.39	High Regime: Finance $>$ 3.39	Low Regime: Finance $\leq$ 3.386	High Regime: Finance $>$ 3.386
Finance	0.1420 (0.1681)	1.0853*** (0.3169)	0.0485 (0.1612)	1.022*** (0.3314)	0.04571 (0.1458)	0.7484*** (0.2532)
Ethnic	-0.0009 (0.0041)	0.0017 (0.0074)	0.0020 (0.0041)	0.0015 (0.0072)	0.0016 (0.0044)	-0.0075 (0.0056)
Fractionalization	-0.0014 (0.0099)	0.0398*** (0.0112)	0.0020 (0.0088)	0.0365*** (0.0108)	0.0015 (0.0084)	0.0046 (0.0098)
Latitude	0.2684 (0.2156)	0.4317 (0.3541)	0.1771 (0.2164)	0.5252 (0.2195)	0.2369 (0.1961)	0.4075 (0.2410)
UK Legal Origin	-0.0951 (0.1713)	-0.8585** (0.3300)	0.1556 (0.2233)	-0.9157*** (0.3157)	0.2908 (0.2526)	-0.9514*** (0.2483)
Crisis	-	-	1.4488** (0.7219)	0.8504 (0.9116)	1.4273** (0.6348)	-0.3432 (0.6402)
Constraints on the Executive	-	-	-	-	0.04695 (0.2402)	-0.3082** (0.1447)
Financial Openness	-	-	-	-	-4.3762** (1.7026)	-5.7284 (4.8842)
Income in 1970	-	-	-	-	0.2884** (0.1081)	0.3922 (0.2841)
Income in 1970 Squared	-	-	-	-		
No. of Countries in Regime	46	37	46	37	45	38
95 % C.I. for $\hat{\gamma}$	[2.966 , 3.429]		[2.464 , 3.429]		[2.466 , 3.39]	

Notes: Standard errors of the split-sample regression are reported in parentheses. Significance at 10%, 5% and 1% are marked with \*, \*\*, \*\*\* respectively. The dependent variable for each regression is the average of the Fraser/Cato Institute Property Rights Index over the sample period 1970-2005. As for the independent variables, constraints on the executive and financial openness are averages over the the sample period 1970-2005. The variables crisis and UK legal origin are binary. Latitude and ethnic fractionalization are time invariant. Income measures for countries are fixed at their respective 1970 values. The finance variable is defined as the  $\log[1+(\text{private credit})/\text{GDP}]$  and then averaged over the time dimension. In each case, the threshold estimate  $\gamma$  corresponds to the finance variable.