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

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**Abstract**

This paper offers an insight into understanding recent empirical findings which suggest that beyond a certain threshold, financial development can catalyze property rights reforms. The explanation is based on a simple trade-off between costs and benefits of securing property. Securing the right to property allows agents to post collateral against loans, bettering their terms. However, securing such rights is costly. We analyze this trade-off along the path of financial development to establish that financial development creates incentives for better property rights institutions. However, for such incentives to materialize, financial development must cross a threshold.

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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). Recently 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). Using the Gwartney and Lawson index,[1] Bose et al. (2014) offer formal evidence in support of the view that increases in the size of the financial sector catalyze property rights reforms and that such an effect is economically meaningful.[2] One of the goals of this paper is to offer an explanation for this empirical regularity. We pivot our explanation on a set activities that form the basis of a financial market and put forward a theoretical argument to suggest that a mature financial system can in fact provide incentives to better codify and protect individuals' right to ownership.

While there is mounting evidence to suggest that financial system can influence the quality of property rights institutions, there is no reason to presume a linear relationship between the two variables. In fact, a formal analysis of the data presented in the Section 2 strongly suggests a non-linear relationship. Even a cursory look at the data brings out the non-linear pattern between the two variables. Suppose that we divide the time interval 1970-2005 into equal five year intervals and for each interval we calculate country specific

[1] 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)

[2] 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.

average value of private credit to GDP ratio for a sample of 106 countries. Next, we divide the sample into two-equal sized groups - one containing countries whose (average) private credit-to-GDP ratio never exceeded 30 percent (low finance group) and the other comprising of countries that have this ratio above 30 percent (high finance group). This leaves us with a distribution of private credit-to-GDP ratio corresponding to each time interval for each group of countries. Finally, we calculate the median of this distribution for each time interval. This is the finance variable of our interest. In Figure 1 we plot an index of property rights (Gwartney et al., 2009) over five year intervals from 1970 to 2005 against the constructed finance variable for the preceding five year interval. In 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 there may be differences in the way finance affects property rights protection in different subsets of countries. We take cue from this cursory evidence and undertake more formal tests with the data in Section 2. The analysis suggests that there exists a threshold in the relationship between property rights and finance 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.

In summary, the data points to two key stylized facts. The first fact is based on conventional wisdom as well as on existing results (Bose et al., 2014) and points to a causal relationship running from finance to the quality of property rights institutions. The second pattern in the data that we present in this paper suggests a non-linear relationship between the two variables. In this paper we seek to offer a theory of financial market that is able to explain both patterns that are present in the data.

Our main argument revolves around 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.[3] Sometimes the proximate triggers for these

[3]In countries adopting market-oriented reforms, this change has been rapid. Based on an index published by the Cato Institute, which ranks the quality of property rights institutions on a 10-point scale, 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

reforms have 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. Here, we build on these basic ideas and argue that a changing economic environment induced by financial developments can shape the evolution of property rights by altering tradeoffs between the costs and the benefits of protecting property.

We offer a formal theoretical rationale using a simple model of financial intermediation with incomplete information. In our economy individuals must access external funds to operationalize investments. Financial intermediaries ration credit because of the asymmetric nature of information. As a result some borrowers are denied loans. Faced with this possibility, borrowers post assets as collateral to improve the terms and conditions of the loans they receive. However, the gaps in the legislative framework allow for encroachment on these assets. This generates push back from property owners which can take many forms. For instance, owners could litigate, they could employ private security, or they could pay public authorities to protect their assets. Whichever is the preferred practice, it comes at a cost that increases with the fraction of property that owners wish to safeguard.[4] Protecting property offers additional non-trivial benefits via its effects on the contractual arrangements with the lenders. Specifically, the more an individual spends securing property, the more collateral an individual can post to better the terms and conditions of a loan contract. Against this background, we show that the marginal net gain from posting collateral increases with the level of financial development. As a result, mature financial markets generate additional incentives for individuals to secure their right to ownership.

Individual initiative to protect property plays a pivotal role in our analysis. One could however question the relevance of such initiative since laws that exist on the book apply equally to all members of the society. Therefore, any private initiative is futile in shaping the extent to which an individual is able to protect his/her own property. We,

between the 1970s and 1990s in 20 of the 71 countries that composed their sample.

[4]We do recognize that costs of enforcing property right could also take a more subtle form such as a misallocation of talent from productive to unproductive sectors (Acemoglu and Verdier, 1996), and an increase in market concentration (Furukawa, 2007). To keep the argument streamlined and tractable, we leave these costs out of our analysis.

however, argue otherwise and view effective property rights as a culmination of the laws that exist on books and the initiatives that are taken by the members of society at an individual or as a group. 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. An individual's effective right to the property also depends on the legal costs which he/she is willing to incur in an event of encroachment. Similarly, putting a fence up around the property or taking measures to prevent trespassing is a common private initiative among land owners. Costly initiatives such as these pre-emptively protect against encroachment and uphold law that exist on books. Also, it is also often the case that individuals as group rally their cause and shape the law that exist on books by undertaking costly initiatives (e.g. hiring lobbyists and public relation experts).[5] These observations let us take the stand that 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.[6]

In the analysis that follows, we exploit the tradeoff between the costs and benefit of protecting property from the perspective of an individual to draw conclusions at the aggregate level. In doing so, we do not simply aggregate individuals' behaviors. Instead we recognize that an individual's cost of protecting property is also affected by the decisions that other individuals make with regard to protecting their own property. This opens the analysis up to a richer set of possibilities and the equilibrium that prevails is uniquely determined by the level of financial development. In particular, beyond a threshold level

[5]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.

[6]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.

of financial development, the number of agents initiating safeguards against encroachment 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.

The remainder of the paper is organized as follows. Section 2 offers formal 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

Though finance matters for the development of property rights institution, there is no reason to presume linearity in their relationship. In this section, we look deeper into the data and use two separate methods to examine potential non-linearity in the relationship. As a first pass, we estimate 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. 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 (drawn from Gwartney et al. (2009)) and the average private sector credit to GDP ratio[7] for country $i$, respectively. 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 preceeding seven or less years. This serves as our baseline specification. With the exception of a financial crisis variable and a dummy for Catholicism, the above specification is identical to the one considered by Ayyagari et al. (2008).

[7]To be precise, our finance variable is the time average of log(1 + private credit to GDP)

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).[8] 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 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) 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:

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

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

[8]The estimation is performed for a sample of 83 countries for which data is fully available in R using the **np** package. See Hayfield and Racine (2008).

real per-capita incomes and greater openness are associated with stronger property rights (Gradstein, 2004; Wei, 2000).[9]

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+(private credit)/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 obatined in our earlier semi-parametric exercise. 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 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 also explains why a certain level of financial maturity is needed before financial development can shape incentives to protect property.

## 3 The Environment

In our model, 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.[10] 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[11] 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 $t+1$.

[9] The estimation is carried out with the same sample of 83 countries as in the previous exercise in R using a code made available by Bruce E. Hansen on his personal webpage. The relevant program can be found here: http://www.ssc.wisc.edu/~bhansen/progs/ecnmt_00.html.

[10] For the purpose of exposition, it is beneficial to think of this asset as a plot of uncultivated land.

[11] 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.

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, $r$.

While the cost of operationalizing the asset is same for all individuals, we assume that these project themselves 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.[12] As it will become apparent, some loan applicants may be adversely selected and denied credit since the project type 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 $\alpha_H = 0$.[13]

In our economy, the arrangements that ensure full rights to property are absent to some degree. However, the quality of property rights institution, whether formal or informal, are not exogenously given. Instead they evolve, 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 timing of events in our economy proceeds as follows. Prior to gaining access

[12] 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.

[13] 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.

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), $\gamma\upsilon$, 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 intermediaries include the cost of providing liquidity services, agency costs, such as those 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. We assume that financial intermediaries operate in a competitive environment and that the terms and conditions of loan contracts offered in the market is common knowledge. Accordingly, 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.

Recall that the project type associated with any given loan application is private information. In response, financial intermediaries exploit known differences between the type-L and type-H project owners when designing a menu of contracts that induces 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 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 $U_i \equiv \pi_i[p_i(Q\rho_{t+1} - R_i)x + \gamma\upsilon] + (1 - \pi_i)[\alpha_i + \gamma\upsilon]$ 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.[14] The following proposition fully describes the elements of the contract.

**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:*

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

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

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

$$p_i R_i x + (1 - p_i)\gamma\upsilon = rx + \delta \tag{5}$$

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

[14] For similar arguments, see Rothschild and Stiglitz (1976), Bencivenga and Smith (1993), and Bose and Cothren (1996).

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 $\gamma\upsilon < rx + \delta$, i.e. there is risk associated with lending. This implies, from (3) and (4) that $R_L < R_H$.

Note that the type-H individuals earn lifetime utility $U_H = \pi_H[p_H(Q\rho_{t+1} - R_H)x + \gamma\upsilon$ from their contracts $C_H$ and type-L individuals earn $U_L = \pi_L[p_L(Q\rho_{t+1} - R_L)x] + (1 - \pi_L)\alpha_L + \gamma\upsilon$ from $C_L$. Now consider the a full information scenario, where banks are able to distinguish between type-L and type-H individuals. In such a scenario, the offered contracts will still earn zero profit for the lenders under competition and banks have no need to deny credit to individuals. Let us define these first best contracts $C_i^F \equiv \{R_i, \pi_i = 1\}$ 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 $U_L(C_H^F) < U_L(C_L^F)$. It is clear that if first best contracts are being offered, then a type-H individual has an incentive to misrepresent herself as being type-L (pooling on $C_L^F$) but the converse isn't true. Hence, in order to separate the two types through self-selection, the banks distort the contracts for type-L individuals $C_L^F$ but have no need to change the contracts for type-H individuals who get their first best contracts $C_H^F = \{R_H, \pi_H = 1\}$. Given the expressions for $R_L$ and $R_H$, the contract for the type-L borrower is then determined by solving the following problem:

$$\max_{\{\pi_L\}} U_L(C_L) = \pi_L[(Q\rho_{t+1} - R_L)x] + (1 - \pi_L)\alpha_L + \gamma\upsilon;$$

$$\text{s.t.: } p_H(Q\rho_{t+1} - R_H)x + (1 - \pi_H)\alpha_H \geq \pi_L[p_H(Q\rho_{t+1} - R_L)x] + (1 - \pi_L)\alpha_H \qquad (6)$$

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, $\gamma\upsilon < rx + \delta$ 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 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.[15] 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. The agent solves this problem with knowledge of the contracts and knowledge of the *ex-ante* probability distribution which determines his 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*. We also assume that an agent takes the value of $\rho_{t+1}$ as given. The outcome of the optimization is summarized in the following proposition.

**Proposition 2** *Assume that $\gamma$ is bounded above and below by $\gamma_{max}$ and $\gamma_{min}$ respectively. Further, let $\Omega(\delta, \rho_{t+1}) \equiv \upsilon \left[1 + \lambda \left(\frac{1-p_H}{p_H}\right) \frac{Q\rho_{t+1}x - xr - \delta - \alpha_L}{Q\rho_{t+1}x - xr - \delta}\right]$. 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** Please recall that for a contract that is granted at time $t$, type-$L$ borrower will receive utility $U_L = \pi_L[p_L(Q\rho_{t+1} - R_L)x + +\gamma\upsilon] + (1 - \pi_L)[\alpha_L + \gamma\upsilon]$, with $\alpha_H = 0$. The first term in this expression is the net pay-off to a type-L borrower from the project in the event that loan is granted and the project is successful. The second term represents the pay-off in the event when the project is not funded. An equivalent expression for a type-H borrower is given by $U_H = \pi_H[p_H(Q\rho_{t+1} - R_H)x + \gamma\upsilon] + (1 - \pi_H)[\alpha_H + \gamma\upsilon]$ with $\alpha_H = 0$. Given the ex-ante probability of being assigned a type-L project $\lambda$, the individual solves

[15] 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 $R_L$.

the following optimization problem.

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

On substituting the expressions for 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 objective function in (7) is linear in $\gamma$ and the term $\Omega(\delta, \rho_{t+1})$ represents the marginal benefit of improving property rights. This includes the welfare gain which follows from an improvement in the terminal value of the land, $\gamma\upsilon$, and the consequent improvement in the terms and conditions of loan contracts. Whereas, $\tau$ represents the marginal costs associated with property rights improvement. Depending on which is greater, the agent sets $\gamma$ either at its maximum or at its minimum value.

The results obtained above 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 our principal focus 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 appealing to two simple notions. First, 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. Second, 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 $t$. It is worth noting that while collective choice of the individuals regarding property rights matters for the value of $\rho_{t+1}$, an individual's time $t$ choice of property rights is influenced by the value of $\rho_{t+1}$ (through Proposition 2). We exploit this feedback loop in the next proposition to demonstrate how economy-wide choice of property rights varies when $\delta$ takes a value from high to low representing a transition from low to high levels of financial development.

**Proposition 3** *Given $\mu_t$ is 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** Define $\Omega_1(\delta) \equiv \Omega(\delta, \rho_{t+1}(\mu_t = 1))$ and $\Omega_0(\delta) \equiv \Omega(\delta, \rho_{t+1}(\mu_t = 0))$. Since, $\rho'_{t+1}(\mu_t) < 0$ and since $\frac{\partial \Omega}{\partial \rho_{t+1}} > 0$, 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 $\delta_f < \delta_c$.[16]

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

[16] Refer to Figure 3 for a diagrammatic representation.

equilibrium condition implies $\frac{d\mu}{d\delta} = -\frac{\partial\Omega/\partial\delta}{(\partial\Omega/\partial\rho)\rho'(\mu)} < 0$. Accordingly, as $\delta \to \delta_f$, more and more individuals will choose $\gamma = \gamma_{max}$ and $\mu_m \to 1$. ∎

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 other features that one may view as relevant for 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.[17] To keep our exposition simple, streamlined and short, we have chosen not to include these features explicitly in the main presentation.

[17] 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

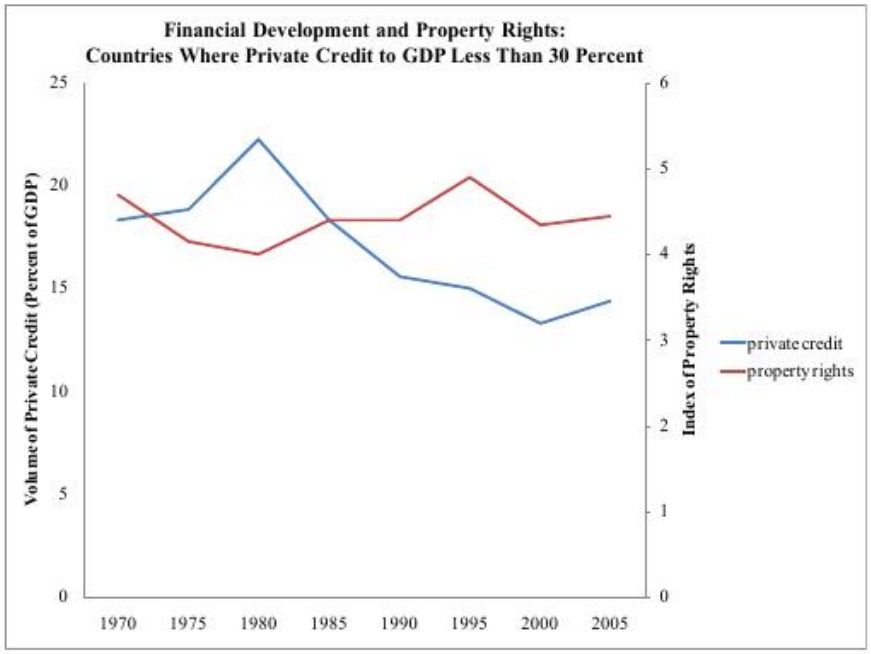
## 6 Conclusion

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 financial markets mature and the costs of intermediation decline. 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 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.

## Figures and Tables



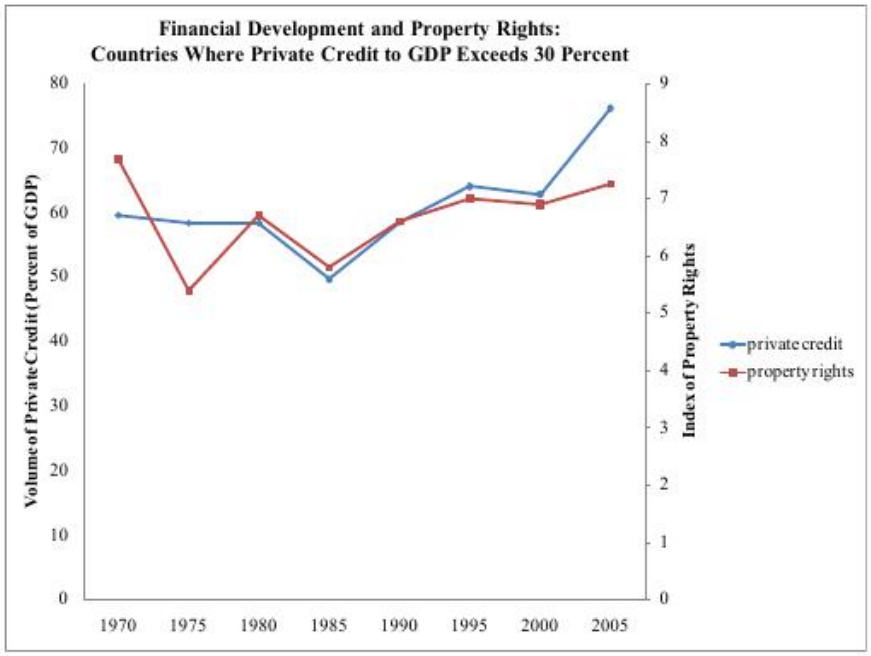




Figure 1: Evolution of Property Rights and Finance Over Time

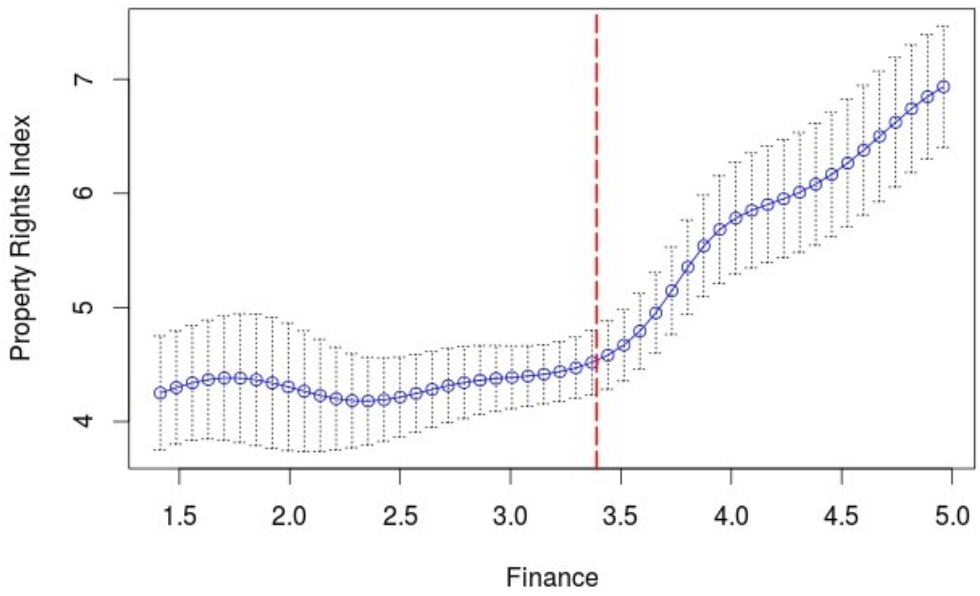



Figure 2: Partial Local Linear Semiparametric Regression Plot with Bootstrapped Pointwise Error Bounds for the Relation Between Property Rights and Finance.

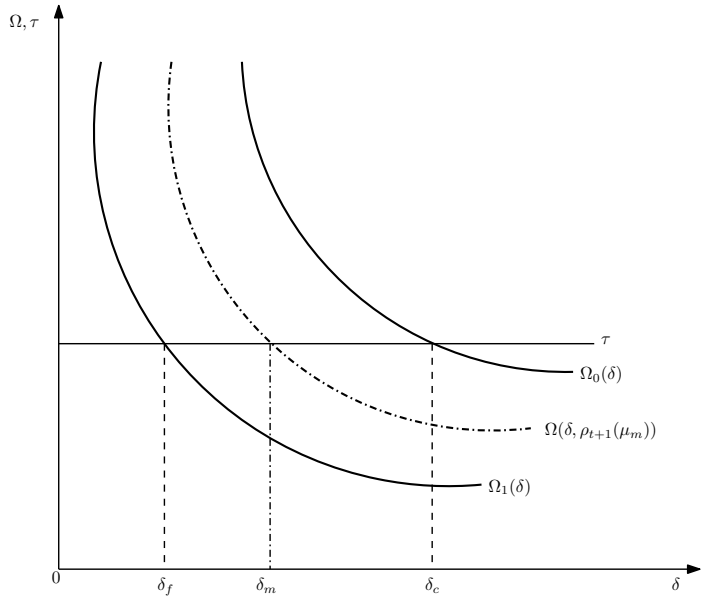



Figure 3: Multiple Equilibria and Threshold Effects in Proposition 3

Table 1: Threshold Regressions

| Independent Variables | (1) $\hat{\gamma} = 3.3900$ Low Regime: Finance $\leq 3.39$ | (1) $\hat{\gamma} = 3.3900$ High Regime: Finance $> 3.39$ | (2) $\hat{\gamma} = 3.3900$ Low Regime: Finance $\leq 3.39$ | (2) $\hat{\gamma} = 3.3900$ High Regime: Finance $> 3.39$ | (3) $\hat{\gamma} = 3.3857$ Low Regime: Finance $\leq 3.386$ | (3) $\hat{\gamma} = 3.3857$ High Regime: Finance $> 3.386$ |
|---|---|---|---|---|---|---|
| Finance | 0.1420 | 1.0853*** | 0.0485 | 1.022*** | 0.04571 | 0.7484*** |
| | (0.1681) | (0.3169) | (0.1612) | (0.3314) | (0.1458) | (0.2532) |
| Ethnic Fractionalization | -0.0009 | 0.0017 | 0.0020 | 0.0015 | 0.0016 | -0.0075 |
| | (0.0041) | (0.0074) | (0.0041) | (0.0072) | (0.0044) | (0.0056) |
| Latitude | -0.0014 | 0.0398*** | 0.0020 | 0.0365*** | 0.0015 | 0.0046 |
| | (0.0099) | (0.0112) | (0.0088) | (0.0108) | (0.0084) | (0.0098) |
| UK Legal Origin | 0.2684 | 0.4317 | 0.1771 | 0.5252 | 0.2369 | 0.4075 |
| | (0.2156) | (0.3541) | (0.2164) | (0.2195) | (0.1961) | (0.2410) |
| Crisis | -0.0951 | -0.8585** | 0.1556 | -0.9157*** | 0.2908 | -0.9514*** |
| | (0.1713) | (0.3300) | (0.2233) | (0.3157) | (0.2526) | (0.2483) |
| Constraints on the Executive | - | - | 1.4488** | 0.8504 | 1.4273** | -0.3432 |
| | | | (0.7219) | (0.9116) | (0.6348) | (0.6402) |
| Financial Openness | - | - | - | - | 0.04695 | -0.3082** |
| | | | | | (0.2402) | (0.1447) |
| Income in 1970 | - | - | - | - | -4.3762** | -5.7284 |
| | | | | | (1.7026) | (4.8842) |
| Income in 1970 Squared | - | - | - | - | 0.2884** | 0.3922 |
| | | | | | (0.1081) | (0.2841) |
| 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+ (private credit)/GDP] and then averaged over the time dimension. In each case, the threshold estimate $\gamma$ corresponds to the finance variable.

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