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Investor Protection and Income Inequality: Risk Sharing vs Risk Taking*

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Abstract

This paper studies the relationship between investor protection and income inequality. In the presence of market frictions, better protection makes investors more willing to take on entrepreneurial risk when lending to firms, thereby improving the degree of risk sharing between financiers and entrepreneurs. On the other hand, by increasing risk sharing, investor protection also induces more risk taking. By increasing entrepreneurial risk taking, it raises income dispersion. By reducing the risk faced by entrepreneurs, it reduces income volatility. As a result, the relationship between investor protection and income inequality is non monotonic, since the risk-taking effect dominates at low levels of investor protection, while risk sharing becomes stronger when more risk is taken. Empirical evidence from up to sixty-seven countries spanning the period 1976-2004 supports the predictions of the model.

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1 Introduction

The literature on institutions, law and economics has shown that investor protection affects significantly the financial structure of an economy, and has investigated the effects of financial development on economic performance in terms of GDP growth, productivity and investment.[1] What has received less attention is that investor protection, through its effect on financial structure and the allocation of risk, may influence the risk taking behavior of investors and firms, thereby affecting income inequality. To fill this gap, this paper investigates the link between investor protection and income inequality, both theoretically and empirically. It proposes a model where investor protection promotes risk sharing between financiers and entrepreneurs, thereby inducing more risk taking in the economy. Better risk sharing and wider risk taking, in turn, affect income inequality in opposite ways. The main results of the model are then confronted with the data.

To formalize these ideas, I construct a simple model of investors and entrepreneurs where agents are risk averse and heterogeneous in ability. Investors decide how to allocate their endowment between safe loans (debt) and diversified portfolios of risky (equity-like) assets, while entrepreneurs face a choice between a safe and a risky technology, whose probability of success depends on ability. Starting up a firm entails a fixed entry cost that entrepreneurs must cover by borrowing. Financial markets are subject to a moral hazard problem arising from the non-observability of output to financiers. Measures of investor protection alleviate this financial friction. In particular, I assume that investor protection promotes transparency by imposing a cost to misreport cash flow.[2] For instance, this cost can be thought of as the additional honorary an auditor would charge to certify a falsified book or to design financial operations to hide revenues from outside financiers. Better guarantees generate more confidence among investors, thereby making them more willing to insure the entrepreneurs through lending. It follows that in financial systems with stronger investor protection there is more equity-like external finance relative to debt, which offers entrepreneurs a higher degree of risk sharing. Finally, I rule out wealth heterogeneity among agents, so that all inequality is due to idiosyncratic factors (ability), financial market conditions and income risk.[3]

[1] See, among others, Acemoglu and Johnson (2005), La Porta et al. (1997) and (2006), Beck and Levine (2004), Levine (2005) and references therein.

[2] Investor protection takes the form of a hiding cost also in Aghion et al. (2005), Castro et al. (2004) and Lacker and Weinberg (1989). In this paper, like in the two latter, the cost is proportional to the hidden amount, while in the first, it equals a fraction of the initial investment.

[3] Using microdata, Hurst and Lusardi (2004) show that wealth may not be the key factor affecting entrepreneurial choices, while Ardagna and Lusardi (2008) provide evidence that skills and the fear of failure are among the most important determinants of entrepreneurship. This lends support to my modelling choice of abstracting from wealth heterogeneity to better focus on other factors, such as risk and ability.

In the model, better investor protection affects income inequality in two ways. (i) It improves risk sharing, thereby reducing income volatility for the agents operating the risky technology; and (ii) it raises the share of entrepreneurs choosing the risky option, and therefore being exposed to earnings risk. While (i) tends to reduce inequality, (ii) raises it. The analysis shows that the "risk taking" effect (ii) dominates when investor protection is low since risky entrepreneurs still face a considerable earnings risk, while the "risk sharing" effect (i) prevails when investor protection is high since better insurance applies to a large mass of risky entrepreneurs. Hence, the relationship between investor protection and income inequality is predicted to be non-monotonic. Moreover, since investor protection affects the financial structure of the economy, the same non-monotonic relationship holds between the share of equity-like external finance and inequality.

To evaluate empirically the main results of the model, I consider a dataset covering up to sixty-seven countries observed between 1976 and 2004. The choice of a cross-country analysis is dictated by the fact that investor protection is generally set by law and hence exhibits little within-country variation. A major challenge for the empirical part is to find appropriate measures of the relevant variables. I adopt two proxies for inequality: first, the Gini coefficient of the income distribution, which is available for a relatively large sample of countries and years. Although the model refers to entrepreneurs, which belong to the top income percentiles, three main arguments may justify the use of a general indicator of inequality.[4] First, recent evidence from several countries suggests that a large fraction of the variation in income inequality over the last two decades is explained by changes at the top of the distribution (see, among others, Atkinson et al., 2009 and Heathcote et al., 2010). Second, employees normally earn higher wages and are subject to higher employment risk when working in more productive and riskier firms.[5] Hence the results obtained for entrepreneurs may be expected to trickle down to all workers. Finally, the model could also be interpreted as one of occupational choice *à la* Kihlstrom and Laffont (1979), where each agent can either be a worker receiving a fixed wage or an entrepreneur facing risk. In this case, the implications on earnings inequality would refer to the entire population. Nonetheless, for robustness, I replicate part of the analysis proxying inequality with the ratio of the top 1st to 10th percentiles of the income distribution. The main shortcoming with this variable, recently compiled by Alvaredo et al. (2011), is its very limited cross-sectional availability (at present, the database covers only 23 countries).

Turning to the independent variables, I proxy investor protection with the *de jure* index

[4] Note that, if investor protection affected inequality among the poor in a different way and through another channel, my estimates would suffer from attenuation bias.

[5] Evidence that more productive firms pay higher wages is provided, among others, by Oi and Idson (1999).

compiled by La Porta et al. (2006), and estimate its non-linear relationship with inequality. Unfortunately, this series is available for a relatively limited number of countries and does not exhibit any time variation. To exploit the wider cross-section of the data on inequality and its time-series dimension, I evaluate empirically the theoretical mechanism following a two-step approach. Since the model predicts that investor protection affects inequality through its effect on the optimal financial contract, I first show that better protection tends to coincide with a higher share of equity-like external finance, and then I estimate a non-linear relationship between the indicator of financial structure and inequality on a wider cross-section and a panel. The results suggest that inequality varies non-monotonically both with investor protection and the relative weight of equity-like finance, as predicted by the model.

The paper is related to four main strands of literature. Acemoglu and Johnson (2005), as well as La Porta et al. (1997, 1998, 1999, 2006), show that investor protection, and in general institutions aimed at contractual protection, affect the financial structure of an economy by promoting the development of stock markets, but have unclear effects on economic performance. No attention was devoted, however, to study the effects on inequality.

Theoretical contributions from the growth literature (see Aghion and Bolton, 1997, Banerjee and Newman, 1993, Galor and Zeira, 1993, Greenwood and Jovanovic, 1990, and Piketty, 1997, among others) have proposed explanations for the relationship between financial development, inequality and growth. In most of these models, income inequality originates from heterogeneity in the initial wealth distribution, paired with credit market frictions.[6] As the poorest are subject to credit constraints, they are prevented from making the efficient investment. Over time, capital accumulation determines the dynamics of wealth and income. I depart from this approach in two main respects. First, the financial friction affects the share of risk borne by agents, rather than the amount of external finance available to them. Second, I consider a different source of ex-ante heterogeneity (entrepreneurial ability), and propose a new mechanism translating differences in ability into income inequality that is independent of wealth accumulation. In the present paper, heterogeneity in productivity, the extent of risk sharing and risk taking ultimately determine the income distribution.[7]

[6] The financial friction may consist in the non-observability of ex-post outcomes as in Banerjee and Newman (1992) and Galor and Zeira (1993), or of effort as in Aghion and Bolton (1997) and Piketty (1997).

[7] Similarly to this paper, in Acemoglu and Zilibotti (1999) income inequality is generated by managerial incentives. Antunes et al. (2008) propose a quantitative model with heterogeneity in wealth and ability where weak financial institutions hinder growth and raise income inequality. Yet, both papers abstract from firm-specific idiosyncratic risk.

This paper also contributes to the recent literature on the macroeconomic implications of entrepreneurship which addresses the effects of financial frictions on investment, growth and volatility through their impact on entrepreneurial choices (see Quadrini, 2010 for a review). The papers focusing on distributional issues tend to consider financial frictions as a factor that perpetuates and exacerbates wealth inequality by affecting the investment and saving choices of entrepreneurs, and abstract from entrepreneurial risk sharing and risk taking. Other papers relate financial institutions and entrepreneurship to growth through risk sharing, risk taking, and managerial ability, but do not study inequality. For instance, Castro et al. (2004) show that financial frictions may slow down aggregate capital accumulation due to imperfect risk sharing, and that the overall effect on growth may be ambiguous. Michelacci and Schivardi (2011) argue that, if firms cannot diversify away their idiosyncratic risk due to financial frictions, there is less risk taking and this has negative effects on growth. Thesmar and Thoenig (2011) point out that increased participation of shareholders, by providing better risk sharing, induces higher risk taking and volatility among public companies, and has the opposite effect on private firms without access to risk sharing. Caselli and Gennaioli (2011) show that weak contract enforcement deteriorates productivity (TFP) by discouraging untalented family-firm owners from hiring competent managers (as in Burkart et al., 2003).

The vast empirical literature on financial development and economic performance (see Levine, 2005 and references therein) provides evidence that deeper financial markets foster growth. Very little attention was paid to the effects of financial development on income inequality. Two recent contributions (see Clarke et al., 2006 and Beck et al., 2007) show that higher availability of credit to the private sector tends to reduce income inequality. My results are consistent with this evidence, but also provide a novel insight suggesting that equity-like finance, promoting risk taking, may increase inequality.

The remainder of the paper is organized as follows. Section 2 presents the model of entrepreneurial choice and shows how earnings and the degree of risk taking vary in equilibrium with investor protection. In section 3, I characterize analytically and by means of numerical solution how income inequality responds to changes in investor protection and financial structure. Section 4 briefly discusses some reasons why investor protection may be imperfect and vary across countries. Section 5 provides empirical evidence from up to sixty-seven countries over the period 1976-2004 supporting the main results of the model, and section 6 concludes.

2 The model

In this section, I propose a simple static model where risk-averse agents, heterogeneous in their entrepreneurial ability, have to choose between safe and risky projects and need external finance. Asymmetric information in the financial market generates a moral hazard problem that makes it too costly for some entrepreneurs to finance risky projects. Investor protection may alleviate moral hazard, thereby easing the conditions of access to finance and promoting both risk sharing and risk taking.

2.1 Set up

Consider a small open economy populated by a continuum of risk-averse agents whose preferences are represented by

$$V = \mathbb{E}\left[u\left(c\right)\right],$$

where $\mathbb{E}$ is the expectation operator, c is consumption of a homogeneous good, and the utility function satisfies the following properties: $u' > 0$, $u'' < 0$ and $\lim_{c\to 0} u'\left(c\right) = \infty$.

Agents are heterogeneous in their ability, denoted by $\pi \in [0, 1]$, drawn from a continuously differentiable distribution $G\left(\pi\right)$, but have no wealth endowment. They work as self-employed entrepreneurs and can choose to produce the consumption good using either a safe or a risky technology. Their consumption may be heterogeneous and depend on individual ability and technological choice. The capital needed for production may be raised on the international financial market, where a risk-free asset yielding a gross return r is traded, along with risky assets that will be described later. The price of the consumption good and the safe interest rate are determined on the world market and are assumed to be constant and normalized to 1.

2.1.1 Technology

Each entrepreneur with ability π can choose between a safe and a risky technology. The former generates a constant level of production which is independent of ability:

$$y^S\left(\pi\right) = y^S = B.$$

The performance of firms using the risky technology depends on entrepreneurial ability.[8] For simplicity, I assume that ability only affects the probability of success and not the

[8] See Schiller and Crewson (1997), and Fairly and Robb (2003) for empirical studies on the determinants of entrepreneurial success, mainly among small firms.

quantities produced.[9] In particular, an entrepreneur with ability π generates output

$$y(\pi) = \begin{cases} y^H = A & \text{with probability } \pi \\ y^L = \varphi A & \text{with probability } 1-\pi \end{cases}$$

where $\varphi \in (0,1)$ and y^H and y^L denote production in the good and bad state respectively. This implies that a firm's expected cash flow is $[\pi + (1-\pi)\varphi]A$, which is increasing in ability. Success is i.i.d. within each ability group, hence there is no aggregate risk and total production of entrepreneurs with ability π equals $g(\pi)[\pi + (1-\pi)\varphi]A$, where $g(\pi)$ is the density of the ability distribution. Moreover, I assume that, regardless of their technological choice, entrepreneurs have to pay a fixed entry cost of 1 that can be covered by raising funds on the international financial market.

2.1.2 Financial market

I assume that investors in the international financial market are atomistic and risk-averse, and have perfect information about the risk-free interest rate ($r = 1$), production technologies (B, A and φ), the individual ability of each entrepreneur (π) and her technological choice, but cannot observe final output (y).

The financial contract entails the commitment of the firm to repay after production a certain amount, possibly contingent on the reported realization of output. Since production functions and technological choices are public information, entrepreneurs using the safe technology are known to generate with certainty a cash flow of B and thus face a fix repayment equal to the international gross risk-free rate, 1, which gives them a payoff of

$$w^S = B - 1.$$

The situation is different if the borrower runs a risky project. Once production has occurred, an unlucky entrepreneur can only report output $y^L = \varphi A$, and hence repay to investors the cash flow minus her earnings: $y^L - w^L(\pi)$. If successful, the entrepreneur may misreport the output realization and pretend to be in the bad state, in order to repay $y^L - w^L(\pi)$ instead of $y^H - w^H(\pi)$. However, I assume that measures of investor protection, specific to the borrower's country, make misreporting costly. For every unit of hidden cash flow, the firm incurs a cost $p \in [0,1]$, so that the payoff from misreporting is

[9] Ability can be considered as playing a twofold role. It enhances the chance of success in risky enterprises, as assumed in the model. But it may also raise productivity regardless of the technological choice. In the next section, I argue that this second effect can be introduced into the model without affecting the qualitative results. The relevant assumption is that ability is more important in the risky sector, which seems realistic.

$w^L(\pi) + (1-p)\left(y^H - y^L\right)$. Truth-telling is rational as long as its value is at least equal to that of misreporting. Therefore, the financial contract $\left\{w^H(\pi), w^L(\pi)\right\}$ must satisfy the incentive compatibility (IC) constraint:

$$u\left(w^H(\pi)\right) \geq u\left(w^L(\pi) + (1-p)\left(y^H - y^L\right)\right). \tag{IC}$$

Financial contracts are set to maximize the entrepreneur's expected utility, $V^R(\pi)$, subject to the IC constraint and the outsiders' participation constraint. The latter requires that investors be indifferent between lending to all entrepreneurs with ability π, and buying the risk-free asset.[10] Thus, the payoffs from the risky choice are determined as the solution to the optimal financial contract problem:

$$\max_{w^H(\pi), w^L(\pi)} V^R(\pi) \equiv \pi u\left(w^H(\pi)\right) + (1-\pi)\, u\left(w^L(\pi)\right), \tag{P1}$$

subject to the incentive compatibility constraint:

$$u\left(w^H(\pi)\right) \geq u\left(w^L(\pi) + (1-p)(1-\varphi)A\right), \tag{IC'}$$

and investors' participation constraint:

$$\pi\left(A - w^H(\pi)\right) + (1-\pi)\left(\varphi A - w^L(\pi)\right) = 1. \tag{PC}$$

Note that a pooled portfolio of loans to the i.i.d. entrepreneurs with ability π yields the LHS of (PC) with certainty, so that investors face no uncertainty.[11]

2.1.3 Equilibrium

Each entrepreneur with ability π has rational expectations and chooses technology, $T \in \{S, R\}$ (safe or risky), to maximize her expected utility:

$$\max_{T \in \{S,R\}} V^T(\pi), \tag{P2}$$

where

$$\begin{aligned} V^S(\pi) &= u\left(w^S\right) \\ V^R(\pi) &= \pi u\left(w^H(\pi)\right) + (1-\pi_i)\, u\left(w^L(\pi)\right). \end{aligned}$$

[10] See Castro et al. (2004) for a similar way of modelling the optimal financial contact.

[11] It follows that the participation constraint is the same as in the case of competitive, risk-neutral financiers with a single borrower with ability π.

In other words, every entrepreneur chooses technology, given her individual ability π and the optimal financial contract $\{w^H(\pi), w^L(\pi)\}$ which solves $(P1)$.

Definition *Given the cost of misreporting, p, the equilibrium for this small open economy is defined as the set of technological choices and financial contracts* $\{T(\pi), w^H(\pi), w^L(\pi)\}_{\pi\in[0,1]}$, *such that each agent with ability* π *solves (P2), with payoffs solving (P1) subject to (IC') and (PC).*

For simplicity, I assume that $\varphi A < B < A$, which implies that the risky technology is on average more productive than the safe one for some entrepreneurs.

2.2 Solution

To solve for the optimal technological choice $(P2)$, entrepreneurs need to know the payoffs from the risky project, determined by the optimal financial contract $\{w^H(\pi), w^L(\pi)\}_{\pi\in[0,1]}$. Therefore, I proceed backwards and start by solving problem (P1) subject to (IC') and (PC). I first obtain the optimal contract under efficient markets (with no information asymmetry) and then compute the optimal payoffs in the presence of asymmetric information for a given level of investor protection. Next, I characterize the technological choice $\{T(\pi)\}_{\pi\in[0,1]}$, given the optimal payoffs. Finally, I show how the equilibrium varies with the degree of investor protection.

2.2.1 Optimal financial contract: efficient markets

If investors could perfectly observe the cash flow of a firm, misreporting would be impossible, and hence the optimal financial contract would simply maximize the expected utility of a risk-averse borrower with success probability π (P1) subject to the participation constraint of a perfectly diversified lender (PC). Thus, investors would provide entrepreneurs with full insurance in exchange for an expected gross return equal to the safe rate, as analytically shown in the first order conditions:

$$\begin{aligned} u'\left(w^H(\pi)\right) &= u'\left(w^L(\pi)\right) = u'\left(w^{FB}(\pi)\right) \\ w^{FB}(\pi) &= \pi A + (1-\pi)\varphi A - 1, \end{aligned}$$

where u' is the first derivative of u and $w^{FB}(\pi)$ denotes the efficient, first-best, payoff of a risky entrepreneur with ability π, which is equal to her expected cash flow, increasing in ability, minus the risk-free interest rate repayment.

2.2.2 *Optimal financial contract: Asymmetric information*

If the cash flow cannot be observed by outsiders, entrepreneurs may have an incentive to misreport, and hence the optimal financial contract must also satisfy the incentive compatibility constraint (IC'). The first-best contract solves (P1) subject to (IC') and (PC) only if investor protection drives the gain from misreporting down to zero, which happens only for $p = 1$. This means that when investor protection is perfect ($p = 1$), outside financiers can behave as if they were perfectly informed, and thus fully insure entrepreneurs without inducing them to misreport.

If investor protection is not perfect ($0 \leq p < 1$), first-best state-invariant earnings are not incentive compatible since $w^{FB}(\pi) < w^{FB}(\pi) + (1-p)(1-\varphi)A$ and entrepreneurs in the good state would be tempted to misreport their cash flow realization. Due to risk aversion, agents want to minimize the difference between the marginal utilities in the two states, $u'\left(w^H(\pi)\right) - u'\left(w^L(\pi)\right)$. The combination of $w^H(\pi)$ and $w^L(\pi)$ that achieves this goal and complies with incentive compatibility is the one satisfying (IC') with equality. Investors' participation constraint (PC) needs also hold with equality, so that the optimal financial contract satisfies the following first order conditions:

$$w^H(\pi) = w^L(\pi) + (1-p)(1-\varphi)A, \tag{1}$$

$$w^L(\pi) = \varphi A - 1 + \pi p(1-\varphi)A. \tag{2}$$

2.2.3 *Technological choice*

Entrepreneurs with ability π will choose the risky technology if it gives at least the same expected utility as the safe project:

$$T(\pi) = R \Longleftrightarrow V^R(\pi) \geq V^S.$$

Since the state-contingent payoffs of a risky entrepreneur, $w^H(\pi)$ and $w^L(\pi)$ in equations (1) and (2), increase with ability (π), while the difference between them is independent of it, her expected utility, V^R, is also increasing with ability. Expected utility of a safe entrepreneur, instead, is constant and does not depend on ability. This implies that the solution to the technological choice problem ($P2$) features a threshold ability level π^* such that the agents with ability higher than π^* choose the risky technology while those with lower ability choose the safe project. This property is formalized in Lemma 1.

Lemma 1 *There exists a unique* π^* *such that* $\forall \pi \geq \pi^*$, $\pi u\left(w^H(\pi)\right) + (1-\pi)u\left(w^L(\pi)\right) \geq u(w^S)$), *and* $\left\{w^H(\pi), w^L(\pi)\right\}$ *is the solution to* ($P1$) *subject to* (IC') *and* (PC).

Proof. *See the Appendix.* ■

Note that, due to risk aversion, the expected payoff of risky entrepreneurs with ability equal to the threshold, $\pi^* w^H(\pi^*) + (1-\pi^*) w^L(\pi^*)$, must be higher than the safe earnings, w^S.

2.2.4 Investor protection and the equilibrium

To study how investor protection affects the equilibrium of the model, I first focus on the optimal financial contract and then on technological choice. The optimal payoffs of risky entrepreneurs can be conveniently re-written as

$$\begin{aligned} w^H(\pi) &= w^{FB}(\pi) + (1-\pi)(1-p)(1-\varphi)A \\ w^L(\pi) &= w^{FB}(\pi) - \pi(1-p)(1-\varphi)A. \end{aligned}$$

The first component, $w^{FB}(\pi)$, represents the payoff of a risky entrepreneur with ability π under perfect investor protection ($p = 1$). The second term is the adjustment that investors have to set to induce truth-telling, which is state contingent and varies with ability and investor protection. This term is positive in the good and negative in the bad state to offset the temptation of an entrepreneur to misreport cash flow. It is decreasing in p because when the unit cost of hiding cash flow is high, the temptation to misreport is low and hence a smaller deviation from the first best is enough to achieve truth-telling. It follows that also the wedge between state-contingent earnings, $w^H(\pi) - w^L(\pi)$, measuring the price that entrepreneurs have to pay for the temptation to misreport, is decreasing in investor protection. Moreover, since more skilled entrepreneurs are more likely to be in the good state, and hence to be tempted to hide cash flow, higher ability implies lower payoffs in both states relative to the efficient case, as long as investor protection is not perfect. Overall, both $w^H(\pi)$ and $w^L(\pi)$ are increasing in entrepreneurial ability, as clearly suggested by equations (1) and (2). Finally, notice that for $p = 0$, the financial contract is akin to debt, implying a constant repayment equal to the risk-free rate, and the entire risk is borne by the entrepreneur. As investor protection increases, investors bear more and more risk, which makes the financial contract closer to equity.

Expected earnings of a risky entrepreneur with ability π,

$$E[w \mid \pi] = [\pi(1-\varphi) + \varphi]A - 1,$$

are equal to the first best payoff, $w^{FB}(\pi)$, and do not vary with investor protection. Her expected utility, due to risk aversion, falls when the difference between state-contingent

earnings grows. Therefore, a rise in p, by reducing the gap between $w^H(\pi)$ and $w^L(\pi)$, increases the expected utility of risky entrepreneurs, V^R.

Since equilibrium earnings are functions of investor protection and the technological parameters, also the threshold ability π^* varies with p, A, φ and B, as formalized in Lemma 2.

Lemma 2 *The threshold ability π^* is a decreasing function of investor protection (p) and technological level of the risky sector (A); it increases with the riskiness of the risky technology (inverse of φ) and the productivity of the safe one (B):*

$$\frac{\partial \pi^*}{\partial p} < 0;\ \frac{\partial \pi^*}{\partial A} < 0;\ \frac{\partial \pi^*}{\partial \varphi} < 0;\ \frac{\partial \pi^*}{\partial B} > 0$$

Proof. *See the Appendix.* ■

Intuitively, stronger investor protection allows entrepreneurs to better share risks with investors, thereby raising the expected utility drawn from the risky project. Since payoffs and hence V^R are increasing in ability, a rise in p makes the risky technology preferable to the most able among safe entrepreneurs, i.e. reduces threshold ability π^*. A higher A implies that productivity of the risky project increases, and more so in the good state. As a consequence, payoffs rise but also the wedge between them. Since the overall effect on expected utility is positive, a more productive technology reduces the threshold ability for risky entrepreneurship. The parameter φ captures the riskiness of the risky technology (maximum risk for $\varphi = 0$, no risk for $\varphi = 1$), and also affects its expected productivity. If it grows, it makes the risky option preferable to the most able among safe entrepreneurs because it reduces the volatility of state-contingent earnings and increases their expected value, thereby raising expected utility. Trivially, higher productivity in the safe industry, B, makes it more attractive, thereby inducing the least able among risky entrepreneurs to adopt the safe technology, which rises the threshold π^*.

The threshold also depends on risk aversion, since the curvature of the utility function affects expected utility for given probability of success (π, i.e., ability). For instance, under CRRA utility with relative risk aversion equal to or higher than one, the risky technology is not run in equilibrium ($\pi^* = 1$) as long as the earnings of the most able in the bad state are non positive, i.e., for $p \leq (1 - \varphi A)/[(1 - \varphi)A]$, which is positive for $\varphi A < 1$. Alternatively, when risk aversion is sufficiently low, there may be entrepreneurs choosing the risky project even in the absence of investor protection ($\pi^*_{p=0} = \pi^*_{\max} < 1$).

In the case of perfect investor protection ($p = 1$), the risky technology gives higher expected utility than the safe one whenever its expected productivity is higher: $[\pi + (1 - \pi)\varphi] A$

$\geq B$. Therefore, it is easy to derive a closed form solution for the threshold ability,

$$\pi^*_{p=1} = \frac{B - \varphi A}{(1-\varphi) A},$$

and verify that it lies in the support of π under the hypothesis that $\varphi A < B < A$.

In the general case of imperfect investor protection ($0 \leq p < 1$), the expression for the threshold is more involved. However, the payoffs are easily obtained as:

$$w(\pi) = \begin{cases} w^S & \text{with probability } 1 & \text{for } \pi < \pi^* \\ w^H(\pi) & \text{with probability } \pi & \text{for } \pi \geq \pi^* \\ w^L(\pi) & \text{with probability } 1-\pi & \text{for } \pi \geq \pi^* \end{cases}$$

where $w^H(\pi)$ and $w^L(\pi)$ are given by (1) and (2). Henceforth, I denote the threshold abilities associated with $p = 1$ and $0 \leq p < 1$ by $\pi^*_{p=1}$ and $\pi^*_{p<1}$, respectively.

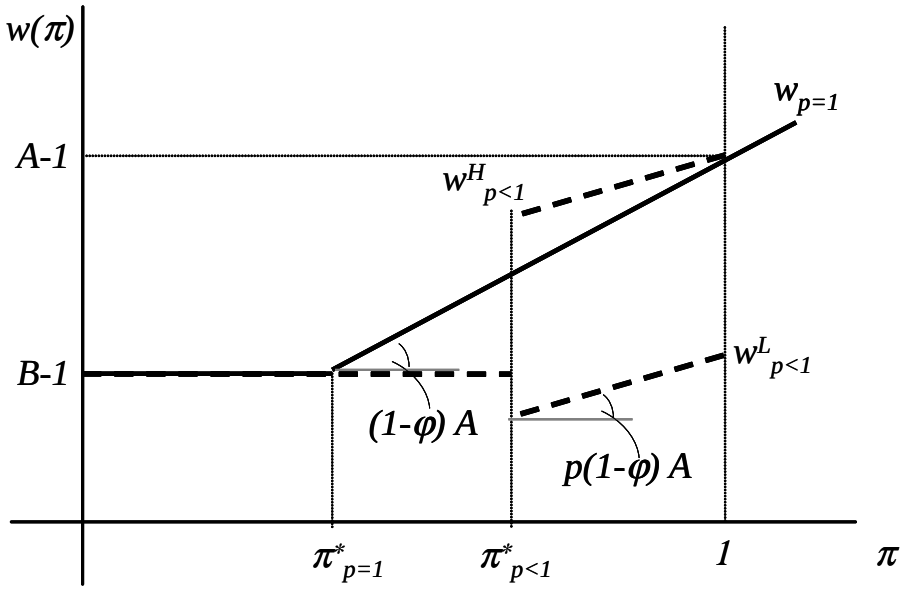

Figure 1: Ability and Earnings in Equilibrium.

Figure 1 illustrates the equilibrium ability-earnings profiles. If there is perfect investor protection, $p = 1$, income of entrepreneurs is described by the solid line. It is flat and equal to w^S for the less able, who run the safe project, and proportional to ability for the more talented ones, who run the risky project. Due to perfect risk sharing, earnings are constant across states. If investor protection drops to $0 \leq p < 1$ (dashed line), financing a risky firm becomes more costly, thereby inducing the least able among entrepreneurs

to shift to the safe technology. Graphically, (1) the mass of risky firms shrinks, i.e., the flat segment of the earnings profile becomes longer. I define this as the "risk taking" effect. (2) Earnings become state contingent, and the wedge between $w^H_{p<1}$ and $w^L_{p<1}$ widens as p falls due to worse risk sharing. I call this the "risk sharing" effect. The fact that imperfect insurance reduces expected utility of risky entrepreneurs is captured by the jump in expected earnings at the threshold $\pi^*_{p<1}$.

Note that safe entrepreneurs are indifferent between raising external finance through standard debt and equity-like contracts. Risky firms instead can only be started if financed through equity-like instruments. This implies that, in the presence of an infinitesimal cost of signing the optimal financial contract, safe entrepreneurs choose debt, and hence the financial structure of the economy, described by the weight of equity in total external finance, is captured in the model by the size of the risky sector, which is denoted as $\eta \equiv 1 - G(\pi^*)$ for empirical purpose. This measure is decreasing in the threshold ability and increasing in investor protection, and varies with technological parameters.

Corollary 1 *The weight of equities in total external finance, η, is decreasing in the threshold ability (π^*), the riskiness of the risky technology (inverse of φ) and the productivity of the safe one (B):*

$$\frac{\partial \eta}{\partial \pi^*} \leq 0, \ \frac{\partial \eta}{\partial \varphi} \geq 0, \ \frac{\partial \eta}{\partial B} \leq 0;$$

it is increasing in investor protection (p) and technological level of the risky sector (A):

$$\frac{\partial \eta}{\partial p} \geq 0, \ \frac{\partial \eta}{\partial A} \geq 0.$$

Proof. *See the Appendix.* ■

3 Evaluating income distribution

In this section, I study how investor protection affects income inequality. I consider measures of inequality accounting for the entire distribution of income such as the variance and the Gini coefficient, and show analytically and by means of numerical solution how these respond to changes in investor protection and in the financial structure.

A first measure of inequality that takes into account the entire income distribution is the variance of the earnings realizations:

$$\begin{aligned} Var(w) &= G(\pi^*)\left[w^S - \mathbb{E}[w]\right]^2 + \int_{\pi^*}^1 \pi\left(w^H(\pi) - \mathbb{E}[w]\right)^2 g(\pi)\, d\pi \\ &\quad + \int_{\pi^*}^1 (1-\pi)\left(w^L(\pi) - \mathbb{E}[w]\right)^2 g(\pi)\, d\pi, \end{aligned} \tag{3}$$

where

$$\mathbb{E}[w] = G(\pi^*)\, w^S + \int_{\pi^*}^1 \mathbb{E}[w \mid \pi]\, g(\pi)\, d\pi$$

is the average income in the economy. Lemma 3 proves $\mathbb{E}[w]$ to be increasing in investor protection.

Lemma 3 *Average entrepreneurial earnings, $\mathbb{E}[w]$, are increasing in investor protection, p.*

$$\frac{d\mathbb{E}[w]}{dp} \geq 0.$$

Proof. *See the Appendix.* ■

Intuitively, an increase in the cost of misreporting, p, gives risky entrepreneurs better insurance, thereby encouraging more agents to choose the risky technology with a higher payoff. This implies that also aggregate production and welfare increase with investor protection.[12]

Equation (3) for the variance of earnings suggests that better investor protection affects inequality both through the "risk sharing" and the "risk taking" effect: by the former, it closes the gap between state-contingent earnings of entrepreneurs, thereby reducing income differentials among agents with the same ability, $\pi \geq \pi^*$, and hence overall inequality. On the other hand, a drop in the threshold ability π^* implies that a mass $g(\pi^*)$ of agents switches to state-contingent earnings, which is likely to translate into higher inequality. To better evaluate these forces and the overall effect of investor protection on inequality, it is useful to write down the analytical expression for the derivative of the variance of the earnings distribution with respect to p:

$$\frac{dVar}{dp} = -2(1-p)(1-\varphi)^2 A^2 \int_{\pi^*}^1 \pi(1-\pi)\, g(\pi)\, d\pi + \frac{\partial \pi^*}{\partial p}\frac{\partial Var}{\partial \pi^*}. \tag{4}$$

[12] In the next session, I discuss alternative assumptions under which perfect investor protection may not be socially optimal or politically viable.

The first term captures the "risk sharing" effect of investor protection, which tends to reduce inequality and is stronger the larger is the mass of risky entrepreneurs, i.e. the lower the threshold ability π^*, as analytically proven in Lemma 4.

Lemma 4 *For a given threshold ability of risky entrepreneurs π^*, better investor protection reduces the variance of the earnings distribution:*

$$\left.\frac{\partial Var}{\partial p}\right|_{\pi^*} \leq 0.$$

Proof. *See the Appendix.* ■

The second term in (4) captures the "risk taking" effect, whereby investor protection may increase inequality. This happens to the extent that the marginal risky entrepreneurs make the earnings distribution more dispersed, that is if the earnings of agents with ability π^* differ enough from the average. Lemma 5 proves analytically that investor protection tends to increase inequality through the "risk taking" effect, provided that π^* is sufficiently high.[13]

Lemma 5 *Necessary condition for $\partial Var/\partial \pi^* < 0$ is that the threshold in the absence of investor protection, $\pi^*_{p=0}$, is high enough:*

$$\frac{\pi^*_{p=0}}{\pi^*_{p=1}} > \Psi$$

with $\Psi \equiv \left[G(\pi^*)\,\pi^*_{p=1} + \int_{\pi^*_0}^{1} \pi g(\pi)\,d\pi + \frac{\pi^*_{p=1}}{2}\right] \Big/ \left[G(\pi^*)\,\pi^*_{p=1} + \int_{\pi^*_0}^{1} \pi g(\pi)\,d\pi - \frac{1}{2}\right]$.

Proof. *See the Appendix.* ■

The overall impact of investor protection on income inequality depends on the strength of the "risk sharing" and "risk taking" effects. In particular, when the cost of misreporting, and hence the size of the risky sector, is close to its maximum, the "risk taking" effect is weak, since the marginal entrepreneurs do not add much to the existing mass of risky firms. The "risk sharing" effect is instead very strong since it applies to nearly all potential risky entrepreneurs, and hence an increase in p reduces inequality. When investor protection is very low, there is a small mass of risky firms in the economy and hence the "risk taking" effect is stronger at the margin, while the "risk sharing" effect is weak since it applies to few entrepreneurs. It follows that inequality may be a non-monotonic function of investor protection, as proven in Proposition 1.

[13] Notice that this conditon is always satisfied if the cashflow in the bad state is non-positive, i.e., $\varphi A \leq 1$.

Proposition 1 *Provided that Lemma 5 holds, the variance of the earnings distribution is increasing in investor protection for low values of p and decreasing for high p:*

$$\lim_{p\to 0}\frac{dVar\left(w\right)}{dp}>0 \quad and \quad \lim_{p\to 1}\frac{dVar\left(w\right)}{dp}<0.$$

Proof. *See the Appendix.* ■

Since, from Corollary 1, the relative weight of equity-like instruments in overall external finance, η, is continuous and monotonic in investor protection, also the relationship between η and income inequality follows the non-monotonic pattern of Proposition 1, to the extent that the variation in financial structure is driven by changes in investor protection.

Proposition 2 *For given parameters $\{A,\ B,\ \varphi\}$ and ability distribution $G\left(\pi\right)$, and provided that Lemma 5 holds, the variance of the earnings distribution is increasing in the relative weight of equity-like instruments in overall external finance, $\eta\equiv 1-G\left(\pi^{*}\right)$, for low values of η and decreasing for high η:*

$$\lim_{\eta\to\eta_{p=0}}\frac{dVar\left(w\right)}{d\eta}>0 \quad and \quad \lim_{\eta\to\eta_{p=1}}\frac{dVar\left(w\right)}{d\eta}<0.$$

Proof. *See the Appendix.* ■

After characterizing analytically the main forces driving the relationship between investor protection and inequality, it is useful to pause and consider whether changing some assumptions would affect the results. First, ability is assumed to affect productivity only when the entrepreneur chooses the risky technology. If this assumption was relaxed, the qualitative results are likely to hold as long as the expected marginal return to ability is lower in the safe than in the risky sector. Intuitively, in this case, the ability-earnings schedule of safe entrepreneurs in Figure 1 would feature, instead of a flat line, a straight one with lower slope and higher intercept than that of risky entrepreneurs. While this would raise the degree of inequality under $p=0$, and may weaken the "risk taking" effect, it does not seem to change the forces giving rise to the non-monotonic relationship between investor protection and inequality.[14]

The financial friction in the model is given by ex-post asymmetric information about entrepreneurial outcomes, generating a moral hazard problem. It may be argued though

[14] What may change is the parameter restriction in Lemma 5, but not the fact that the "risk taking" effect is more likely to dominate at low levels of investor protection and the "risk sharing" effect becomes stronger as p increases.

that credit markets are also subject to ex-ante asymmetric information on the quality of the borrowers, which may give rise to adverse selection. If in addition ability was ex-ante unobservable, investors would have to induce entrepreneurs to truthfully reveal it by offering them a menu of financial contracts such that agents with a certain level of ability would be worse off declaring a higher π, since earnings are proportional to it. Therefore, the degree of risk sharing would be decreasing in ability. This may weaken both the "risk sharing" and the "risk taking" effect. While adding this friction to the model would complicate the analytical characterization, it does not seem to qualitatively affect the forces behind the non-monotonic relationship between investor protection and inequality, since the risk taking effect would still be stronger at low levels of investor protection and risk sharing would dominate at high levels.

Finally, the assumption of fixed capital requirement implies that entrepreneurs only decide whether to take risk or not (extensive margin), but not how much risk to take (intensive margin). In reality, the degree of entrepreneurial risk taking varies along both margins, and it is therefore meaningful to wonder how the results would change if also the intensive margin was introduced in the model. Castro et al. (2004) show, within a similar framework, that investor protection may have an ambiguous effect on the intensive margin of risk taking (i.e. continuous capital investment in the risky technology). Hence, it is not *a priori* obvious whether introducing the intensive margin would strengthen or weaken the "risk taking" effect. Moreover, the presence of the intensive margin is unlikely to alter the "risk sharing" effect.

3.2 Numerical solution

Although intuitive, the full characterization of inequality as a function of investor protection is awkward to derive analytically, given the highly non-linear expression for $Var(w)$. Solving the model numerically allows me to easily compute alternative measures of inequality and study how they vary with the parameter p. To this end, I assume that utility is logaritmic and the ability distribution is lognormal with mean and variance taken from the actual distribution of years of schooling for the US, and set the technological parameters (A, B and φ) so as to satisfy the model restrictions.[15] First, I solve the model under different riskiness parameters to generate variation in the threshold ability π^* for given investor protection.[16] Based on the earnings distributions derived numerically, I

[15] This numerical solution has no quantitative aim. All details are given in the Appendix.

[16] Recall that, as predicted by Lemma 2 the ability of the marginal risky entrepreneur, π^*, is increasing in investor protection (p) and decreasing in technological riskiness. Alternatively, I could assume a CRRA utility function and let the risk aversion parameter vary. The results, available upon request, are analogous.

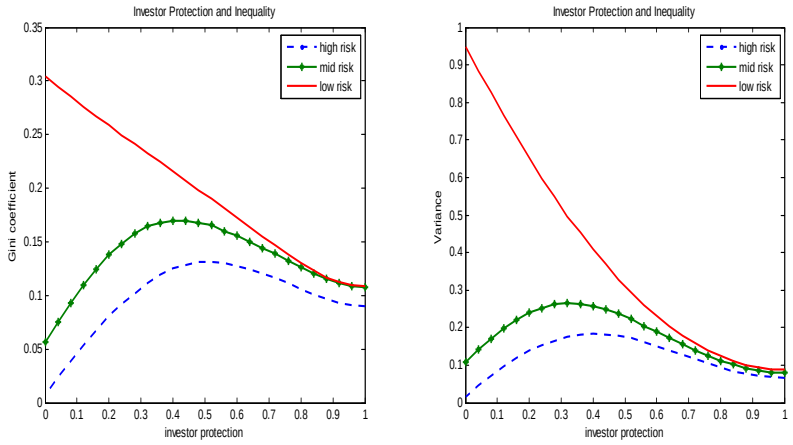

Figure 2: Investor Protection and Income Inequality.

then compute two indicators of inequality, the variance and the Gini coefficient, and plot them against investor protection in Figure 2.

Figure 2 shows that both measures of inequality may be non-monotonic in investor protection. Note first that in the simulation for low risk, nearly all entrepreneurs choose the risky technology independently of investor protection, so that the necessary condition of Lemma 5 is violated and the "risk taking" effect is not at work. Only in this special case, inequality is unambiguously decreasing in p. When Lemma 5 holds, for higher riskiness, inequality is increasing in investor protection when p is sufficiently low, and becomes decreasing when investor protection gets high enough. The "risk sharing" channel is effectively illustrated by the downward-sloping lines for the low-risk technology, which exhibit a sharp decline in inequality associated to an increase in p when nearly all firms adopt the risky technology independently of investor protection. The "risk taking" effect is instead captured by the initial upward-sloping part of the lines for the middle and high risk cases, and by the fact that, for any value of p, inequality is higher when the riskiness is lower and hence risk taking is larger.

4 Optimality and political viability of investor protection

In the model, perfect investor protection is ex-ante Pareto efficient, since it raises both aggregate income and the expected utility of all agents. This is due to the absence of costs, which implies that the level of investor protection that both the social planner and individual agents would chose is $p = 1$. In the real world however, we do not observe perfect investor protection, and reforms aimed at improving it may be opposed by different interest groups in the society, as argued by the literature on the political determinants of

financial institutions (see Rajan and Zingales, 2003, Perotti and von Thadden, 2005 and Pagano and Volpin, 2005, among others).

Assuming that enforcing investor protection entails a cost, $c(p)$ with $c'(\cdot) > 0$, e.g. given by the monitoring and judicial activities, would immediately imply that a benevolent social planner would choose imperfect investor protection. The reason is that the marginal value of investor protection,

$$(1-\varphi) A\pi (1-\pi) \int_0^1 \left[u'\left(w^L(\pi)\right) - u'\left(w^H(\pi)\right)\right] g(\pi)\, d\pi,$$

tends to zero for $p = 1$. Moreover, if the cost has to be financed through uniform lump-sum taxation, even a socially optimal $p < 1$ could be politically difficult to implement because there would be a constituency against it. In particular, an increase in investor protection would be opposed by the least and the most able agents since they would bear the cost withouth enjoying enough benefit from risk sharing. In other words, the constituency against investor protection would be formed by the more productive, and ex-post richer, incumbents of the risky sector and the least able outsiders, which recalls the result in Pagano and Volpin (2006) that managers may form a coalition with workers to oppose the reform. Interestingly, if investor protection was chosen according to the preferences of a median voter who would always choose the safe project, the prevailing p would be zero!

In the model, the entry of new entrepreneurs in the risky sector does not affect the payoffs for the incumbents. If the safe technology was assumed to be employed to produce a homogeneous final good, while the risky one produced differentiated intermediate goods, entry would erode the profits of risky incumbents, thereby giving them an additional reason to oppose the reform, as suggested, for instance, by Rajan and Zingales (2003) and Perotti and Volpin (2007). Safe entrepreneurs, on the other hand, might benefit from the increased competition in the risky sector, and therefore switch in favor of better investor protection if this gain outweighed its cost.

The model also abstracts from wealth heterogeneity, so that the ex-post income distribution, only depends on ability, investor protection and luck. If wealth heterogeneity was introduced, the implications for income inequality would become more complicated to derive. Yet, more insights may arise for the political economy of investor protection, because the composition of the constituencies considered above would also be affected by wealth. On the one hand richer agents, as entrepreneurs do not benefit much from investor protection since safe returns from investment account for a larger part of their total income. On the other hand, as investors, they would benefit from the effect that

investor protection might have on the interest rate.[17]

5 Empirical Analysis

In this section, I evaluate empirically the main theoretical predictions derived in section 3. Since investor protection is generally determined by law, it is not expected to exhibit large variation across geographical areas or sectors within a country. Hence, cross-country data, possibly with time variation, seem more appropriate for empirical purpose. First, I assess the overall relationship between investor protection and income inequality on a cross-section of 47 countries over the period 1980-2000 using a time-invariant *de jure* indicator of investor protection and a general measure of income inequality. Next, I show that the prediction in Corollary 1 is supported by the data since, as in La Porta et al. (2006), the financial structure of a country is more oriented towards equity relative to debt, the higher its degree of investor protection. I then take to the data the result of Proposition 2 and estimate the relationship between financial structure and inequality on a wider cross-section of 67 countries and a panel of 58 countries with 5-year observations between 1976 and 2000. Moreover, I show that the main result holds even when considering only inequality at the top of the income distribution, and that risk taking, captured by firm entry, is positively correlated with inequality as predicted by the model. Finally, I show that the results are specific to investor protection and financial structure, as predicted by the model, and do not apply to more general indicators of financial development.

5.1 Data

The first empirical task is to measure the main variables of interest: inequality and investor protection. In most of the analysis, I proxy the dependent variable, inequality, with the Gini coefficient of the income distribution which is a widely used measure and is available for a relatively large sample of countries and years. I take the data from Dollar and Kraay's (2002) database that relies on four sources: the UN-WIDER World Income Inequality Database, the "high quality" sample from Deininger and Squire (1996), Chen and Ravallion (2001), and Lundberg and Squire (2000).[18] Although the theory proposed in

[17] As shown in Bonfiglioli (2005), in a general equilibrium version of the model, investor protection would raise productivity and hence the interest rate.

[18] The original sample consists of 953 observations, which reduce to 418 separated by at least five years, on 137 countries over the period 1950-1999. Countries differ with respect to the survey coverage (national vs subnational), the welfare measure (income vs expenditure), the measure of income (net vs gross) and the unit of observation (households vs individuals). For better comparability, data from Deininger and Squire are usually adjusted by adding 6.6 to the Gini coefficients based on expenditure. Here, the adjustment was made in a slightly more complicated way to account for the variety of sources; see Dollar and Kraay (2002) for details.

the paper refers to entrepreneurs, who usually belong to the top percentiles of the income distribution, three arguments may justify the use of a general indicator of inequality.[19] First, recent evidence from several countries shows that a large fraction of the variation in income inequality over the last two decades is explained by changes at the top of the distribution (see, among others, Atkinson et al., 2009 and Heathcote et al., 2010), which suggests that the effects of investor protection on inequality at the top of the distribution are likely to show up even on data for the entire population. Second, employees normally earn higher wages and are subject to higher employment risk when working in more productive and riskier firms.[20] Hence the results obtained for entrepreneurs may be expected to trickle down to all workers. Finally, the model could be interpreted as one of occupational choice *à la* Kihlstrom and Laffont (1979), where each agent can either be a worker receiving a fixed wage or an entrepreneur facing risk. In this case, the implications on earnings inequality refer to the entire population.

Yet, to assess the robustness of my empirical results to the measure of inequality, I replicate part of the analysis using the data on top income percentiles collected by Alvaredo et al. (2011). Unfortunately, these data are available for a limited number of countries (23 in the data release of March 2011), though over a reasonably long time-spam, which restricts my sample to 16 countries with 5-year observations from 1976 to 2004. Proxying inequality with the ratio of the average income of the top 1 and 0.1 per cent over the one of the top 10 per cent of the income distribution, I obtain the same results, in line with the model predictions.

As regards the main explanatory variable, I first consider a *de jure* measure of investor protection, i.e., the index of shareholder protection compiled by La Porta et al. (2006), that takes values between 0 (no protection) and 10 (maximum protection). This index is available for 49 developed and developing countries and has no time variation, which is its main limitation.

Next, I adopt an alternative approach and evaluate the predictions of the model in two steps. I first take to the data Corollary 1, arguing that the relative weight of equity in external finance should be a positive function of investor protection, and then Proposition 2, establishing the non-monotonic relationship between the indicator of financial structure

[19] This would be a serious concern if investor protection affected inequality among the poor in the same way as predicted by the model, but through a different channel, thereby generating a bias in favor of the model. If, however, there was no effect, or an opposite one, this would just be a source of attenuation bias.

[20] Evidence that more productive firms pay higher wages is provided, among others, by Oi and Idson (1999).

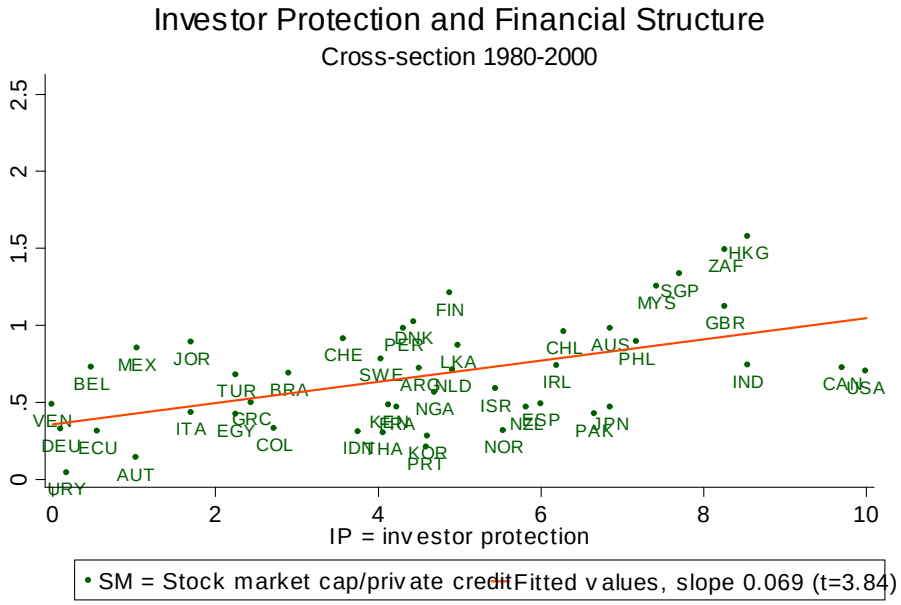

Figure 3: Investor Protection and the Financial Structure from a cross-section of 47 countries, 1980-2000.

and inequality.[21] The advantage of this strategy is that it allows me to enlarge the cross-sectional dimension and to exploit the time variation, since data on inequality and financial structure are available for a large number of countries and years. In particular, I proxy the size of the stock market relative to overall external finance with the ratio of stock market capitalization over credit to the private sector, where the data on stock market capitalization and credit to the private sector as a ratio of GDP are taken from the 2009 update of the database on Financial Development and Structure by Beck et al. (2000). A preliminary data inspection lends graphical support to this two-step procedure. Consistently with the empirical evidence in La Porta et al. (2006), the plot in Figure 3 suggests that better investor protection is associated to a larger relative size of the stock market.[22] Figure 4 plots instead five-year observations of the Ginis against relative stock market size. Despite showing unconditional correlations only, it is suggestive of a non-monotonic relationship, as predicted by the model.[23]

[21] In the model, financial structure varies with other parameters, as summarized in Corollary 1. These variables may only affect quantitatively but not qualitatively the non-monotonicity of the relation between investor protection and inequality through financial structure, for instance by determining where its sign is inverted.

[22] The OLS and IV regressions reported in the next subsection confirm that the correlation between investor protection and the ratio of stock market capitalization over private credit is positive and significant.

[23] In the regression analysis, the non-monotonicity is shown to be statistically significant and robust to the inclusion of controls and the exclusion of outliers.

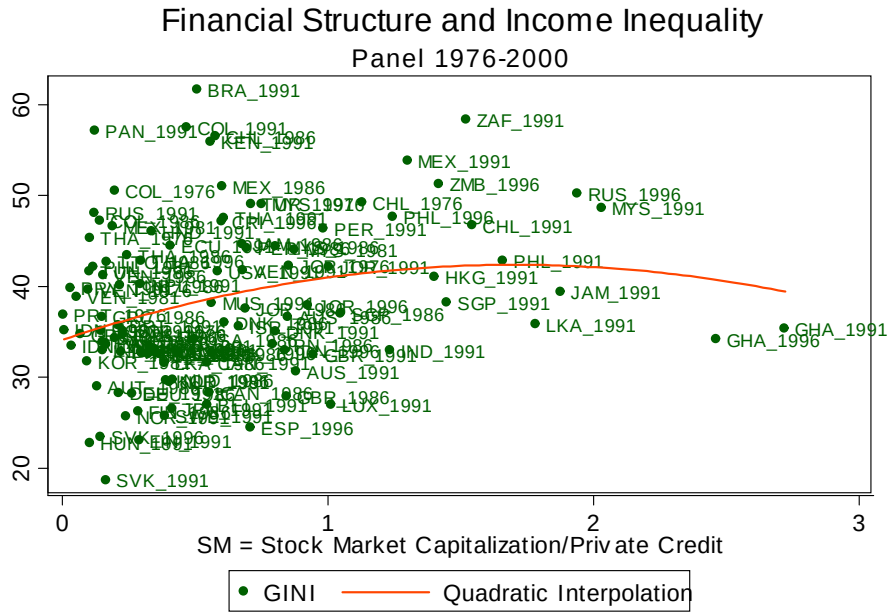

Figure 4: Financial Structure and Income Inequality from a panel of 58 countries, 1976-2000.

Finally, since risk taking is an important determinant of inequality in the model, it would be desirable to also control for it in the empirical analysis. I take data on firm entry as a proxy for the extensive margin of entrepreneurial risk taking and control for it in the specifications for inequality among top income levels. Entry is computed as the percentage annual growth rate in the number of establishments as reported by the UNIDO database. The main shortcoming with this control variable is the time span it covers. Although data are available for up to 116 countries, observations start in the late Nineties for most countries in the sample, which makes the overlap with the Ginis too limited for econometric analysis.

Other control variables are human capital, proxied by the share of population aged above 25 years with completed secondary education from Barro and Lee (2000, updated in 2010), real per capita GDP, government expenditure and trade as a share of GDP from the Penn World Tables 6.3 (Heston et al., 2009).

When combining the data sources for the main dependent and explanatory variables, I am left with two cross-sections of 47 and 67 countries and two unbalanced panels of 58 and 16 countries observed over the period 1976-2004.

5.2 Cross-sectional Estimates

First, I focus on the cross-section of 47 countries and estimate with Ordinary Least Squares the following equation for the overall effect of investor protection on inequality:

$$Gini_i = \alpha_0 + \alpha_1 IP_i + \alpha_2 IP * IP\_HIGH + \alpha_3 X_i + \epsilon_i, \quad (5)$$

where $Gini$ is the measure of income inequality, i is the country index, IP is the indicator of investor protection, IP_HIGH is a dummy taking value one for IP above the median, X is a vector of control variables, and ϵ is the error term.[24] Following the empirical literature on income inequality, I include in X the log of the real per capita GDP and its square to account for the Kuznets' hypothesis, the share of population above 25 years that completed secondary education (from Barro and Lee, 2001) to control for education, government expenditure as a ratio of GDP to account for the degree of redistribution, and total trade (Export+Import) as a ratio of GDP. All variables are expressed in period average for the period 1980-2000. The model predicts a non-monotonic relationship between investor protection and inequality, which is consistent with a positive α_1 and a negative $\alpha_2 < 0$.

Table 1 reports the estimated coefficients. In column 1, I only control for investor protection and education and obtain a non significant α_1, suggesting that there is no clear correlation. As soon as I allow for non-linearity in investor protection, I obtain significant coefficients with the expected sign: positive α_1 and negative α_2. These results hold if I control for real GDP per capita and its square, government expenditure and trade over GDP, in columns 3 and 4. In column 5, the dummy capturing the non linearity accounts for observations of IP above the 60th percentile instead of the median. Although more imprecise, the coefficients maintain the expected signs. To correct for possible simultaneity, in columns 6 and 7, I take the last available observation of the Gini coefficient for each country and regress it on the same variables as in columns 2 and 3. The estimates are qualitatively and quantitatively very close to the ones for period averages. These results suggest that the relationship between investor protection and income inequality is non-monotonic in the way predicted by the model.

In the model, investor protection affects income inequality through its effect on the financial structure of the economy, which in turn affects entrepreneurial risk taking and thereby income realizations. I evaluate whether better investor protection tilts the financial

[24] The countries in this sample are: Australia, Austria, Belgium, Brazil, Canada, Chile, Colombia, Denmark, Ecuador, Egypt, Finland, France, Germany, Greece, Hong Kong, China, India, Indonesia, Ireland, Israel, Italy, Japan, Jordan, Kenya, Korea, Rep., Malaysia, Mexico, Netherlands, New Zealand, Norway, Pakistan, Peru, Philippines, Portugal, Singapore, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Taiwan, China, Thailand, Turkey, United Kingdom, United States, Uruguay, Venezuela, Zimbabwe.

structure towards equity rather than debt by estimating the following equation:

$$SM_i = a_0 + a_1 IP_i + a_2 Z_i + e_i,$$

where SM is the ratio of stock market capitalization over total credit to the private sector, Z is a vector of control variables, and e is the error term. Data are averaged over the period 1980-2000. Following La Porta et al. (2006), I include in Z the real per capita GDP and an index of efficiency of the judiciary system (eff_jud from La Porta et al., 2006). I first estimate the equation above with OLS and then, to control for possible endogeneity of investor protection with respect to relative stock market size, with Two-Stages Least Squares instrumenting investor protection with dummies for UK, French and German legal origins. The results, reported in Table 2, exhibit positive and significant estimates of a_1 both with OLS and 2SLS Instrumental Variables. This is in line both with Corollary 1 and with the evidence in La Porta et al. (2006).

Next, I turn to the second step and consider the relationship between financial structure and inequality on a wider cross-section.[25] In particular, I estimate the following equation

$$Gini_i = \tilde{\alpha}_0 + \tilde{\alpha}_1 SM_i + \tilde{\alpha}_2 \left(SM_i\right)^2 + \tilde{\alpha}_3 X_i + \epsilon_i,$$

and report the results in Table 3. The estimates confirm that human capital plays an important role at reducing inequality and lend support to the Kuznets hypothesis of an inverse-U shaped relationship between per capita income and inequality. The most novel result, however, is that financial structure seems to be an important, yet so far overlooked, covariate of inequality. In particular the significant estimates of a positive $\tilde{\alpha}_1$ and a negative $\tilde{\alpha}_2$, are consistent with the model prediction. The fact that the results are robust to controlling for per capita GDP and its square reassures that the non-monotonic relationship between relative stock market size and inequality is not spuriously driven by the level of income of a country. Robustness to the inclusion of government expenditure in columns 4 and 8 also suggests that the results in the previous columns are not driven by redistributive policies or openness to trade, which may be correlated with financial structure. As in Table 1, to correct for a possible simultaneity, in columns 5-8, I take the last available observation of the Gini coefficient for each country and regress it on the

[25] The countries in this sample are: Australia, Austria, Bangladesh, Belgium, Bolivia, Botswana, Brazil, Canada, Chile, Colombia, Costa Rica, Denmark, Ecuador, Egypt, El Salvador, Finland, France, Germany, Ghana, Greece, Guatemala, Honduras, Hong Kong, Hungary, India, Indonesia, Iran, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Korea, Luxembourg, Malaysia, Mauritius, Mexico, Nepal, Netherlands, New Zealand, Norway, Pakistan, Panama, Paraguay, Peru, Philippines, Portugal, Romania, Russian Federation, Singapore, Slovak Republic, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Thailand, Trinidad and Tobago, Tunisia, Turkey, United Kingdom, United States, Uruguay, Venezuela, Zambia.

same variables as in columns 1-4. The estimates are qualitatively and quantitatively very close to the ones for period averages. Back of the envelope calculations suggest that an increase in the relative size of the stock market should reduce inequality only after getting to a level (between 1.34 and 1.53) that only a few countries have reached in the sample.

5.3 Panel Estimates

The time-series variation in the data on financial structure allow me to better exploit the information contained in the time-varying data for inequality, and estimate with least squares the following equation:

$$Gini_{it} = \beta_0 + \beta_1 SM_{it} + \beta_2 \left(SM_{it}\right)^2 + \beta_3 X_{it} + \nu_{it}, \tag{6}$$

where time subscripts refer to non-overlapping 5-year periods between 1976 and 2000, all regressors are the same as described above, and ν_{it} is the error term. I estimate equation (6) both considering ν_{it} as a random effect, thereby exploiting both time and cross-sectional variation, and under the assumption that $\nu_{it} = \eta_i + \varepsilon_{it}$ where η_i is the country fixed effect. In the second case, the link between financial structure and inequality is identified out of within-country variation. In both cases, the reported standard errors are clustered by country and robust. A positive estimate for β_1 and a negative one for β_2 would be consistent with the model prediction that better investor protection, by raising the weight of stocks in the financial structure, tends to increase inequality until it becomes high enough so that the risk sharing effect dominates thereby inverting the sign of the relationship.

The results are reported in Table 4.[26] The first two rows tend to confirm the result of Table 3, that inequality is non monotonic, as suggested by the model, in the relative size of the stock market, although the positive estimate for β_1 is now significant even when I do not control for the quadratic term. This pattern is robust to controlling for common determinants of inequality such as real per capita GDP, government expenditure and openness to trade. The regressions in columns 5 and 10 suggest that the results are not sensitive to the exclusion of Ghana, which appears as an outlier in Figure 4. Notice that the results of positive β_1 and, especially, negative β_2 hold stronger when the coefficients

[26] The countries in this sample are: Australia, Austria, Bangladesh, Belgium, Brazil, Canada, Chile, Colombia, Costa Rica, Denmark, Ecuador, Egypt, Finland, France, Germany, Ghana, Greece, Honduras, Hong Kong, Hungary, India, Indonesia, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Korea, Luxembourg, Malaysia, Mauritius, Mexico, Nepal, Netherlands, New Zealand, Norway, Pakistan, Panama, Paraguay, Peru, Philippines, Portugal, Russian Federation, Singapore, Slovak Republic, South Africa, Spain, Sri Lanka, Sweden, Thailand, Trinidad and Tobago, Tunisia, Turkey, United Kingdom, United States, Venezuela, Zambia.

are estimated with random effects. This makes the evidence more consistent with the predictions of the model, because the cross-sectional variation in SM, accounted for in these specification, is more likely to be generated by differences in investor protection than time-series changes.

The evidence presented so far is obtained using a broad measure of inequality, based on the entire income distribution, while it may be argued that the model applies to entrepreneurs who are more likely to belong to the top end of the income distribution. I address this concern by estimating equation (6) for two indicators of income inequality among the rich, such as the ratio of the average income of the top 1 (or 0.1) over the top 10 per cent of the income distribution. Note that data availability is limited to a maximum of 16 OECD countries, observed between 1976 and 2004.[27] The results, reported in Table 5, are consistent with the ones obtained for the Gini coefficients, suggesting the existence of a non-monotonic relationship whereby inequality increases with the relative size of the stock market up to a certain point and then decreases with it. Using the same restricted sample of OECD countries I am also able to account for the role of risk taking, which is what drives the positive effect of investor protection on inequality in the model. In particular, in columns 3 and 6-8, I add to the specification the annual growth rate of establishments, as a proxy of firm entry, capturing the extensive margin of risk taking. Consistently with the theory, the estimates for entry are positive and tend to reduce the size and significance of the linear coefficients for relative stock market size, suggesting that its positive correlation with inequality is driven by a higher exposition to risk.

5.4 Financial Structure vs Financial Development

The results in this section document the existence of a non-monotonic relationship between investor protection, financial structure, and income inequality, both measured on the overall population and at the top of the income distribution. This evidence is robust and consistent with the model proposed in sections 2 and 3. Here, I assess whether the relationship found in the data refers specifically to investor protection and financial structure, or it captures a more general pattern linking inequality to financial development, which could be consistent with alternative theories. To this end, I add to the main specifications *de jure* indicators of creditors' rights, taking values between 0 and 4 (from Djankov et al., 2007), and efficiency of the judiciary, and control separately for the size of the stock market and total credit to the private sector, which is commonly taken as a *de facto* measure of financial depth. The results are reported in Tables 6 and 7.

[27] These countries are: Australia, Canada, France, Germany, Italy, Netherlands, New Zealand, Norway, Portugal, Singapore, South Africa, Spain, Sweden, Switzerland, United Kingdom, United States.

In Table 6, columns 1-2 report the content of columns 1-2 of Table 1, while columns 3-4 replicate it adding the two *de jure* indicators of institutional and financial development. The coefficients for investor protection remain unchanged, while the new variables are not significantly correlated with inequality. Column 5, reports column 1 of Table 2, regressing relative stock market size on investor protection, and column 6 replicates it adding the *de jure* index of financial development. Note that creditors' rights are not significantly correlated with financial structure, which may explain the result of columns 1-4 in light of the model. Since the general indicators of financial and institutional development are not related to financial structure, and hence to entrepreneurial risk taking, they do not relate to inequality either.

In columns 1-4 of Table 7, I replicate the estimates of Table 4, columns 1-2 and 6-7, splitting SM in stock market capitalization and credit to the private sector expressed as ratios of GDP. The results suggest that, while financial depth alone (PRIVO) tends to be associated to lower inequality, as found by Beck et al. (2007) and Clarke et al. (2006), it is a higher weight of equities in the financial structure that may correlate positively with inequality, as long as SM is not so large that the sign of the relationship gets inverted. Finally, given that the de jure indicator of creditors' right exhibits some time variation, I add it to the panel specifications of Table 4, columns 2 and 7. The coefficients reported in columns 5 and 6, consistently with the previous results, suggest that income inequality correlates in opposite ways with financial structure and indicators of overall financial development.

The evidence in Tables 6 and 7 points to the fact that the non-monotonic relationship between investor protection, financial structure and inequality does not generalize to other, more general, measures of financial development.

6 Conclusions

This paper provides theoretical and empirical support for a systematic relationship between investor protection, financial structure and income inequality. While there are contributions addressing the effects of investor protection on financial structure and economic growth through risk sharing and risk taking, little attention has been paid to the implications for income distribution. To fill this gap, I develop a simple static model with risk-averse agents, heterogeneous in their ability, that can produce using either a safe or a risky technology. I assume that entrepreneurs have to borrow funds in order to start their business, and that there are financial frictions, arising from the non-observability of a firm's cash-flow to investors.

In this framework, I study how investor protection, by alleviating frictions, affects

optimal financial contracts, the technological choice of agents with different ability and the distribution of their earnings. Better investor protection affects income inequality in two opposite ways. By improving risk sharing between entrepreneurs and financiers, it reduces income volatility. On the other hand, by inducing more agents to choose the risky technology, it may increase the dispersion of the earnings realizations. The first, "risk sharing", effect reduces inequality, while "risk taking" tends to raise it. The overall impact of investor protection on inequality is shown to be non-monotonic. In particular, the "risk taking" effect dominates at low levels of investor protection, and is outweighed by "risk sharing" when investor protection is high. In the empirical section, I provide evidence from a cross-section of up to sixty seven countries and a panel of up to fifty-eight countries over the period 1976-2004 that is consistent with the main theoretical predictions.

The model is deliberately kept simple to emphasize the mechanism linking investor protection to income inequality. It follows that its implications for economic performance and welfare may appear simplistic: aggregate income increases with investor protection due to risk taking, and welfare increases due to higher output and better risk sharing. Yet, an interesting insight is that investor protection, through its positive effect on aggregate output and the non-monotonic impact on inequality, generates a Kuznets' curve. Contrary to existing models, this inverse-U shaped relationship between GDP and inequality is generated by the development of financial institutions, rather than by wealth accumulation. Moreover, as discussed in paper, the model may be easily modified to address a number of issues, such as the political economy of financial institutions.

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A Proofs

Lemma 1

The assumptions that $A > B + 1 > \varphi A$ and $u' > 0$, imply that agents with $\pi = 1$ always choose the risky technology since $V^R(1) = u(w^H(1)) = u(A-1) > u(B) = V^S$; while agents with $\pi = 0$ always make the safe choice since $V^R(0) = u(w^L(0)) = u(\varphi A - 1) < V^S$. To prove that there exist a unique ability $\pi^* \in (0,1)$ such that $V^R(\pi) < (>)$ V^S for all $\pi > (<)$ π^*, I just need to show that V^R is increasing in π. The derivative of V^R w. r. t. π under the optimal financial contract is

$$\frac{\partial V^R}{\partial \pi} = u\left(w^H(\pi)\right) - u\left(w^L(\pi)\right) + p(1-\varphi)A\left[\pi u'\left(w^H(\pi)\right) + (1-\pi)u'\left(w^L(\pi)\right)\right] > 0$$

since $w^H(\pi) > w^L(\pi)$. Therefore, there exist a unique threshold ability π^* such that $V^R(\pi^*) = V^S$ and $\forall \pi > \pi^*$, $\pi u\left(w^H(\pi)\right) + (1-\pi)u\left(w^L(\pi)\right) > u(B)$.

Lemma 2

To prove that the threshold ability is decreasing in investor protection, I characterize π^* as implicit function of p,

$$V^R(\pi^*, p) = V^S,$$

and obtain its derivative with respect to p as

$$\frac{\partial \pi^*}{\partial p} = -\frac{\partial V^R}{\partial p}\left(\frac{\partial V^R}{\partial \pi^*}\right)^{-1}.$$

To prove that this derivative is negative, I just need to show that $\frac{\partial V^R}{\partial p}$ is positive, since by Lemma 1 $\frac{\partial V^R}{\partial \pi^*} > 0$. I obtain

$$\begin{aligned}\frac{\partial V^R}{\partial p} &= \pi^* u'\left(w^H(\pi^*)\right)\frac{\partial w^H}{\partial p} + (1-\pi^*)u'\left(w^L(\pi^*)\right)\frac{\partial w^L}{\partial p} \\ &= \pi^*(1-\pi^*)\left[u'\left(w^L(\pi^*)\right) - u'\left(w^H(\pi^*)\right)\right](1-\varphi)A \geq 0,\end{aligned}$$

since utility is concave and $w^L(\pi) \leq w^H(\pi)$, implying that $\frac{\partial \pi^*}{\partial p} \leq 0$.

Moreover, $\lim_{p\to 1}\frac{\partial \pi^*}{\partial p} = 0$ since $\lim_{p\to 1} w^H(\pi) = \lim_{p\to 1} w^L(\pi) = w^S$.

The threshold ability varies with the technological parameters A, φ and B as follows

$$\begin{aligned}
\frac{\partial \pi^*}{\partial A} &= -\frac{\partial V^R}{\partial A}\left(\frac{\partial V^R}{\partial \pi^*}\right)^{-1} < 0 \\
\frac{\partial \pi^*}{\partial \varphi} &= -\frac{\partial V^R}{\partial \varphi}\left(\frac{\partial V^R}{\partial \pi^*}\right)^{-1} < 0 \\
\frac{\partial \pi^*}{\partial B} &= \frac{\partial V^S}{\partial B}\left(\frac{\partial V^R}{\partial \pi^*}\right)^{-1} > 0
\end{aligned}$$

since

$$\begin{aligned}
\frac{\partial V_t^R}{\partial A} &= \pi^* u'\left(w_{it}^H\right)\left[\varphi + \pi p\left(1-\varphi\right) + \left(1-p\right)\left(1-\varphi\right)\right] \\
&\quad + \left(1-\pi^*\right) u'\left(w_{it}^L\right)\left[\varphi + \pi p\left(1-\varphi\right)\right] > 0,
\end{aligned}$$

$$\frac{\partial V_t^R}{\partial \varphi} = \left(1-\pi^*\right) u'\left(w_{it}^H\right) Ap\pi^* + \left(1-\pi^*\right) u'\left(w_{it}^L\right) A\left(1-p\pi^*\right) > 0$$

and

$$\frac{\partial V_t^S}{\partial B} = u'\left(B-1\right) > 0.$$

Corollary 1

The derivative of η w.r.t. π^* is

$$\frac{\partial \eta}{\partial \pi^*} = -g\left(\pi^*\right) \leq 0.$$

The derivative of η w.r.t. φ is

$$\frac{\partial \eta}{\partial \varphi} = \frac{\partial \pi^*}{\partial \varphi}\frac{\partial \eta}{\partial \pi^*} \geq 0$$

since $\frac{\partial \pi^*}{\partial \varphi} < 0$ by Lemma 2.

The derivative of η w.r.t. B is

$$\frac{\partial \eta}{\partial B} = \frac{\partial \pi^*}{\partial B}\frac{\partial \eta}{\partial \pi^*} \leq 0$$

since $\frac{\partial \pi^*}{\partial B} > 0$ by Lemma 2.

The derivative of η w.r.t. p is

$$\frac{\partial \eta}{\partial p} = \frac{\partial \pi^*}{\partial p}\frac{\partial \eta}{\partial \pi^*} \geq 0$$

since $\frac{\partial \pi^*}{\partial p} < 0$ by Lemma 2.

The derivative of η w.r.t. A is

$$\frac{\partial \eta}{\partial A} = \frac{\partial \pi^*}{\partial A}\frac{\partial \eta}{\partial \pi^*} \geq 0$$

since $\frac{\partial \pi^*}{\partial A} < 0$ by Lemma 2.

Lemma 3

The derivative of average entrepreneurial earnings w.r.t. π^* is

$$\frac{\partial \mathbb{E}[w]}{\partial \pi^*} = g(\pi^*)\left[w^S - \pi^* w^H(\pi^*) - (1-\pi^*)\, w^L(\pi^*)\right] \leq 0,$$

since, by risk aversion and the definition of π^*, $w^S \leq \pi^* w^H(\pi^*) - (1-\pi^*)\, w^L(\pi^*)$.

Lemma 4

The partial derivative of $Var(w)$ w.r.t. p is

$$\frac{\partial Var}{\partial p} = \int_{\pi^*}^{1} \left\{ 2\pi w^H \frac{\partial w^H}{\partial p} + 2(1-\pi)\, w^L \frac{\partial w^L}{\partial p} \right\} g(\pi)\, d\pi,$$

which becomes, after simplifying and replacing for w^H, w^L, $\frac{\partial w^H}{\partial p} = -(1-\pi)(1-\varphi)A$ and $\frac{\partial w^L}{\partial p} = \pi(1-\varphi)A$,

$$\frac{\partial Var}{\partial p} = -2(1-p)(1-\varphi)^2 A^2 \int_{\pi^*}^{1} \pi(1-\pi)\, g(\pi)\, d\pi \leq 0.$$

To prove that this derivative is higher the higher is the threshold ability π^*, I obtain the derivative of $\partial Var(w)/\partial p$ w.r.t. π^* and show that it is positive:

$$\frac{\partial \left(\frac{\partial Var}{\partial p}\right)}{\partial \pi^*} = 2(1-p)(1-\varphi)^2 A^2 \pi^* (1-\pi^*)\, g(\pi) \geq 0.$$

Lemma 5

Derive the partial derivative of $Var(w)$ w.r.t. the threshold, π^*:

$$\begin{aligned} \frac{\partial Var}{\partial \pi^*} &= g(\pi^*)\pi^*\left[w^L(\pi^*) - w^H(\pi^*)\right]\left[w^L(\pi^*) + w^H(\pi^*) - 2\mathbb{E}[w]\right] \\ &\quad + g(\pi^*)\left[w^S - w^L(\pi^*)\right]\left[w^S + w^L(\pi^*) - 2\mathbb{E}[w]\right] \end{aligned}$$

This is positive, $\frac{\partial Var}{\partial \pi^*} > 0$, iff

$$\pi^*\left[w^H(\pi^*) - w^L(\pi^*)\right]\left[2\mathbb{E}[w] - w^H(\pi^*) - w^L(\pi^*)\right] - \left[w^S - w^L(\pi^*)\right]\left[2\mathbb{E}[w] - w^S - w^L(\pi^*)\right] > 0,$$

that is, since both $2\mathbb{E}[w] - w^S - w^L(\pi^*)$ and $w^H(\pi^*) - w^L(\pi^*)$ are positive, iff:

$$\pi^* \frac{2\mathbb{E}[w] - w^H(\pi^*) - w^L(\pi^*)}{2\mathbb{E}[w] - w^S - w^L(\pi^*)} - \frac{w^S - w^L(\pi^*)}{w^H(\pi^*) - w^L(\pi^*)} > 0,$$

i.e.,

$$\begin{aligned} 0 \quad < \quad & \pi^* \frac{G(\pi^*)(B - \varphi A) + \varphi A + A(1-\varphi)\int_{\pi^*}^1 \pi g(\pi)\, d\pi - \varphi A - \pi^* pA(1-\varphi)}{G(\pi^*)(B - \varphi A) + \varphi A + A(1-\varphi)\int_{\pi^*}^1 \pi g(\pi)\, d\pi - \frac{1}{2}\left[B + \varphi A + \pi^* pA(1-\varphi)\right]} \\ & - \frac{\frac{\pi^*}{2}(1-p)A(1-\varphi)}{G(\pi^*)(B - \varphi A) + \varphi A + A(1-\varphi)\int_{\pi^*}^1 \pi g(\pi)\, d\pi - \frac{1}{2}\left[B + \varphi A + \pi^* pA(1-\varphi)\right]} \\ & - \frac{B - \varphi A - \pi^* pA(1-\varphi)}{(1-p)A(1-\varphi)}. \end{aligned}$$

Multiplying and dividing by $A(1-\varphi)$, and substituting $(B - \varphi A)/A(1-\varphi) = \pi^*_{p=1}$ (the first-best threshold) delivers, after further simplifications:

$$\pi^* \frac{G(\pi^*)\pi^*_{p=1} + \int_{\pi^*}^1 \pi g(\pi)\, d\pi - \pi^* p - (1-p)/2}{G(\pi^*)\pi^*_{p=1} + \int_{\pi^*}^1 \pi g(\pi)\, d\pi - \left(\pi^* p - \pi^*_{p=1}\right)/2} - \frac{\pi^*_{p=1} - \pi^* p}{(1-p)} > 0,$$

which holds for the threshold π^* high enough relative to its first-best value, $\pi^*_{p=1}$. Since the highest π^* is associated to $p = 0$, necessary condition for the existence of at least one value of p so that $\frac{\partial Var}{\partial \pi^*} > 0$ is that

$$\frac{\pi^*_{p=0}}{\pi^*_{p=1}} > \frac{G(\pi^*)\pi^*_{p=1} + \int_{\pi^*_0}^1 \pi g(\pi)\, d\pi + \pi^*_{p=1}/2}{G(\pi^*)\pi^*_{p=1} + \int_{\pi^*_0}^1 \pi g(\pi)\, d\pi - 1/2}.$$

Proposition 1

Compute the limit of $\frac{dVar}{dp}$ at the extreme values of p. For $p \to 0$, $\pi^* \to \pi^*_{p=0}$ satisfying Lemma 5, so that $\lim_{p\to 0} \frac{\partial Var}{\partial \pi^*} > 0$, and

$$\lim_{p\to 0} \frac{\partial \pi^*}{\partial p} = -\pi^*_{p=0}\left(1 - \pi^*_{p=0}\right)(1-\varphi)A \frac{\left[u'\left(w^L\left(\pi^*_{p=0}\right)\right) - u'\left(w^H\left(\pi^*_{p=0}\right)\right)\right]}{u\left(w^H\left(\pi^*_{p=0}\right)\right) - u\left(w^L\left(\pi^*_{p=0}\right)\right)} < 0,$$

hence:

$$\lim_{p\to 0} \frac{dVar}{dp} = -\frac{\partial Var}{\partial \pi^*}\frac{\partial \pi^*}{\partial p} \geq 0.$$

For $p \to 1$, $w^H(\pi) \to w^L(\pi)$ for any $\pi \geq \pi^*$, and $w^H(\pi^*) = w^L(\pi^*) = w^S$, hence $\frac{\partial \pi^*}{\partial p} \to 0$, $\frac{\partial Var}{\partial \pi^*} \to 0$ and $\frac{dVar}{dp} \to 0$. To verify that it approaches zero from above, express

$\frac{dVar}{dp}$ in second order Taylor expansion in a neighborhood of $p = 1$:

$$\begin{aligned}\lim_{p\to 1}\frac{dVar}{dp} &= (p-1)\frac{d^2Var}{(dp)^2}\\ &= (p-1)\,2\,(1-\varphi)^2 A^2\int_{\pi^*_{p=1}}^{1}\pi\,(1-\pi)\,g\,(\pi)\,d\pi < 0.\end{aligned}$$

Proposition 2

For given parameters and ability distribution, the derivative of the variance of earnings w.r.t. η can be expressed as:

$$\frac{dVar}{d\eta} = \frac{dVar}{dp}\left(\frac{d\eta}{dp}\right)^{-1} = \frac{dVar}{dp}\left(-g\,(\pi^*)\,\frac{d\pi^*}{dp}\right)^{-1}.$$

As $p \to 0$, Proposition 1 and the non-degenerate ability distribution imply that:

$$\lim_{p\to 0}\frac{dVar}{d\eta} = \frac{\partial Var}{\partial \pi^*}\frac{\partial \pi^*}{\partial p}\left(g\,(\pi^*)\,\frac{d\pi^*}{dp}\right)^{-1} \geq 0.$$

As $p \to 1$, $\frac{d\eta}{dp} \to 0$ since $\frac{\partial \pi^*}{\partial p} \to 0$, and hence

$$\begin{aligned}\lim_{p\to 1}\frac{dVar}{d\eta} &= (p-1)\frac{d^2Var}{d\eta dp}\\ &= (p-1)\left[\frac{d^2Var}{(dp)^2}\left(\frac{d\eta}{dp}\right)^{-1}\Bigg|_{p=1} - \frac{d^2\eta}{(dp)^2}\frac{dVar}{dp}\left(\frac{d\eta}{dp}\right)^{-2}\Bigg|_{p=1}\right],\end{aligned}$$

which is negative since $\frac{d^2Var}{(dp)^2} > 0$, $\lim_{p\to 1}\frac{dVar}{dp} < 0$ from Proposition 1, $\frac{d\eta}{dp} > 0$ from Corollary 1, and $\lim_{p\to 1}\frac{d^2\eta}{(dp)^2} < 0$ since the threshold is convex as proven below.

Derive

$$\frac{d^2\pi^*}{(dp)^2} = \frac{\frac{d^2V^R}{d\pi dp}\frac{dV^R}{dp} - \frac{d^2V^R}{(dp)^2}\frac{dV^R}{d\pi}}{\left(\frac{dV^R}{d\pi}\right)^2}.$$

This is conveniently expressed multiplied by the positive term $\frac{dV^R}{d\pi}$:

$$\begin{aligned}\frac{d^2\pi^*}{(dp)^2}\frac{dV}{d\pi} &= -\frac{d\pi^*}{dp}\pi^*(1-\pi^*)A\left[u'\left(w^L(\pi^*)\right)-u'\left(w^H(\pi^*)\right)\right] \\ &\quad -\frac{d\pi^*}{dp}A\left[\pi^* u'\left(w^H(\pi^*)\right)+(1-\pi^*)u'\left(w^L(\pi^*)\right)\right] \\ &\quad +\frac{d\pi^*}{dp}pA^2\pi^*(1-\pi^*)(1-\varphi)\left[u''\left(w^L(\pi^*)\right)-u''\left(w^H(\pi^*)\right)\right] \\ &\quad -A^2(1-\varphi)^2\pi^*(1-\pi^*)\left[\pi^* u''\left(w^H(\pi^*)\right)+(1-\pi^*)u''\left(w^L(\pi^*)\right)\right],\end{aligned}$$

which is positive since $u'\left(w^L(\pi^*)\right) > u'\left(w^H(\pi^*)\right)$ and $u''\left(w^L(\pi^*)\right) - u''\left(w^H(\pi^*)\right)$ by assumption, and $\frac{d\pi^*}{dp} \leq 0$.

B Numerical Solution

This section describes step by step the procedure I followed for solving numerically the model of sections 2 and 3

1. Set values for the main parameters: A=4, B=2, φ=[0.251 0.3 0.46], r=1.

2. Compute values for the parameters of the Lognormal distribution of abilities, (μ, σ), from Barro and Lee's (2000) data. The database provides observations for the percentages of the population aged 15 and above with no, primary, secondary and tertiary education (lu, lp, ls, lh), along with the average year of each education level (pyr, syr, hyr). I compute the average years of schooling for people with primary, secondary and tertiary education (q_1, q_2, q_3, respectively):

$$q_1 = \frac{pyr}{lp+ls+lh}; q_2 = q_1 + \frac{syr}{ls+lh}; q_3 = q_1 + q_2 + \frac{hyr}{lh}.$$

The average years of schooling and their variance are then

$$\begin{aligned}E(Q) &= \sum_{i=1}^{3} l_i q_i \\ V(Q) &= \sum_{i=0}^{3} l_i \left(q_i - E(Q)\right)^2,\end{aligned}$$

with $l_0 = lu$, $l_1 = lp$, $l_2 = ls$ and $l_3 = lh$. Finally, μ and σ can be derived from the expressions for mean and variance of the Lognormal distribution:

$$\begin{aligned}E(Q) &= e^{\mu+\frac{\sigma^2}{2}} \\ V(Q) &= e^{2\mu+2\sigma^2} - e^{\mu+\sigma^2}.\end{aligned}$$

3. For each value of φ, compute the threshold ability with perfect investor protection $\left(\pi^*_{p=1}\right)$.

   (a) Define a grid of 101 degrees of investor protection $p \in [0,1]$, and a grid of initial guesses for the threshold ability $\pi^* \in \left[\pi^*_{p=1}, 1\right]$, equally spaced by 0.00005 (the finer the grid, the better the approximation).

   (b) Draw Π =100001 ability levels from a Lognormal (μ, σ) and sort them in ascending order. Identify the ability level $\pi_{.999}$: $G(\pi_{.999}) = 0.999$ and divide every $\pi \leq \pi_{.999}$ by this figure. Replace all $\pi > \pi_{.999}$ by 1, so that the distribution is normalized to values included in $[0,1]$, and truncated in a way that makes the top 0.1 per cent of the population successful with certainty. Compute the Cdf of ability,

$$G(\pi_i) = \frac{\#\text{ of realizations } \pi \leq \pi_i}{\Pi}.$$

   (c) For each degree of investor protection p

      i. compute $\pi^*(p)$ as the solution to the technology choice problem. In particular, recursively find the point in the grid of π^* satisfying:

$$\log(B-r) = \pi^* \log\left(w^H(\pi^*)\right) + (1-\pi^*)\log\left(w^L(\pi^*)\right)$$

      with $w^H(\pi^*)$ and $w^L(\pi^*)$ defined by (1) and (2)

      ii. for every ability π

         A. draw the earning realization:

$$\begin{aligned} w &= \begin{cases} B-r & \pi < \pi^* \\ A\left[\pi^* p(1-\varphi) + \varphi + (1-p)(1-\varphi)\epsilon\right] - r & \pi \geq \pi^* \end{cases} \\ \epsilon &\sim Bi(N,\pi), \text{ with } N = \#\text{ of } \pi \geq \pi^*. \end{aligned}$$

         B. sort w and derive its cumulative density function as $F(w_i) = \frac{\#\text{ of realizations } w \leq w_i}{\Pi}$

         C. compute the variance of

         D. compute the Lorenz Curve as $L(w_m) = \frac{mean \text{ of } w \leq w_m}{mean \text{ of } w} \frac{m}{\Pi}$ for $m = 1, 2, ...\Pi$

         E. compute the Gini coefficient as $Gini = 1 - 2\sum_{m=1}^{\Pi} \frac{L(w_m)}{\Pi}$

      iii. save the threshold, the variance and the Gini in $(1 \times p)$ vectors, $\boldsymbol{\pi}^*(p)$, $Var(w(p))$, and $Gini(p)$

Table 1. Investor Protection and Income Inequality (Gini) - Cross-section 1980-2000

	1	2	3	4	5	6	7
IP	0.128	2.004**	2.370***	2.253**	0.585	2.215**	2.427***
	[0.457]	[0.959]	[0.844]	[0.855]	[0.736]	[1.015]	[0.893]
IP_HIGH		-1.562**	-1.796***	-1.717**	-0.354	-1.713**	-1.852**
		[0.724]	[0.664]	[0.651]	[0.612]	[0.781]	[0.710]
SCHOOL	-0.260***	-0.251***	-0.07	-0.063	-0.059	-0.260***	-0.03
	[0.076]	[0.071]	[0.097]	[0.112]	[0.102]	[0.091]	[0.134]
LRGDP			124.462***	129.804***	114.407***		152.672***
			[31.944]	[33.031]	[38.293]		[34.153]
LRGDP^2			-7.201***	-7.522***	-6.674***		-8.862***
			[1.827]	[1.899]	[2.182]		[1.958]
GOV				-0.123			
				[0.081]			
TRADE				-0.011			
				[0.011]			
R^2	0.237	0.31	0.519	0.536	0.433	0.274	0.533
Countries	47	47	47	47	47	47	47
						last obs.	last obs.
Gini year	1980-2000	1980-2000	1980- 2000	1980- 2000	1980- 2000		
IP index	investor protection	investor protection	investor protection	investor protection	investor protection	investor protection	investor protection

Note: the dependent variable is the Gini coefficient of the income distribution. The regressors are: IP= investor protection, IP_HIGH= IP*dummy for IP>median (60th percentile in column 5), SCHOOL= share of people above 25 years with completed secondary education, LRGDP(2)= log of real per capita GDP (squared), GOV= government expenditure, TRADE= (import+export)/GDP. Estimation is performed with Ordinary Least Squares. Robust standard errors are reported in brackets. *, **, and *** stand for 10, 5, and 1 per cent significance level.

Table 2. Investor Protection and Financial Structure - Cross-section 1980-2000

	1 OLS	2 2SLS - 2nd stage	3 2SLS - 1st stage
IP	0.059***	0.061**	
	[0.019]	[0.026]	
LRGDP	-0.05	-0.053	0.574
	[0.058]	[0.071]	[0.510]
EFF_JUD	0.053*	0.054*	-0.011
	[0.028]	[0.032]	[0.231]
UK legal origin			2.728**
			[1.185]
FR legal origin			-1.22
			[1.250]
GE legal origin			-1.448
			[1.373]
R^2	0.327	0.282	0.497
Sargan over-id			0.202
Wu-Hausman F			0.898
Countries	46	46	46
Dep. variable	SM	SM	IP
IP index	investor protection	investor protection	investor protection

Note: the dependent variable is either SM=stock market capitalization as ratio of credit to the private sector or IP= index of investor protection, as specified. The regressors are: IP, LRGDP= log of real per capita GDP, EFF_JUD= index of efficiency of the judiciary and legal origins. Estimation is performed with Ordinary Least Squares and Two-Stages Least Squares. Robust standard errors are reported in brackets. *, **, and *** stand for 10, 5, and 1 per cent significance level. P-values are reported for the Sargan test of over-identification and the Wu-Hausman test of endogeneity.

Table 3. Financial Structure and Income Inequality (Gini) - Cross-section 1980-2000

	1	2	3	4	5	6	7	8
SM	3.292	11.459**	12.415**	13.487***	3.603	13.636***	15.402***	16.809***
	[2.350]	[4.395]	[4.890]	[4.758]	[2.774]	[4.775]	[5.211]	[5.076]
SM^2		-4.146**	-4.125*	-4.398**		-5.093***	-5.460**	-5.739***
		[1.677]	[2.260]	[2.019]		[1.782]	[2.381]	[2.078]
SCHOOL	-0.187***	-0.215***	-0.056	0.002	-0.191**	-0.226***	-0.028	0.029
	[0.062]	[0.066]	[0.072]	[0.078]	[0.077]	[0.080]	[0.092]	[0.098]
LRGDP			33.089	46.268*			32.287	48.162*
			[24.631]	[23.589]			[25.307]	[24.330]
LRGDP^2			-2.054	-2.872**			-2.063	-3.034**
			[1.371]	[1.314]			[1.408]	[1.357]
GOV				-0.311**				-0.369**
				[0.147]				[0.141]
TRADE				0.008				0.003
				[0.016]				[0.018]
R^2	0.433	0.459	0.53	0.574	0.401	0.433	0.518	0.565
Countries	67	67	67	67	67	67	67	67
Gini year	1980-2000	1980-2000	1980-2000	1980-2000	last obs.	last obs.	last obs.	last obs.

Note: The dependent variable is the Gini coefficient of the income distribution. The regressors are: IP= investor protection, IP_HIGH= IP*dummy for IP>median, SM=stock market capitalization as ratio of credit to the private sector, School= share of people above 25 years with completed secondary education, LRGDP(2)= log of real per capita GDP (squared), GOV= government expenditure/GDP, TRADE= (import+export)/GDP. Estimation is performed with OLS. Robust standard errors are reported in brackets. *, **, and *** stand for 10, 5, and 1 per cent significance level.

Table 4. Financial Structure and Income Inequality (Gini) - Panel 1976-2000

	1	2	3	4	5	6	7	8	9	10
SM	2.265**	7.743***	7.164**	7.105**	6.975**	1.871*	6.262*	7.469*	7.663**	8.908**
	[0.911]	[2.708]	[2.976]	[3.081]	[3.253]	[1.007]	[3.153]	[3.735]	[3.501]	[3.630]
SM^2		-2.814**	-2.649*	-2.724**	-2.591*		-2.267	-2.756	-3.197*	-4.038**
		[1.293]	[1.408]	[1.373]	[1.590]		[1.594]	[1.841]	[1.658]	[1.733]
SCHOOL	-0.194***	-0.219***	-0.105*	-0.111*	-0.112*	-0.171***	-0.195***	-0.179***	-0.237***	-0.249***
	[0.045]	[0.046]	[0.057]	[0.062]	[0.062]	[0.052]	[0.050]	[0.062]	[0.070]	[0.071]
LRGDP			31.565**	33.634**	29.789*			-19.452	-18.08	-21.37
			[15.675]	[15.736]	[15.690]			[24.946]	[26.898]	[29.020]
LRGDP^2			-1.962**	-2.095**	-1.886**			1.033	0.902	1.06
			[0.893]	[0.901]	[0.899]			[1.458]	[1.587]	[1.709]
GOV				-0.12	-0.102				-0.142*	-0.129
				[0.083]	[0.081]				[0.082]	[0.083]
TRADE				0.009	0.012				0.051	0.075**
				[0.018]	[0.018]				[0.031]	[0.032]
R^2 within	0.118	0.157	0.122	0.13	0.143	0.118	0.157	0.175	0.221	0.251
R^2 between	0.168	0.204	0.367	0.377	0.374	0.166	0.2	0.159	0.133	0.118
Obs.	113	113	113	113	111	113	113	113	113	111
Countries	58	58	58	58	57	58	58	58	58	57
Country-FE	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes

Note: the dependent variable is the Gini coefficient of the income distribution. The regressors are: SM=stock market capitalization as ratio of credit to the private sector, School= share of people above 25 years with completed secondary education, LRGDP(2)= log of real per capita GDP (squared), GOV= government expenditure, TRADE= (import+export)/GDP. Estimation is performed with Least Squares with random effects (columns 1-5) and country fixed effects (columns 6-10). Columns 5 and 10 are estimated on the sample without Ghana. Robust standard errors are clustered by country and reported in brackets. *, **, and *** stand for 10, 5, and 1 per cent significance level.

Table 5. Financial Structure and Top Income Inequality - Panel 1976-2004

	1	2	3	4	5	6	8	10
	Top 1 to 10 per cent	Top 1 to 10 per cent	Top 1 to 10 per cent	Top 1 to 10 per cent	Top 1 to 10 per cent	Top 1 to 10 per cent	Top 0.1 to 10 per cent	Top 0.1 to 10 per cent
SM	1.760***	1.667***	0.626***	1.139**	0.908	0.718*	5.918***	11.256**
	[0.402]	[0.484]	[0.238]	[0.513]	[0.534]	[0.346]	[2.100]	[3.905]
SM^2	-0.932***	-0.967***	-0.318***	-0.686***	-0.665**	-0.352**	-2.266*	-2.748***
	[0.203]	[0.256]	[0.099]	[0.220]	[0.253]	[0.130]	[1.305]	[0.896]
SCHOOL	0.009	0.005	-0.006*	0.028**	0.027*	-0.01	-0.012	-0.167
	[0.006]	[0.007]	[0.004]	[0.013]	[0.013]	[0.008]	[0.034]	[0.102]
LRGDP		-19.056***	-43.548***		-19.341**	-39.615**	-146.341*	-155.049*
		[6.698]	[7.176]		[7.434]	[13.663]	[74.978]	[72.843]
LRGDP^2		0.981***	2.214***		0.996**	2.023**	7.643**	7.849**
		[0.332]	[0.358]		[0.380]	[0.686]	[3.659]	[3.444]
ENTRY			1.390***			1.650***	0.421	-0.088
			[0.255]			[0.392]	[0.503]	[0.357]
R^2 within	0.647	0.716	0.874	0.675	0.754	0.883	0.84	0.901
R^2 between	0.193	0.33	0.355	0.127	0.175	0.288	0.344	0.00358
Obs.	42	42	24	42	42	24	24	24
Countries	16	16	14	16	16	14	14	14
Country-FE	No	No	No	Yes	Yes	Yes	No	Yes

Note: the dependent variables are: average income of top 1 over top 10 percentile (columns 1-6) and of top 0.1 over top 10 percentile (columns 7-10) of the income distribution. The regressors are: SM=stock market capitalization as ratio of credit to the private sector, School= share of people above 25 years with completed secondary education, LRGDP= log of real per capita GDP, ENTRY= percentage annual change in the number of establishments. Estimation is performed with Least Squares with random effects (columns 1-3 and 7-8) and country fixed effects (columns 4-6 and 9-10). Robust standard errors are clustered by country and reported in brackets. *, **, and *** stand for 10, 5, and 1 per cent significance level.

Table 6. Investor Protection and Income Inequality - Robustness - Cross-section 1980-2000

	1	2	3	4	5	6
IP	0.128	2.004**	0.255	1.922*	0.059***	0.060***
	[0.457]	[0.959]	[0.443]	[0.984]	[0.019]	[0.020]
IP_HIGH		-1.562**		-1.419*		
		[0.724]		[0.807]		
SCHOOL	-0.260***	-0.251***	-0.195**	-0.207**		
	[0.076]	[0.071]	[0.091]	[0.090]		
LRGDP					-0.05	-0.053
					[0.058]	[0.060]
EFF_JUD			-0.852	-0.594	0.053*	0.055*
			[0.777]	[0.857]	[0.028]	[0.029]
CR			-0.436	-0.316		-0.011
			[1.197]	[1.184]		[0.040]
R^2	0.237	0.31	0.267	0.324	0.327	0.328
Countries	47	47	47	47	46	46
Dep. var.	Gini	Gini	Gini	Gini	SM	SM

Note: the dependent variables are the Gini coefficient of the income distribution (columns 1-4) and SM= stock market capitalization as a ratio of credit to the private sector (columns 5-6). The regressors are: IP= investor protection, IP_HIGH= IP*dummy for IP>median, SCHOOL= share of people above 25 years with completed secondary education, LRGDP= log of real per capita GDP, EFF_JUD= index of efficiency of the judiciary, CR= index of creditors' rights. Estimation is performed with Ordinary Least Squares. Robust standard errors are reported in brackets. *, **, and *** stand for 10, 5, and 1 per cent significance level.

Table 7. Financial Structure vs Financial Development and Income Inequality (Gini) - Panel 1976-2000

	1	2	3	4	5	6
SM_CAP	4.806***	7.600*	3.736**	5.905		
	[1.342]	[4.578]	[1.639]	[5.728]		
SM_CAP^2		-1.392		-1.149		
		[1.816]		[2.082]		
PRIVO	-5.330***	-8.435*	-1.491	0.717		
	[1.799]	[5.148]	[2.045]	[6.698]		
PRIVO^2		1.742		-1.585		
		[3.073]		[3.322]		
SCHOOL	-0.163***	-0.170***	-0.171**	-0.188***	-0.222***	-0.189***
	[0.050]	[0.053]	[0.065]	[0.064]	[0.044]	[0.053]
SM					8.475***	8.057**
					[2.863]	[3.461]
SM^2					-2.962*	-3.106*
					[1.522]	[1.832]
CR					-9.107***	-16.815***
					[2.899]	[4.201]
CR^2					2.066***	3.847***
					[0.730]	[0.939]
R^2 within	0.106	0.104	0.121	0.129	0.184	0.198
R^2 between	0.245	0.25	0.171	0.153	0.331	0.256
Obs.	111	111	111	111	108	108
Countries	57	57	57	57	54	54
Country-FE	No	No	Yes	Yes	No	Yes

Note: the dependent variable is the Gini coefficient of the income distribution. The regressors are: SM_CAP= stock market capitalization as ratio of GDP, PRIVO= credit to the private sector as a ratio of GDP, SM=stock market capitalization as ratio of credit to the private sector, School= share of people above 25 years with completed secondary education, CR= index of creditors' rights. Estimation is performed with Least Squares with random effects and country fixed effects. Robust standard errors are clustered by country and reported in brackets. *, **, and *** stand for 10, 5, and 1 per cent significance level.