

Seminar Paper No. 737
EQUITIES AND INEQUALITY

by
Alessandra Bonfiglioli



INSTITUTE FOR INTERNATIONAL ECONOMIC STUDIES
Stockholm University

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Equities and Inequality*

Alessandra Bonfiglioli
IIES, Stockholm University

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Abstract

This paper studies the relationship between investor protection, the development of financial markets and income inequality. In the presence of market frictions, investor protection promotes financial development by raising confidence and reducing the costs of external financing. Developed financial systems spread risks among financiers and firms, allocating them to the agents bearing them the best. Therefore, financial development plays the twofold role of encouraging agents to undertake risky enterprises and providing them with insurance. By increasing the number of risky projects, it raises income inequality. By extending insurance to more agents, it reduces it. As a result, the relationship between financial development and income inequality is hump-shaped. Empirical evidence from a cross-section of sixty-nine countries, as well as a panel of fifty-two countries over the period 1976-2000, supports the predictions of the model.

JEL Classification: D31, E44, G30, O15, O16

Keywords: Income inequality, financial development, capital market frictions, investor protection, instrumental variables, dynamic panel data.

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1 INTRODUCTION

A recent literature on law and finance has shown that investor protection plays a significant role in promoting the development of financial markets (see Acemoglu and Johnson, 2003, La Porta et al., 1997 and 2003, and Rajan and Zingales, 2002, among others). In particular, measures aimed at improving transparency and enforcement of financial contracts reduce the costs of outside-finance (see, for instance, Shleifer and Wolfenzon, 2002) and shift risks onto the parties that can best bear them (see Castro et al., 2004). Several works have recognized the importance of financial development for various macroeconomic variables such as growth and productivity (see, Demirgüç-Kunt and Levine, 2001 for a survey). However, this growing literature has not recognized that the changes in risk-taking behavior of investors and firms, associated with better shareholder protection, may also affect income inequality. The data suggest indeed that these variables are correlated. As shown by Table 1, for a sample of sixty-eight countries observed between 1980 and 2000, the Gini coefficient of the net income distribution is on average 10% higher (at the 5% significance level) in countries where financial markets are more developed.¹ Controlling for average human capital, one of the most important determinants of inequality, this difference rises to 14% (now significant at the 1% significance level).² Table 1 also shows that countries with more developed financial markets tend to have better institutions aimed at investor protection.³

This paper investigates the link between investor protection, financial development and inequality, both theoretically and empirically. It proposes a simple model where investor protection promotes financial development, thereby improving risk sharing. This induces more risk-taking in the economy and better insurance on individual earnings, which affect income inequality in opposite ways. The relationships predicted by the model are confronted with the data.

To formalize these ideas, I construct a general equilibrium two-period overlapping generations model. Agents are risk averse and heterogeneous in their entrepreneurial ability. They face a choice between a safe and a risky technology, and entrepreneurial ability af-

¹I refer to the ratio of stock market capitalization over credit to the private sector as an indicator of financial development. This ratio measures the weight of equity-finance on overall borrowings, and is well suited to capture the risk sharing function of financial development. It is frequently used for this purpose in the literature (see Rajan and Zingales, 2002).

² $Gini_{HC}$ in Table 1 is $Gini - \hat{\beta}HC$, where $\hat{\beta}$ is the OLS estimate from the regression: $Gini_i = \alpha + \beta HC_i + \epsilon_i$. HC is human capital, proxied by the share of the population aged above 25 with some secondary education (from Barro and Lee, 2001). The results do not change if I also control for the Kuznets' hypothesis by including real per capita GDP and its square, and for geography by including dummy variables. These results are available upon request.

³The index of investor protection is taken from La Porta et al. (2003) and accounts for measures aimed at transparency (accounting and disclosure requirements) and the enforcement of private contracts.

Table 1
Inequality, financial development and institutions - mean comparisons

	<i>Low Smcap</i>	<i>High Smcap</i>	<i>Diff</i>
<i>Gini</i>	37.48 (1.42)	41.30 (1.85)	3.819** (2.3)
<i>Gini_{HC}</i>	44.07 (1.19)	50.10 (1.46)	6.024*** (1.88)
<i>investor_pr</i> ^(a)	3.79 (.46)	5.95 (.67)	2.154*** (.788)
Observations	41	27	

Note. A country is labeled *High Smcap* if its ratio of stock market capitalization over credit to the private sector is above cross-sectional average. The results are robust to the adoption of the median as a threshold. *Gini* coefficients refer to the distribution of net per capita income, *Gini_{HC}* are controlled for human capital. Means and differences are reported for each variable, with standard errors in parenthesis. *** and ** indicate that the difference is positive at the 1 and 5 per cent significance level. ^(a) the sample is reduced to 18 and 24 countries with *Low* and *High Smcap*, respectively. Sample period is 1980-2000.

fects the probability of success in the risky project. I assume that financial markets are subject to imperfections arising from the non-observability of output to financiers and that measures of investor protection can be adopted to amend these frictions. In particular, by promoting transparency, investor protection makes misreporting output costly for entrepreneurs.⁴ For instance, this cost can be thought of as the extra-compensation the advisory firm charges to certify a falsified book. Better guarantees generate more confidence among investors, thereby making them more willing to bear risk and insure the entrepreneurs. In turn, investors can spread the individual risk by holding diversified portfolios of risky activities. As a result, financial systems with stronger investor protection allow higher degrees of risk sharing. Finally, I rule out wealth heterogeneity, so that all inequality is due to idiosyncratic factors (ability), financial market conditions and income risk. Under these assumptions, better investor protection promotes financial development and affects income inequality in three ways. (i) It improves risk sharing, thereby reducing income volatility for a given size of the risky sector; (ii) it raises the share of the population exposed to earning risk; and (iii) it increases the reward to ability. (i) tends to reduce inequality, while it is increased by (ii) and (iii).

The main result of the paper is that income inequality is a hump-shaped function of investor protection and financial development. Any improvement upon a low level investor protection increases risk taking more than risk sharing, thereby driving inequality up. However, when investor protection is sufficiently high, any further improvement is more

⁴Also in Aghion et al. (2005), Castro et al. (2004) and Lacker and Weinberg (1989) does investor protection take the form of a hiding cost. 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.

effective on risk sharing than risk taking, hence reduces income inequality.

To make the predictions of the model more easily testable, I assume that there are only two financial instruments, which I label equity and debt. Equity makes risk sharing between investors and entrepreneurs possible, depending on the degree of investor protection, while debt does not.⁵ In this way, financial development is captured by the thickness of the equity market, which is also a common empirical measure of financial development (see Rajan and Zingales, 2002, among others). Then, the testable predictions of the model will be that (1) stock market size grows with investor protection, (2) there is a hump-shaped relationship between income inequality and the thickness of the equity market, and (3) investor protection affects inequality only through stock market development. I provide empirical evidence from a cross-section of sixty-nine countries and a panel of fifty-two countries over the period 1976-2000 in support of these results.

The contribution of this paper is related to three main strands of literature. Acemoglu and Johnson (2003), as well as La Porta et al. (1997, 1998, 1999, 2003), show that institutions aimed at contracting protection (such as those measured by *investor_pr* in Table 1) promote the development of stock markets, but have controversial effects on economic performance. None of these studies has considered income inequality.

Many papers (Beck and Levine, 2002, Levine, 2002, Levine and Zervos, 1998, Rajan and Zingales, 1998 among others) provide empirical evidence on the link between financial development and macroeconomic variables, such as growth, investments and productivity, but none of them has addressed distributional issues.⁶

Theoretical contributions by 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. As the poorest are subject to credit constraints, they are prevented from making efficient investments in the most productive activities.⁷ Over time, capital accumulation determines the dynamics of wealth and income. I depart from this approach by focusing on a different source of ex-ante heterogeneity, namely entrepreneurial ability, and by describing a new

⁵This labeling is based on the common distinction between standard equity and debt contracts. However, as the financial structure becomes more developed, a variety of sophisticated debt contracts are offered to also achieve better risk sharing. These instruments, like venture capital, for instance, can be assimilated to equity in the model.

⁶All these works account for the influence of the legal environment on financial structure. In particular, financial variables are instrumented with legal origins, which Acemoglu and Johnson (2003) and La Porta et al. (1997, 1998, 1999, 2003) used as instruments for contracting protection.

⁷The credit constraint can derive from the non-observability of physical output as in Banerjee and Newman (1992) and Galor and Zeira (1993), or effort as in Aghion and Bolton (1997) and Piketty (1997).

mechanism translating differences in ability into income inequality that is independent of accumulation. In particular, I assume productivity to be a function of ability and that entrepreneurs have no wealth for starting their firms. By encouraging investors to ensure entrepreneurs, better investor protection allows the more talented to undertake risky projects, whose payoffs depend on ability. Heterogeneity in productivity, the extent of risk sharing and the size of the risky sector ultimately determine the income distribution. In this respect, the approach of Acemoglu and Zilibotti (1999) is closer to mine. In their paper, income inequality is generated by managerial incentives, which depend on risk sharing, not by ex-ante wealth heterogeneity. There, risk sharing evolves endogenously over time as a consequence of information accumulation, while here it varies only as an effect of exogenous changes in investor protection.

The only empirical assessments of the relationship between financial development and income inequality are, to my knowledge, Clarke et al. (2003) and Beck et al. (2004). Both find evidence of a negative, though non robust, relationship between the degree of financial intermediation and income inequality. The main difference with respect to my empirical analysis lays in the measure of financial development. Instead of financial depth, I use the size of the equity market relative to total credit, which seems better suited to account for the degree of risk sharing allowed by a financial system.

The remainder of the paper is organized as follows. Section 2 presents the model and its solution in partial equilibrium (a small open economy). In section 3, I study analytically and by means of numerical solution how income inequality varies with investor protection and financial development. Section 4 argues that the main results hold in general equilibrium (a closed economy). This version of the model is extensively described in the appendix. Section 5 shows that empirical evidence from a cross-section of sixty-nine countries and a panel of fifty-two countries over the period 1976-2000 supports the main results of the model. Section 6 concludes.

2 THE MODEL

2.1 SET UP

The model economy is populated by two-period overlapping generations of risk-averse agents. There is no population growth and the measure of each cohort is normalized to one. For simplicity, preferences are represented by the following utility function:

$$U_t = \log(c_t) + \beta \log(c_{t+1}).$$

Second-period utility is discounted at the rate $\beta \in (0, 1)$.

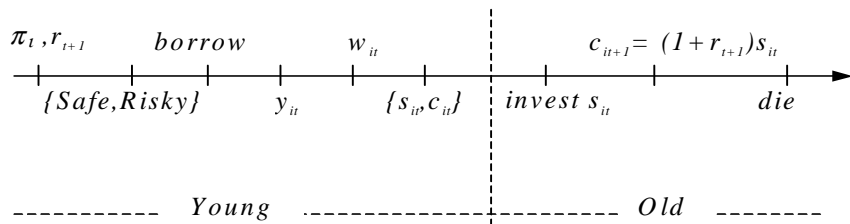


Figure 1: Timing of the model

At any time t , each young agent in group i is born with no wealth and ability $\pi_i \in [0, 1]$, drawn from distribution $G(\pi)$. Each group is populated by a continuum $g(\pi)$ of individuals. In the first period, agents work as self-employed entrepreneurs producing an intermediate good, and allocate their income among consumption and savings, $s(\cdot)$. When old, they invest their savings and consume all the returns before dying. When investing, they can choose between safe loans, yielding a return r_{t+1} , and portfolios of risky assets. There are no bequests.

2.1.1 Intermediate goods sector

Two production processes are available to each young agent: a safe and a risky one. The safe technology does not employ capital, while the risky one requires a fixed unit investment. Therefore, the individual technological choice is analogous to an occupational choice whereby some agents become “workers” and others “entrepreneurs”. In line with empirical findings, I assume that the risky activity, if successful, has higher returns than the safe one and that the probability of success depends on the ability of the entrepreneur.⁸ For simplicity, and without much loss of generality, I assume that ability only affects the probability of success and not the payoffs.⁹ In particular, production is given by:

$$x_{it} = \left\{ \begin{array}{ll} B & \text{for } i \text{ running } \textit{Safe} \text{ technology} \\ A \text{ with prob. } \pi_i & \\ \varphi A \text{ with prob. } 1 - \pi_i & \end{array} \right\} \text{ for } i \text{ running } \textit{Risky} \text{ technology,}$$

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

⁹Ability can be considered as playing a twofold role. It enhances the chance of succeeding in risky enterprises, as assumed in the model. But it may also raise productivity regardless of the riskiness of projects. Introducing this second effect into the model would not affect the results.

where $B < A$, $\varphi \in (0, 1)$ and success is i.i.d. within each group. It follows that there is no aggregate risk and total production of group i equals $g(\pi_i)B$ or $g(\pi_i)[\pi_i + (1 - \pi_i)\varphi A]$, depending on the technology, safe or risky, in use.

2.1.2 Final good sector

A homogeneous final good Y , used for consumption and investment, is produced by competitive firms using capital and intermediate goods. The intermediate goods produced by all agents are perfect substitutes in production. The aggregate technology has the following Cobb-Douglas form:

$$Y_t = K_{Yt}^\alpha X_t^{1-\alpha}, \quad (1)$$

where X_t is the total amount of intermediate goods, with a unit price of χ_t , and K_{Yt} is capital employed in the final good sector. Y_t is the numeraire.

2.1.3 Financial sector

Both final good firms and risky entrepreneurs need to borrow capital from the old to produce. Information about technology (A, B, φ, α) and individual ability (π_i) is public, but outside financiers cannot observe the outcome of risky activities, x_{it} . Two financial instruments, equity and debt, are available.

Equity is modeled as follows. Upon receiving one unit of capital, each young in group i commits to pay, after production, dividend payouts θ_{it}^h and θ_{it}^l in case of success and failure, respectively. Once production has occurred, unlucky entrepreneurs can only return the promised amount $\theta_{it}^l x_{it}^l \chi_t$. Successful entrepreneurs, instead, may misreport their realization of x_{it} and pay $\theta_{it}^l x_{it}^l \chi_t$, pretending to be in the bad state. However, I assume that measures of shareholder protection make misreporting costly. For every unit of hidden cash flow, the entrepreneur incurs a cost $p \in [0, 1]$. Since both ability and technology are common knowledge, either the entire $(x_{it}^h - x_{it}^l)$ or nothing is hidden, so that the payoff from misreporting is $(x_{it}^h - \theta_{it}^l x_{it}^l) \chi_t - p(x_{it}^h - x_{it}^l) \chi_t$. Truth-telling is rational as long as its value is at least equal to that of misreporting. Therefore, the equity contract $\{\theta_{it}^h, \theta_{it}^l\}$ must satisfy the incentive compatibility (IC) constraint:

$$v \left[\left(1 - \theta_{it}^h\right) x_{it}^h \chi_t, r_{t+1} \right] \geq v \left[\left(x_{it}^h - \theta_{it}^l x_{it}^l\right) \chi_t - p \left(x_{it}^h - x_{it}^l\right) \chi_t, r_{t+1} \right], \quad (\text{IC})$$

where $v[w_t, r_{t+1}]$ is the indirect utility of a young agent with a given income w_t and facing an interest rate r_{t+1} when old.

Debt requires a fixed repayment, R_{it} . In case entrepreneurs are not able (or willing) to

pay, bankruptcy enables creditors to obtain $\min\{R_{it}, x_{it}\}$.¹⁰ Due to log-utility, agents in the risky sector can afford debt financing only as long as output in the bad state is higher than the interest rate. This implies that debt is always repaid and its return equals that of safe loans ($R_{it} = r_t$ for any i).

Financial contracts are set to maximize the agents' expected indirect utility, V_{it} , subject to the IC constraint and the outsiders' participation constraint. As for the latter, old agents must be indifferent between the following investments: a portfolio with shares of all group- i firms and safe loans. Risk aversion implies that debt is never optimal for financing risky projects. Furthermore, assuming that firms bear an infinitesimal cost of issuing equity, debt is preferred by the safe firms in the final good sector. Thus, payoffs from the risky technology are determined as the solution to the contracting problem for equities:

$$\max_{\theta_{it}^h, \theta_{it}^l} V_{it} \equiv \left\{ \pi_i v \left[\left(1 - \theta_{it}^h\right) A\chi_t, r_{t+1} \right] + (1 - \pi_i) v \left[\left(1 - \theta_{it}^l\right) \varphi A\chi_t, r_{t+1} \right] \right\}, \quad (\text{P1})$$

subject to the incentive compatibility constraint:

$$v \left[\left(1 - \theta_{it}^h\right) A\chi_t, r_{t+1} \right] \geq v \left[\left(1 - \varphi\theta_{it}^l\right) A\chi_t - p(1 - \varphi) A\chi_t, r_{t+1} \right], \quad (\text{IC}')$$

and the old's participation constraint:

$$\pi_i \theta_{it}^h A\chi_t + (1 - \pi_i) \theta_{it}^l \varphi A\chi_t = r_t. \quad (\text{PC})$$

Note that a pooled portfolio of i.i.d. shares of group i yields the LHS of (PC) with certainty, so that the old face no uncertainty.¹¹

2.1.4 Equilibrium

Firms in the final good sector are perfectly competitive and maximize profits taking prices (r_t, χ_t) as given. Each young agent from group i has perfect foresight and chooses how much to save, $s(\cdot)$, and the technology to use (safe or risky), to maximize her expected utility. Thus, each of them solves the following program:

$$\max_{T \in \{\text{Safe}, \text{Risky}\}} V_{it}^T, \quad (\text{P2})$$

¹⁰Limited liability can hardly apply in this context, since the entire capital accrues to the outside financiers. Entrepreneurs do not own, and are not entitled to anything before repaying their debt.

¹¹It follows that the participation constraint is the same as in the case of risk-neutral financiers with a single equity- i issuer.

where

$$\begin{aligned}
V_{it}^{Safe} &= v(B\chi_t, r_{t+1}) \\
V_{it}^{Risky} &= \pi_i v \left[\left(1 - \theta_{it}^h\right) A\chi_t, r_{t+1} \right] + (1 - \pi_i) v \left[\left(1 - \theta_{it}^l\right) \varphi A\chi_t, r_{t+1} \right] \\
v(w_{it}, r_{t+1}) &= \log[w_{it} - s(w_{it}, r_{t+1})] + \beta \log[(1 + r_{t+1}) s(w_{it}, r_{t+1})] \\
s(w_{it}, r_{t+1}) &= \arg \max_{s_{it}} \{ \log(w_{it} - s_{it}) + \beta \log[(1 + r_{t+1}) s_{it}] \}.
\end{aligned}$$

where w_{it} is realized income, i.e., $B\chi_t$ in case the safe technology is chosen, otherwise $(1 - \theta_{it}^h) A\chi_t$ and $(1 - \theta_{it}^l) \varphi A\chi_t$ in the good and bad state respectively. In other words, young entrepreneurs choose technology, given their individual ability π_i , factor prices r_t and χ_t , and the dividend payouts $\{\theta_{it}^l, \theta_{it}^h\}$ which solve (P1).

To state the mechanism of the model in the clearest way, I first assume this to be a small open economy.¹² Both capital and intermediate goods are internationally traded, so that r_t and χ_t are exogenously given from the world markets, while Y is non traded.¹³ Assuming that prices are constant, the economy is always in a steady-state and I can drop all the time indexes. For simplicity, I normalize the price of intermediate goods to one ($\chi = 1$). It follows that aggregate domestic consumption is $C = (1 + r)K^d + \int_0^1 w(\pi) g(\pi) d(\pi)$, where K^d denotes aggregate domestic capital.

Definition *Given the interest rate r and the intermediate good price $\chi = 1$, the equilibrium for this small open economy is defined as the set of savings, technological choices and dividends $\{s_i, T_i, \theta_i^l, \theta_i^h\}_{i \in [0,1]}$, such that each agent in group i solves (P1) - (P2); and the factor employments $\{K_Y, X\}$ that maximize profits in the final good sector.*

For simplicity, I assume that $\varphi A < B + r < A$ and $\varphi A < r$. This implies that both safe and risky intermediate projects are run in equilibrium; and when investor protection is absent, nobody chooses the risky technology.¹⁴

2.2 SOLUTION

2.2.1 Final good sector

Profit maximization by competitive firms in the final good sector yields the following demand functions for capital and intermediates: $K_Y = \alpha \frac{Y}{r}$ and $X = (1 - \alpha)Y$. Market

¹²Later on, I will endogenize interest rate and prices, and show that the main results continue to hold.

¹³This assumption is immaterial, since factor prices are equalized everywhere.

¹⁴This assumption also rules out risky debt. However, it can be shown that removing this restriction would not have any considerable effect on the results.

clearing requires $Y = C + K^d$.

2.2.2 Young agents

Due to log-utility, the optimal saving function of each young agent is simply a constant fraction $(1 + \beta)^{-1}$ of her earnings. To solve for the optimal occupational choice (P2), an agent born in group i needs to know the payoffs from the risky technology. Therefore, I proceed backwards. First, I derive the optimal equity contracts $\{\theta_i^h, \theta_i^l\}_{i \in [0,1]}$ from (P1), under both perfect and imperfect investor protection. Then, I characterize the occupational choice, $\{T_i\}_{i \in [0,1]}$, given the optimal payoffs. Finally, I show how the equilibrium is affected by investor protection.

Optimal equity contract: efficient markets, $p = 1$

In this case, the payoff from hiding cash flow equals earnings in the bad state, $(1 - \theta_i^l) x_i^l$. This means that there is no incentive for entrepreneurs to misreport, so that investors can act as if they had perfect information about x_i . Having a state-invariant income is the first best for risk-averse entrepreneurs. Since outside financiers behave as if they were risk-neutral and perfectly informed, they are willing to provide insiders with full insurance, given that the expected return equals the safe rate. Analytically, the first-order conditions for (P1) subject to (PC) require:

$$\begin{aligned} v'_h &= v'_l & \text{and} \\ (1 - \theta_i^h) &= [\pi_i + (1 - \pi_i)\varphi] - \frac{r}{A}, \end{aligned}$$

where v'_h and v'_l are the derivatives of $v[(1 - \theta_i^h)A, r]$ and $v[(1 - \theta_i^l)\varphi A, r]$ with respect to θ_i^h and θ_i^l , respectively. This means that (IC') holds with equality and $(1 - \theta_i^h)A = (1 - \theta_i^l)\varphi A$ (i.e., earnings of entrepreneurs are state invariant: $w_i^h = w_i^l$).

Optimal equity contract: general case, $0 < p < 1$

If investor protection is not perfect, state invariant earnings are not incentive compatible: entrepreneurs in the good state would be tempted to misreport x_i and enjoy the higher utility given by earnings $(1 - \varphi\theta_{it}^l)A - p(1 - \varphi)A$. Investors are aware of this and hence account for it when determining the dividend payouts. In other words, both (IC') and (PC) must hold with equality, so that

$$\begin{aligned} w_i^l &= (1 - \theta_i^l)\varphi A = \{[\pi_i + (1 - \pi_i)\varphi] - \pi_i(1 - p)(1 - \varphi)\}A - r, \\ w_i^h &= (1 - \theta_i^h)A = \left[(1 - \theta_i^l)\varphi + (1 - p)(1 - \varphi) \right] A. \end{aligned}$$

The wedge between state-contingent earnings, i.e. the price for the temptation to misre-

port, is decreasing in investor protection. If the cost of hiding profits is high, temptation to misreport is low, as is its price in terms of distance from the first best. The ratio between payoffs and ability is lower than in the efficient case, and increasing in p . This means that, by discouraging misbehavior, investor protection also fosters meritocracy. Expected earnings for entrepreneurs are the same as under perfect investor protection, but expected utility is lower, due to risk aversion. Notice that for $p = 0$, the payoffs from equity-finance are the same as those implied by a standard debt contract.

Technological choice

The solution to (P2) features a threshold ability level π^* such that the *Risky* technology is chosen by any agent with ability higher than π^* . This property is formalized in Lemma 1.

Lemma 1 *There exists a unique π^* such that $\forall \pi_i \geq \pi^*$, $\pi_i v[(1 - \theta_i^h)A, r] + (1 - \pi_i)v[(1 - \theta_i^l)\varphi A, r] \geq B$, and $\{\theta_i^h, \theta_i^l\}$ is the solution to (P1).*

Proof. *See the Appendix.* ■

2.2.3 Investor protection and the equilibrium

Since the dividend payouts $\{\theta_i^h, \theta_i^l\}$ are functions of investor protection, also the threshold ability π^* varies with p , as formalized in Lemma 2

Lemma 2 *The threshold ability π^* is a decreasing, convex function of investor protection p .*

Proof. *See the Appendix.* ■

Given that the risky technology is financed with equity, the measure of agents who choose it represents the size of the stock market. From Lemmas 1 and 2, it follows that stock market size is a function of investor protection, as stated by Proposition 1.

Proposition 1 *Stock market size, $sm \equiv 1 - G(\pi^*)$, is increasing in investor protection, and concave for high p .*

Proof. *See the Appendix.* ■

Corollary 1 *Stock market size as a ratio of GDP is increasing in investor protection and concave for high p .*

Proof. *See the Appendix.* ■

In the efficient case ($p = 1$), the value of producing with the risky technology is higher whenever $[\pi_i + (1 - \pi_i)\varphi]A - r \geq B$. Therefore, I can easily get a closed form solution

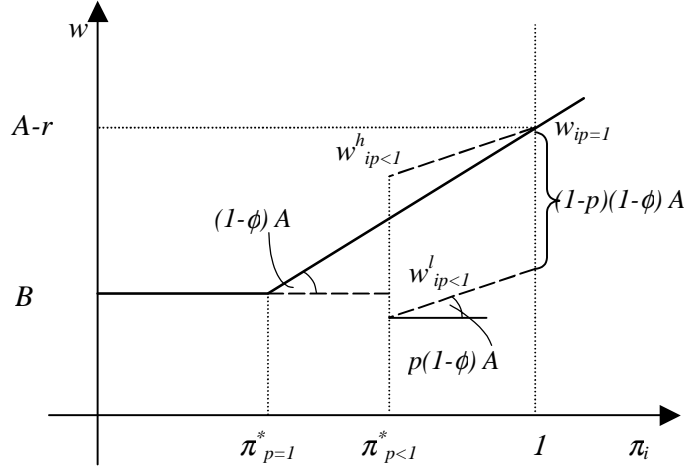


Figure 2: Ability-earnings profiles.

for the threshold ability,

$$\pi_{p=1}^* = \frac{(B - A\varphi) + r}{(1 - \varphi)A},$$

and verify that it lies in the support of π under the hypotheses that $A > B + r$ and $\varphi A < B + r$.

In the general case of imperfect investor protection ($p < 1$), the expression for the threshold ability is more complicated. However, payoffs are easily derived:

$$w(\pi_i) = \begin{cases} B & \text{with probability 1} & \text{for } \pi_i < \pi^* \\ w_i^h & \text{with probability } \pi_i & \text{for } \pi_i \geq \pi^* \\ w_i^l & \text{with probability } 1 - \pi_i & \text{for } \pi_i \geq \pi^* \end{cases}$$

$$w_i^h = [\pi_i p (1 - \varphi) + \varphi + (1 - p)(1 - \varphi)] A - r \quad (2)$$

$$w_i^l = [\pi_i p (1 - \varphi) + \varphi] A - r. \quad (3)$$

Henceforth, I denote the threshold abilities associated with $p = 1$ and $0 < p < 1$ by $\pi_{p=1}^*$ and $\pi_{p<1}^*$, respectively. For $p = 1$, perfect risk sharing is achieved through equity financing so that entrepreneurs act as if they were risk-neutral. They choose the risky technology as soon as their ability implies expected earnings equal to the safe ones, i.e. $\pi_i = \pi_{p=1}^*$. This means that their earnings are state invariant and exhibit no discontinuity at the threshold ability level. When $0 < p < 1$, at $\pi_i = \pi_{p<1}^*$ the expected productivity of the risky technology needs to be higher than the productivity of the safe technology, because entrepreneurs are risk averse and cannot be fully insured through equity.

Figure 2 illustrates the optimal ability-earnings profiles. If there is no investor protection, nobody chooses the risky technology and hence earnings are flat and equal to B . In the opposite extreme case of $p = 1$, income of young agents is described by the solid line. It is flat for the less able, who run the safe project, and proportional to ability for the more talented, risky entrepreneurs. Due to perfect risk-sharing, earnings are state invariant. If investor protection drops to $0 < p < 1$ (dashed line), equity-finance becomes more costly, thereby inducing the least able among risky entrepreneurs to shift to the safe sector. Graphically, (1) the stock market shrinks, i.e., the flat portion of the earnings profile becomes longer. I define this as the “market size” effect. (2) Proportionality between stochastic payoffs and ability becomes weaker due to higher incentives to misreport, and the wedge between state contingent earnings widens due to worse risk-sharing. I call this, as illustrated by the flatter slope and higher distance between $w_{ip < 1}^h$ and $w_{ip < 1}^l$, the “risk sharing” effect. The extent of imperfect risk sharing is captured by the jump in expected earnings at $\pi_{p < 1}^*$. At any $\pi_i \geq \pi_{p < 1}^*$, the expected payoff from the risky technology is independent of p since, for a given interest rate, the old are indifferent between stocks and loans. However, even though expected earnings are invariant, welfare is higher under perfect investor protection because of risk aversion.

3 EVALUATING INCOME INEQUALITY

In this section, I derive the key implications of the model on the overall effect of investor protection on income inequality, through the development of the stock market. To do so, I compute the variance of earnings,

$$\begin{aligned} Var(w) = & G(\pi^*) [B - E(w)]^2 + \int_{\pi^*}^1 \left\{ \pi [w^h(\pi) - E(w)]^2 \right. \\ & \left. + (1 - \pi) [w^l(\pi) - E(w)]^2 \right\} g(\pi) d\pi, \end{aligned}$$

with $E(w) = G(\pi^*) B + A \int_{\pi^*}^1 [\pi + (1 - \pi)\varphi] g(\pi) d\pi - [1 - G(\pi^*)] r$, and study how it varies with p .¹⁵

If there is no investor protection, all agents choose the safe technology and thus, the variance is zero. If the cost of hiding cash flow becomes any higher than zero ($p = \varepsilon$), some agents prefer the risky technology and raise funds through equity, thereby driving the stock market size from zero to $sm(\varepsilon)$. By the “market size” effect, a share of the economy becomes subject to income risk (having state-contingent earnings), thereby raising the

¹⁵Since income of the old is $1 - 1 + r$ linked to that of the young, I focus on the earnings of the active population only.

variance of income (analytically, positive terms fall under the integral). Moreover, average earnings grow higher than B , so that also the agents on the flat portion in Figure 2 contribute to raising the variance.

As investor protection improves, “market size” is paired with the “risk sharing” effect, which shrinks the wedge between state-contingent earnings and hence, tends to reduce the variance. Analytically, the “risk sharing” effect tends to reduce the term under integration. The extent of the “market size” effect is decreasing in investor protection, due to the concavity of sm at high p . On the other hand, risk-sharing becomes more effective, the larger is the share of equity-financed agents. This means that, when investor protection is weak (sm is small), the market-size effect dominates because risk-sharing applies to a small fraction of the economy. Therefore, inequality at first increases with p (and with sm).

When investor protection is perfect, $Var(w) = G(\pi_{p=1}^*) [B - E(w)]^2 + \int_{\pi_{p=1}^*}^1 \{[\pi + (1 - \pi)\varphi]A - r - E(w)\}^2 g(\pi) d\pi > 0$. As p falls any lower than 1 ($p = 1 - \varepsilon$), the “market size” effect drives only few agents out of the risky sector, thereby reducing income inequality by a small amount, since the difference between B , $w^h(\pi^*)$ and $w^l(\pi^*)$ is still slight. The “risk sharing” effect, instead, applies to a large share of the population, and outweighs the “market size” effect, so that there is an increase in income inequality. Therefore, improvements upon an already very good investor protection may in fact reduce inequality, although never below the case of no investor protection. Lemma 3 and Proposition 2 formalize this intuition.

Lemma 3 *The variance of earnings is a non-monotonic function of investor protection: $\frac{dVar(w)}{dp} > 0$ in a neighborhood of $p = 0$, and $\frac{dVar(w)}{dp} < 0$ in a neighborhood of $p = 1$.*

Proof. See the Appendix. ■

Since, from Proposition 1, sm is continuous and monotonic in p , also the relationship between stock market size and income inequality follows a non-monotonic pattern.

Proposition 2 *The relationship between earnings variance and stock market size, $sm \equiv 1 - G(\pi^*)$, is non-monotonic: $\frac{dVar(w)}{dsm} > 0$ in a neighborhood of $sm(0)$, and $\frac{dVar(w)}{dsm} < 0$ in a neighborhood of $sm(1)$.*

Proof. See the Appendix. ■

Proposition 2 shows that income inequality, as measured by the earnings variance, increases with stock market size for small sm and falls with large sm . However, this does not give a full characterization of the relationship between inequality and stock market size for any p . Moreover, there are alternative measures of inequality, such as the Gini

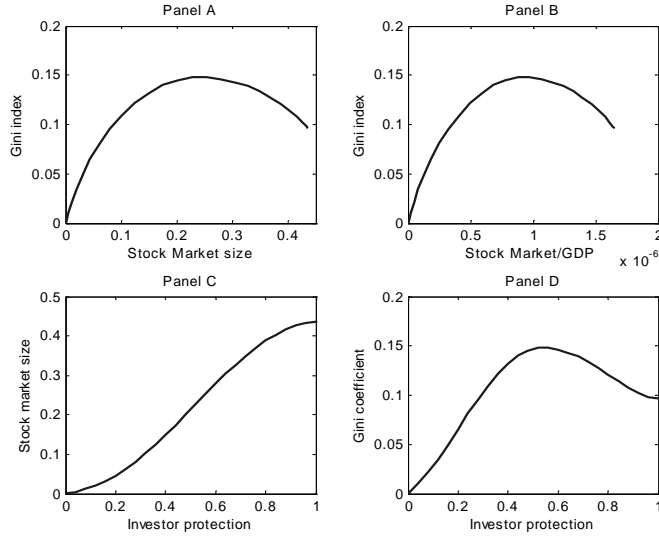


Figure 3: Stock market size and income inequality (Panels A-B), investor protection, stock market size (Panel C), and income inequality (Panel D). Simulation output.

coefficient, that are more commonly used in empirical work. Since a characterization of this indicator is awkward to derive analytically, I obtain it through numerical solution. This exercise allows me to study the relationship between investor protection, stock market size and income inequality on the whole domain of p and to obtain a more testable version of the prediction in Proposition 2.¹⁶

To simulate the model, I choose parameter values consistently with the restrictions imposed on parameters throughout the paper.¹⁷ I approximate the distribution of ability with a Lognormal(μ, σ) and parametrize the mean and variance of the associated Normal distribution, μ and σ , with values from the actual data. Although ability per se is difficult to measure, it is likely to be reflected in educational attainment. Therefore, I take the sample mean and variance of school years from the Barro and Lee (2000) database of 138 countries in 1995. Since the support of the Lognormal distribution is unbounded from above, it must be truncated to comply with the set-up of the model. I assume the top 0.05 per cent to have ability 1, while π is lognormally distributed across the remaining 99.95 per cent of the population. I parameterize μ and σ to match the US data, where the

¹⁶If the assumption that risky output in the bad state is lower than the international interest rate is removed, some of the most able agents can finance the risky project through debt, even at $p=0$. This means that the upper bound for the threshold ability becomes $\tilde{\pi} < 1$ s.t. $\tilde{\pi}v(A-r) + (1-\tilde{\pi})v(\varphi A-r) = v(B)$, and stock market size is $G(\tilde{\pi}) - G(\pi^*)$. All results hold, after this relabeling.

¹⁷Notice that this numerical solution is for qualitative rather than quantitative purposes. Therefore, the technological parameters are not calibrated to the actual data.

average years of schooling are 14.258, with a variance of 26.93. I normalize the resulting ability distribution so that it fits in the interval $[0, 1]$, consistent with the model. I set $\alpha = 0.33$, $r = 0.06$, $B = 1$, $A = 2.33$, $\varphi = 0.026$, implying $sm(p = 1) \simeq 0.4$.

Both the market size and the risk-sharing effects are expected to affect the Gini coefficients and the variance of earnings in similar ways. Panel A of Figure 3, plotting the Gini coefficient against stock market size, confirms the expectations: the Gini exhibits a non-monotonic pattern, featuring a hump peaking at a high sm . From Corollary 1, stock market size as a ratio of GDP is monotonically increasing in investor protection, and is concave for high p . Therefore, a pattern close to Panel A can be expected for the relationship between $\frac{sm}{Y}$ and income inequality. Panel B confirms this prediction. Panel C shows stock market size to be a function of investor protection, with the properties predicted by Proposition 1. Finally, Lemma 3 is given graphical representation in Panel D, which plots the relationship between investor protection and income inequality.

4 CLOSED ECONOMY

In this section, I show briefly how the economy can be closed without affecting the main results discussed so far. Details of the analysis are provided in the appendix. Assume that capital and intermediate goods can no longer be imported or exported. Therefore, their prices will be pinned down by domestic demand and supply: $r_t = \alpha \frac{Y_t}{K_{Yt}}$, and $\chi_t = (1 - \alpha) \frac{Y_t}{X_t}$. Further, capital will follow the law of motion:

$$K_{t+1} = \frac{1}{1 + \beta} \left\{ G(\pi_t^*) B \chi_t + A \chi_t \int_{\pi_t^*}^1 [\pi + (1 - \pi) \varphi] g(\pi) d\pi - [1 - G(\pi_t^*)] r_t \right\}, \quad (4)$$

where the RHS is aggregate savings. Aggregate capital is allocated between the final good sector and risky activities:

$$K_{t+1} \equiv K_{Yt+1} + 1 - G(\pi_{t+1}^*).$$

The aggregate supply of intermediate goods, X_t , equals total production of safe and risky projects:

$$X_t = G(\pi_t^*) B + A \int_{\pi_t^*}^1 [\pi + (1 - \pi) \varphi] g(\pi) d\pi.$$

Optimal technology adoption maintains the threshold property of Lemma 1, since agents take prices as given and the risky payoffs are still increasing in ability. In any

period, the threshold ability π_t^* satisfies:

$$\pi_t^* v \left(w_t^h(\pi_t^*), r_{t+1} \right) + (1 - \pi_t^*) v \left(w_t^l(\pi_t^*), r_{t+1} \right) = v(B\chi_t, r_{t+1}). \quad (5)$$

Differently from the small open economy, equilibrium payoffs $w_t(\pi_i)$ now depend also on the capital used in the final sector, K_{Yt} .

Equations (5) and (4) characterize the dynamic equilibrium. In the appendix, I report numerical solutions for the steady state and the transition dynamics. In particular, I show that Lemmas 2-3 and Propositions 1-2 continue to hold in the steady state. Moreover, along the transition between steady states with different investor protection, stock market size converges monotonically. Income inequality may instead converge along an oscillatory path, as a consequence of the dynamics of prices and capital.

5 EMPIRICAL EVIDENCE

The model developed through sections 2 and 3 generates three main results. (1) Stock markets are more developed, the better is investor protection. (2) Income inequality has an inverted-U shaped relationship with stock market size, both in (a) absolute terms and (b) relative to GDP. (3) Investor protection only affects income inequality through stock market size. Here, I empirically assess all the results by applying a series of cross-section and panel data methodologies. The section is structured as follows: I first present the cross-sectional and panel data techniques to be used, then the data, and finally report and comment on all the results.

5.1 ESTIMATION STRATEGIES

5.1.1 Cross-section

To test the predictions of the model, I estimate the following static equation:

$$g_{i(t-k,t)} = \alpha + \beta \mathbf{x}_{i(t-k,t)} + \gamma_1 smdev_{i(t-k,t)} + \gamma_2 (smdev_{i(t-k,t)})^2 + \epsilon_i, \quad (6)$$

where $g_{i(t-k,t)}$ is the Gini coefficient observed in country i over the period between $t - k$ and t , the terms in $\mathbf{x}_{i(t-k,t)}$ are additional explanatory variables, and $smdev_{i(t-k,t)}$ is the measure of stock market development. All variables are expressed in logarithm. To test both versions of result (2), I use two proxies for $smdev$: the ratios of stock market capitalization over GDP ($smcap$) and over credit to the private sector ($smpr$). The second variable measures the weight of equity finance over the total external finance (broadly, equity plus debt). It has also been used in the literature to proxy the overall degree of risk-sharing that

can be achieved through the financial market. I select the regressors in $\mathbf{x}_{i(t-k,t)}$ so as to match the technology and skill parameters of the model with observable counterparts, and to control for factors commonly given attention in the empirical literature on inequality. $\mathbf{x}_{i(t-k,t)}$ includes time $t - k$ GDP and GDP squared to account for technology and the Kuznets hypothesis. I take two measures of the initial education attainment to proxy both the level and the dispersion of human capital. In particular, I use the share of the population aged above 25, with some secondary education (*sec25*), and the Gini coefficient for the years of education in the population aged above 15 (*gh_15*). I control for government expenditure and trade openness to check the robustness of the results, and replace $g_{i(t-k,t)}$ with g_{it} for sensitivity analysis. Result (2) is confirmed by the data if $\hat{\gamma}_1 > 0$ and $\hat{\gamma}_2 < 0$. Notice, however, that g in the model may start to decline with *smdev* at high levels of stock market development that are rarely observed. As a consequence, the significance of $\hat{\gamma}_2$ might be weak in the data.

Equation (6) only captures the main result (2) of the paper (the inverted-U shaped relationship between stock market development and income inequality). To account for the intermediate link between investor protection and the size of the stock market (results (1) and (3)), I also estimate equation (6) by Two-Stages Least Squares, using a number of investor protection indicators as instruments for $smdev_{i(t-k,t)}$:

$$\begin{aligned} g_{i(t-k,t)} &= \alpha + \beta \mathbf{x}_{i(t-k,t)} + \gamma_1 smdev_{i(t-k,t)} + \gamma_2 (smdev_{i(t-k,t)})^2 + e_i \\ smdev_{i(t-k,t)} &= \zeta + \xi \mathbf{ip}_{i(t-k,t)} + u_i. \end{aligned}$$

I adopt two alternative sets of instruments, $\mathbf{ip}_{i(t-k,t)}$, for stock market development following the analysis in La Porta et al. (LLS, 2003): (i) the indicators of investor protection and efficiency of the judiciary suggested by LLS as determinants of stock market development; (ii) the origin of the legal system which is, in turn, used by LLS to instrument investor protection. The advantages of the second set of instruments are that these are most certainly exogenous and available for a wider cross-section of countries. The IV estimation validates result (1), if $\hat{\xi} > 0$ and the F statistics of the excluded instruments from the first-stage regression is high. Result (3) is supported by the data, if the Sargan test of overidentifying restrictions has a high p-value, excluding correlation between investor protection and the residuals e_i .

5.1.2 Fixed and random effects

To test if the results of the paper hold both across countries and over time, I use the panel data methodology and estimate the following equation:

$$g_{it} = \alpha + \beta' \mathbf{x}_{it} + \gamma_1 smdev_{it} + \gamma_2 (smdev_{it})^2 + \eta_i + \nu_t + \epsilon_{it}, \quad (7)$$

where g_{it} is the Gini coefficient observed in country i over a five-year period t , the terms in \mathbf{x}_{it} and $smdev_{it}$ are the same as for equation (6), and η_i , ν_t and ϵ_{it} are unobservable country- and time-specific effects, and the error term, respectively. I estimate equation (7) under the alternative hypotheses of a random versus fixed idiosyncratic component η_i . Fixed-effects estimates capture the evolution of the relationship within each country over time. Random effects are more efficient, since they exploit all the information available across countries and over time. However, the latter may be inconsistent if country-specific effects are correlated with the residuals. Including time fixed effects in both regressions allows me to account for the presence of trends, such as skill-biased technical change, which drives inequality worldwide. I rely on the Hausman test for the choice between FE and RE, and an F test for the inclusion of time dummies.

5.1.3 Dynamic Panel Data

As a further evaluation of result (2) in a dynamic setting, I follow the approach of the latest studies on growth and inequality, and focus on the expression:

$$g_{it} = \lambda g_{it-1} + \tilde{\beta}' \mathbf{x}_{it} + \tilde{\gamma}_1 smdev_{it} + \tilde{\gamma}_2 (smdev_{it})^2 + \eta_i + \nu_t + \epsilon_{it}. \quad (8)$$

Notice that the specification in equation (8) includes a lagged endogenous variable among the regressors. It immediately follows that, even if ϵ_{it} is not correlated with g_{it-1} , the estimates are not consistent with a finite time span. Moreover, consistency may be undermined by the endogeneity of other explanatory variables, such as income and stock market development. A number of contributions provide theoretical support (see, for instance, Banerjee and Duflo, 2003, Barro, 2000, Benabou, 1997, Forbes, 2003, and Lopez, 2003) and empirical treatments for the simultaneity between growth and inequality. Feedbacks with stock market size instead capture the reaction of capital supply to changes in the income distribution. To correct for the bias created by lagged endogenous variables, and the simultaneity of some regressors, I adopt the approach of Arellano and Bover (1995) and Blundell and Bond (1998).¹⁸ I time-differentiate both sides of (8) to obtain

$$\Delta g_{it} = \lambda \Delta g_{it-1} + \tilde{\beta}' \Delta \mathbf{x}_{it} + \tilde{\gamma}_1 \Delta smdev_{it} + \tilde{\gamma}_2 \Delta (smdev_{it})^2 + \Delta \nu_t + \Delta \epsilon_{it}, \quad (9)$$

¹⁸The system-DPD methodology dominates the difference-DPD proposed by Arellano and Bond (1991), because it amends problems of measurement error bias and weak instruments, arising from the persistence of the regressors (as pointed out by Bond et al., 2001).

and estimate the system of equations (8) and (9). The differences in the variables that are either endogenous or predetermined can be instrumented with their own lagged values, while lagged differences are instruments for levels. For instance, I use g_{it-3} as an instrument for Δg_{it-1} and $smdev_{it-2}$ for $\Delta smdev_{it}$, as well as Δg_{it-2} and $\Delta smdev_{it-1}$ for g_{it-1} and $smdev_{it}$. The estimation is performed with a two-step System-GMM technique. The moment conditions for the equation in differences are $E[\Delta g_{it-s} (\epsilon_{it} - \epsilon_{it-1})] = 0$ for $s \geq 2$, and – if the explanatory variables y are predetermined – $E[\Delta y_{it-s} (\epsilon_{it} - \epsilon_{it-1})] = 0$ for $s \geq 2$. For equation (8), the additional conditions are $E[\Delta g_{i,t-s} (\eta_i + \varepsilon_{i,t})] = 0$ and $E[\Delta y_{i,t-s} (\eta_i + \varepsilon_{i,t})] = 0$ for $s = 1$. The validity of the instruments is guaranteed under the hypothesis that ϵ_{it} exhibit zero second-order serial correlation. Coefficient estimates are consistent and efficient, if both the moment conditions and the no-serial correlation are satisfied. I can validate the estimated model through a Sargan test of overidentifying restrictions, and a test of second-order serial correlation of the residuals, respectively. As pointed out by Arellano and Bond (1991), the estimates from the first step are more efficient, while the test statistics from the second step are more robust. Therefore, I will report coefficients and statistics from the first and second step, respectively.

5.2 DATA

I use two cross-sections and two unbalanced panel datasets. The cross-section includes observations for 69 countries for the period 1980-2000. The sample shrinks to 43 observations when I account for investor protection and efficiency of the judiciary in the regressions, since these variables are only available for 49 countries, some of which do not intersect with the wider dataset. The main panel consists of 157 non-overlapping five-year observations, at least two for each of 52 countries, over the period 1976-2000. Since 16 countries have less than the three subsequent observations needed for the Arellano and Bover (1995) estimation, I use the full dataset only for the static panel regressions. I perform the dynamic panel GMM, as well as further static regressions, on a restricted sample of 125 observations for 36 countries over the same time span.

As a measure of income inequality, I take the Gini coefficients from Dollar and Kraay’s (2002) database on inequality which 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).¹⁹

¹⁹The 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). 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

Data on stock market capitalization (*smcap*) as a ratio of GDP and credit to the private sector (*privo*) on GDP come from the database of Beck et al. on Financial Development and Structure, which expands the data used in Beck et al. (1999). Their ratio is $smpr \equiv \frac{smcap}{privo}$.

The series for real per capita GDP, government expenditure and trade as a share of GDP are taken from Heston and Summers' version 6.1 of the Penn World Tables. Throughout the estimations, real per capita GDP is expressed as a ratio of the first observation for US GDP (1980 in the cross-section, 1976 in the panel).

I use two measures of human capital. The first is the percentage of people older than 25 years who have completed or are enrolled in secondary education (*sec25*). Data are taken from Barro and Lee's (2000) database. The second measure, better suited to capture the distribution of human capital, is the Gini coefficient of school years (*gh_15*) constructed by Castellò and Doménech (2002) on data from Barro and Lee (2000).

The indicators of investor protection and efficiency of the judiciary come from LLS(2003). Both *investor_pr* and *eff_jud* are indexes scaling from 0 to 10 in ascending order of protection and efficiency. See LLS (2003) for a detailed description.

The data on legal origins are taken from the World Development Indicators.

5.3 RESULTS

5.3.1 Cross-sectional regressions

Table 2 reports the Ordinary Least Squares estimates for different versions of equation (6). Columns 1-10 suggest human capital and stock market development to be the major forces driving income inequality over the sample of 69 countries. As predicted by the model, $\hat{\gamma}_1$ is positive and significant for both stock market capitalization and its ratio to private credit, while $\hat{\gamma}_2$ is negative, though only significant for *smpr*. Notice that, according to these estimates, stock market development should start reducing inequality after reaching levels so high that five countries at most would be on the declining part of the *Gini(smcap)* schedule, and nine in the case of *Gini(smpr)*. Thus, it seems that only very few countries have reached the point where the relationship between stock market size and inequality becomes negative. This may explain the low statistical significance for $\hat{\gamma}_2$. Moreover, the model predicts that inequality should never completely revert, even when the stock market achieves its maximum development; hence, it is reasonable to expect the linear term to be generally more relevant, as is the case in Table 2.

The significantly negative coefficients on *sec25* through columns 1-4 and 9-10, in line

more complicated way to account for the variety of sources; see Dollar and Kraay (2002) for details.

with most empirical evidence, mean that inequality tends to be lower, the larger is the share of the population with high education. The positive and significant estimates for gh_15 in columns 5-8 show that the dispersion of human capital boosts income inequality. However, the coefficients for $sec25$ and gh_15 jointly estimated (Columns 9-10) suggest that the former is more effective at reducing inequality than the latter is at raising it. Given that $sec25$ dominates gh_15 , I will henceforth report the results obtained with $sec25$ only. Finally, for the Kuznets hypothesis to hold, the estimated coefficients of GDP and $(GDP)^2$ should be positive and negative, respectively. The results in Table 2 do not allow me to validate this hypothesis, due to the lack of significance of both coefficients.

To get a quantitative flavor of the implications of columns 2 and 4, take pairs of countries with similar human capital (the other main determinant of inequality) but different stock market development, and compare the actual Gini differentials with their predicted values. Ecuador and Bolivia, for instance, had roughly the same school attainment (23.6 and 23 per cent of the population aged above 25 with secondary education), while stock market capitalization over GDP was 2.5 times larger in Ecuador. Column 2 would predict a lower Gini coefficient in Bolivia, with a three per cent difference: very close to the actual 3.1 per cent. Consider also Austria, which had the same level of secondary school attainment as Switzerland (65.1 vs 65.3), but a much less developed stock market ($smpr$ was seven times smaller). Its predicted Gini (from the estimates in column 4) is lower than the Swiss by 19.1 vs the actual 19.7 per cent.

The results in Table 2 support the main prediction of the model on the relationship between stock market development and income inequality, but cannot provide evidence on the mechanism generating it, starting from investor protection. To ascertain that investor protection does not affect income inequality unless through stock market development, I first regress the Gini coefficient on the control variables in x and LLS's indicator of investor protection, and then add $smdev$. Table 3 shows that $investor_pr$ indeed has a positive and significant effect on income inequality. However, the coefficients in columns 2 and 3 suggest that this effect is absorbed by stock market development, once controlled for. Moreover, columns 3 and 5 support the hypothesis that investor protection has no effect on inequality, unless paired by a thicker stock market. These results suggest that investor protection only affects income inequality through the development of equity markets.

The instrumental variables estimates reported in Tables 4 and 5 are meant to explicitly account for the intermediate step linking stock market development to the degree of investor protection. Estimating the first step of the IV regressions allows me to partially replicate the analysis in LLS (2003) to verify the predictive power of investor protection and efficiency of the judiciary on both indicators of stock market development. The coeffi-

coefficients in columns 1 and 4 of Table 5 confirm that better contractual protection boost stock market development, relative to the size of the economy and the overall financial depth. Since these variables can be suspected to be endogenous, I replace them with legal origins when estimating the first stage for *smcap* and *smpr*. Columns 1 and 3 confirm the results in LLS (2003) that the common law (UK) legal origin strongly promoted the development of stock markets. The results from only including the instrumented linear term of *smdev* in the regression for the Gini's (odd columns of Table 4) strongly support the prediction $\gamma_1 > 0$. P-values of the F and Sargan tests guarantee that both sets of instruments are valid. In other words, investor protection is a good predictor for *smdev* (result 1), but only affects inequality through stock market development (result 3). Estimating the equation with both linear and quadratic instrumented *smdev*, delivers a worse fit and insignificant coefficients for almost all covariates (also sec 25 loses significance in one case). However, the coefficient estimates from the first step suggest the existence of collinearity between the two sets of instruments, which undermines the validity of this specification.

So far, I have regressed average Gini coefficients on average stock market development. To verify if the results are sensitive to the timing of observations, the estimates of Tables 2 and 4 are replicated in two alternative ways. First, I replace the average Gini with its latest available observation and keep the regressors as in the previous estimates. The results are reported in Table 6. As a further check, I focus on the period 1985-2000 and regress the average Gini on the initial values of *smcap* and *smpr*. In this case, I do not need to perform instrumental variables estimations. As shown by Table 6b, one third of the observations gets lost. This can partly motivate the insignificance of γ_2 , since a relevant part of the countries on the right-hand side of the hump is missing. Overall, this evidence favors the existence of a positive γ_1 , and a weaker negative γ_2 .

Finally, the robustness of the results is tested in Table 7, which reports the estimates of equation (7) where government expenditure and trade (as a ratio of GDP) are added as additional covariates. There are no major changes from Tables 2 and 4, and the additional coefficients are not significantly different from zero.

5.3.2 Panel regressions

Columns 1 and 2 in Table 8 report the coefficients of equation (7) estimated with fixed and random effects, respectively. Stock market development significantly affects income inequality, following a humped-shaped relation as predicted by the model. Four observations lay on the downward sloping part of the hump: Hong Kong and Malaysia in the period 1991-2000. When I control for time fixed effects, the significance of the quadratic term in stock market capitalization is weakened, while the positive linear relationship re-

mains strong, as shown in columns 3 and 4. Education turns out to be negatively related to inequality throughout all estimations, consistently with most of the empirical literature. The Kuznets hypothesis is not validated by the results in Table 8. The results for the stock market as a ratio of private credit in the last two columns of Table 8 confirm the existence of a positive γ_1 , but do not provide strong support for $\gamma_2 < 0$. In conclusion, the static panel analysis suggests that stock market development plays as important a role as education in shaping income distribution.

The regression in column 3 of Table 8 to some extent controls for the time variation in the relationship between changes in stock market development and income inequality within countries and across time. However, it does not account for the existence of dynamic feedbacks between inequality and stock market development. To overcome these methodological limitations, I adopt the approach of Arellano and Bover (1995) and Blundell and Bond (1998), and estimate various versions of system (8)-(9).

The results in Table 9 confirm the existence of a significant positive linear relationship between the Gini and stock market development. The quadratic term is also significant and exhibits the expected negative sign, in the estimates for *smpr*. The positive γ_1 survives the inclusion of time, as well as time-continent effects.²⁰ All estimated coefficients for $d\log(Gini_{t-1})$ support the convergence hypothesis for income inequality, as in previous empirical work by Benabou (1996), Lopez (2003) and Ravallion (2002). As in the previous evidence, the Kuznets' hypothesis finds no support and the effectiveness of human capital becomes weaker.

To make the results from dynamic and static panel regressions comparable, I replicated the Fixed and Random Effects estimates on the restricted sample and reported the coefficients in Table 10. The linear term for stock market development still has a positive and significant effect throughout all estimates, while the $\hat{\gamma}_2$ are non-significantly different from zero in all specifications.

As a robustness check, I re-estimate the equations in Tables 9-10 with government expenditure and trade over GDP as additional regressors. Table 11 reports the estimated coefficients for stock market capitalization, both in linear and non-linear terms, and for the new control variables. Both static and dynamic regressions support the prediction of a positive γ_1 , while the negative γ_2 is only significant in the system-GMM for *smpr*. The estimates for government expenditure, which are non-significantly different from zero, reflect the ambiguity of theoretical predictions and previous empirical evidence. The coefficients for trade openness from Fixed Effects regressions point towards a positive effect on inequality, consistently with previous theoretical predictions and empirical evidence

²⁰Results with time-continent effects are available upon request.

(see, for example, Epifani and Gancia, 2002, Feenstra and Gordon, 2001, Robbins, 1996, Spilimbergo et al., 1999). The dynamic panel data estimates support the opposite view, even though to a lesser extent, since the negative coefficients are significant at 8 per cent, at most.

5.3.3 Summary

The estimates reported in this section suggest that stock market development tends to raise income inequality. The declining part of the hump predicted by the model is supported in a less robust way by the data. This evidence can be reconciled with the model, since the peak of the Gini coefficient may only occur at such high levels of stock market development that are not observed in the sample. Dynamic Panel Data estimates suggest the relationship between stock market development and income inequality to hold in the long run, as predicted by the general equilibrium version of the model. Results from the cross-sectional regressions confirm the prediction that investor protection only affects income inequality through the development of the equity market.

6 CONCLUSIONS

This paper provides theoretical predictions and empirical support for a systematic relationship between investor protection, financial development and income inequality. I develop an overlapping generation model with risk-averse agents, heterogeneous in their ability, where production can take place with a safe or a risky technology. In the presence of financial frictions, arising from the non-observability of realizations and imperfect investor protection, I study the occupational and financial choices for different ability groups. Better investor protection promotes financial development and affects income inequality in a number of ways. First, it improves risk sharing, thereby reducing income volatility for a given size of the risky sector. Second, it raises the share of population exposed to earning risk. Finally, since ability affects risky payoffs, it increases the overall reward to ability. The first effect tends to reduce inequality, while the other two boost it. The main result of the paper is that income dispersion increases at first with financial development, and then declines. In the empirical section, I provide evidence consistent with the predictions of the model.

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A PROOFS

Lemma 1

The assumptions that $A > B + r$ and $\varphi A < B + r$ together with continuity of V_i in π_i imply the existence of a unique point $\pi^* \in (0, 1)$ where $V^* = B$. From this, it follows that for $\pi_i = 1$, $(1 - \theta_i^h) A = (A - r) > Bx$, hence $V_i = v[(1 - \theta_i^h) A, r] > v(B, r)$, and for $\pi_i = 0$, $(1 - \theta_i^l) \varphi A = \varphi A - r < B$, thus $V_i = v[(1 - \theta_i^l) \varphi A, r] < v(B, r)$. To prove that π^* is a threshold, I just need to show that V_i is increasing in π_i . The derivative of V_i w. r. t. π_i under the optimal equity contract is

$$\frac{dV_i}{d\pi_i} = v\left[(1 - \theta_i^h) A, r\right] - v\left[(1 - \theta_i^l) \varphi A, r\right] + [\pi_i v'_h + (1 - \pi_i) v'_l] pA > 0.$$

Therefore, $\forall \pi_i \geq \pi^*$, $\pi_i v[(1 - \theta_i^h) A, r] + (1 - \pi_i) v[(1 - \theta_i^l) \varphi A, r] \geq v(B, r)$.

Lemma 2

To prove that the threshold ability is decreasing in investor protection, I obtain the derivative of π^* with respect to p ,

$$\frac{d\pi^*}{dp} = -\frac{dV}{dp} \left(\frac{dV}{d\pi}\right)^{-1},$$

and show that it is negative. I have derived $\frac{dV}{d\pi^*} > 0$ in the proof of Lemma 1. I just need to derive

$$\frac{dV}{dp} = \pi_i (1 - \pi_i) (1 - \varphi) A (v'_l - v'_h).$$

Notice that $\frac{dV}{dp} > 0$ for any π , since utility is concave. It follows that $\frac{d\pi^*}{dp} < 0$.

To prove that the threshold is convex in investor protection, I need to prove that $\frac{d^2\pi^*}{(dp)^2} > 0$.

$$\begin{aligned} \frac{d^2\pi^*}{(dp)^2} &= \frac{\frac{d^2V}{d\pi dp} \frac{dV}{dp} - \frac{d^2V}{(dp)^2} \frac{dV}{d\pi}}{\left(\frac{dV}{d\pi}\right)^2} \\ &= -\left(\frac{dV}{d\pi}\right)^{-1} \left\{ \pi^* (1 - \pi^*) A (v'_l - v'_h) + A [\pi^* v'_h + (1 - \pi^*) v'_l] \right. \\ &\quad \left. - pA^2 \pi^* (1 - \pi^*) (1 - \varphi) (v''_l - v''_h) \right\} \frac{d\pi^*}{dp} \\ &\quad - \left(\frac{dV}{d\pi}\right)^{-1} \left\{ A^2 (1 - \varphi)^2 \pi^* (1 - \pi^*) [\pi^* v''_h + (1 - \pi^*) v''_l] \right\}. \end{aligned}$$

All terms divided by $\frac{dV}{d\pi}$ are positive, since the CRRA specification of the utility function implies that $v'_l > v'_h$ and $v''_l < v''_h$, and $\frac{d\pi^*}{dp} \leq 0$. Therefore, $\frac{d^2\pi^*}{(dp)^2} = -(> 0)^{-1} \{(\geq 0) +$

$(> 0) - (\leq 0) \} (\leq 0) - (> 0)^{-1} \{ < 0 \} > 0$.

Proposition 1

To prove the increasing monotonicity of stock market size, and its concavity at high levels of investor protection, I derive

$$\begin{aligned} \frac{dsm}{dp} &= -g(\pi^*) \frac{d\pi^*}{dp} \\ \frac{d^2 sm}{(dp)^2} &= -g'(\pi^*) \left(\frac{d\pi^*}{dp} \right)^2 - g(\pi^*) \frac{d^2 \pi^*}{(dp)^2}. \end{aligned}$$

From Lemma 1, $\frac{d\pi^*}{dp} \leq 0$, that implies $\frac{dsm}{dp} \geq 0$; hence, the stock market size is increasing in investor protection. From Lemma 2, $\frac{d^2 \pi^*}{(dp)^2} > 0$. Moreover, $\lim_{p \rightarrow 1} \frac{d\pi^*}{dp} = \lim_{p \rightarrow 1} \left(\frac{dV}{dp} / \frac{dV}{d\pi} \right) = \lim_{p \rightarrow 1} \frac{\pi(1-\pi)(1-\varphi)[v'(w^l, r) - v'(w^h, r)]}{v(w^h, r) - v(w^l, r) + [\pi v'(w^h, r) + (1-\pi)v'(w^l, r)]pA} = 0$. It follows that sm is concave in p in a neighborhood of $p = 1$, since $\lim_{p \rightarrow 1} \frac{d^2 sm}{(dp)^2} < 0$.

Corollary 1

Re-write $Y = C = \frac{1+r+\beta}{1+\beta} \left\{ G(\pi^*) B + \int_{\pi^*}^1 [\pi + (1-\pi)\varphi] A - r \right\} g(\pi) d\pi$. The first derivative of $\frac{sm}{Y}$ w.r.t. p is

$$\begin{aligned} \frac{d \frac{sm}{Y}}{dp} &= -\frac{d\pi^*}{dp} \frac{g(\pi^*)}{Y^2} \frac{1+r+\beta}{1+\beta} \left\{ A \int_{\pi^*}^1 [\pi + (1-\pi)\varphi] d\pi \right. \\ &\quad \left. + B - A[1 - G(\pi^*)][\pi^* + (1-\pi^*)\varphi] \right\}. \end{aligned}$$

Stock market as a ratio of GDP is increasing in investor protection, $\frac{d \frac{sm}{Y}}{dp} \geq 0$ for any $p \in [0, 1]$, since $\frac{d\pi^*}{dp} \leq 0$ and the term in brackets is always positive. To prove concavity of $\frac{sm}{Y}$ in a neighborhood of $p = 1$, I derive

$$\begin{aligned} \frac{d^2 \frac{sm}{Y}}{(dp)^2} &= -\frac{d^2 \pi^*}{(dp)^2} \frac{g(\pi^*)}{Y^2} \frac{1+r+\beta}{1+\beta} - \left(\frac{d\pi^*}{dp} \right)^2 \frac{1+r+\beta}{1+\beta} \left\{ \frac{g'(\pi^*)}{Y^2} \Psi \right. \\ &\quad \left. + 2 \frac{g(\pi^*)}{Y^3} \frac{dY}{d\pi^*} \Psi + \frac{g(\pi^*)}{Y^2} A [1 - g(\pi^*)][\pi^* + (1-\pi^*)\varphi] \right. \\ &\quad \left. + (1-\varphi)[1 - G(\pi^*)] \right\}, \\ \Psi &\equiv A \int_{\pi^*}^1 [\pi + (1-\pi)\varphi] d\pi + B - A [1 - G(\pi^*)][\pi^* + (1-\pi^*)\varphi]. \end{aligned}$$

As $\lim_{p \rightarrow 1} \frac{d\pi^*}{dp} = 0$, while $\frac{d^2 \pi^*}{(dp)^2} > 0$ at any p , $\lim_{p \rightarrow 1} \frac{d^2 \frac{sm}{Y}}{(dp)^2} < 0$.

Lemma 3

To prove non monotonicity, I differentiate $Var(w)$ with respect to p :

$$\begin{aligned}
\frac{dVar(w)}{dp} &= \frac{d\pi^*}{dp} \left\{ g(\pi^*) [B - E(w)]^2 - 2G(\pi^*) [B - E(w)] \frac{dE(w)}{d\pi^*} \right\} \\
&\quad - \frac{d\pi^*}{dp} g(\pi^*) \left\{ \pi^* [w^h(\pi^*) - E(w)]^2 + (1 - \pi^*) [w^l(\pi^*) - E(w)]^2 \right\} \\
&\quad + \frac{d\pi^*}{dp} \frac{dE(w)}{d\pi^*} 2 \int_{\pi^*}^1 \left\{ \pi [w^h - E(w)] + (1 - \pi) [w^l - E(w)] \right\} g(\pi) d\pi \\
&\quad + 2 \int_{\pi^*}^1 \left\{ \pi \frac{dw^h}{dp} [w^h - E(w)] + (1 - \pi) \frac{dw^l}{dp} [w^l - E(w)] \right\} g(\pi) d\pi \\
&= \frac{d\pi^*}{dp} g(\pi^*) \left\{ [B - E(w)]^2 - \pi^* [w^h(\pi^*) - E(w)]^2 \right. \\
&\quad \left. - (1 - \pi^*) [w^l(\pi^*) - E(w)]^2 \right\} \\
&\quad - 2(1 - \varphi) A \int_{\pi^*}^1 \pi(1 - \pi) (w^h - w^l) g(\pi) d\pi.
\end{aligned}$$

Notice that the term in the first two lines represents the market size effect and is positive for all p , while the last line accounts for the risk sharing effect and is negative for all p .

For $p \rightarrow 0$, $\pi^* \rightarrow 1$, $E(w) \rightarrow B$, $w^h \rightarrow A - r$, $w^l \rightarrow \varphi A - r$. Therefore,

$$\lim_{p \rightarrow 0} \frac{dVar(w)}{dp} = -\frac{d\pi^*}{dp} g(1) (A - B - r)^2 > 0.$$

For $p \rightarrow 1$, $\pi^* \rightarrow \pi_{p=1}^* = \frac{(B - \varphi A) + r}{(1 - \varphi)A}$, $w^h(\pi^*) - w^l(\pi^*) \rightarrow 0$, $w^h(\pi_{p=1}^*) \rightarrow w^l(\pi_{p=1}^*) = [\pi_{p=1}^* + (1 - \pi_{p=1}^*)\varphi]A - r = B$, $\frac{d\pi^*}{dp} \rightarrow 0$. I study how $\frac{dVar(w)}{dp}$ approaches zero in a left neighborhood of $p = 1$ by means of Taylor's first-order approximation. Notice that

$$\begin{aligned}
\frac{d^2Var(w)}{(dp)^2} &= \left[\frac{d^2\pi^*}{(dp)^2} g(\pi^*) + \left(\frac{d\pi^*}{dp} \right)^2 g'(\pi^*) \right] \left\{ [B - E(w)]^2 \right. \\
&\quad \left. - \pi^* [w^h(\pi^*) - E(w)]^2 - (1 - \pi^*) [w^l(\pi^*) - E(w)]^2 \right\} \\
&\quad + \frac{d\pi^*}{dp} g(\pi^*) \left\{ 2 \frac{d\pi^*}{dp} \frac{dE(w)}{d\pi^*} \{ [\pi^* + (1 - \pi^*)\varphi]A - r - B \} \right. \\
&\quad \left. + 2\pi^*(1 - \pi^*)(1 - \varphi)^2 A^2 - \frac{d\pi^*}{dp} \left\{ [w^h(\pi^*) - E(w)]^2 \right. \right. \\
&\quad \left. \left. - [w^l(\pi^*) - E(w)]^2 \right\} + 2(1 - \varphi)^2 A^2 \int_{\pi_{p=1}^*}^1 \pi(1 - \pi) g(\pi) d\pi. \right.
\end{aligned}$$

It follows that, in a neighborhood to the left of $p = 1$,

$$\frac{dVar(w)}{dp} = 2(p-1)(1-\varphi)^2 A^2 \int_{\pi_{p=1}^*}^1 \pi(1-\pi)g(\pi)d\pi < 0.$$

Proposition 2

Recall from Proposition 1 that sm is increasing in p . I characterize the relationship between stock market size and the variance of earnings by studying

$$\begin{aligned} \frac{dVar(w)}{dsm} &= \frac{dVar(w)}{dp} \left(\frac{dsm}{dp} \right)^{-1} \\ &= -[B - E(w)]^2 + (1 - \pi^*) [w^l(\pi^*) - E(w)]^2 \\ &\quad + \pi^* [w^h(\pi^*) - E(w)]^2 + \left[\frac{d\pi^*}{dp} g(\pi^*) \right]^{-1} \times \\ &\quad 2(1 - \varphi)^2 A^2 (1 - p) \int_{\pi^*}^1 \pi(1 - \pi)g(\pi)d\pi \end{aligned}$$

For $p \rightarrow 0$, $\pi^* \rightarrow 1$, $E(w) \rightarrow B$, $w^h \rightarrow A - r$, $w^l \rightarrow \varphi A - r$, hence

$$\lim_{p \rightarrow 0} \frac{dVar(w)}{dsm} = (A - B - r)^2 > 0.$$

For $p \rightarrow 1$, $\pi^* \rightarrow \pi_{p=1}^* = \frac{(B-\varphi A)+r}{(1-\varphi)A}$, $w^h(\pi^*) - w^l(\pi^*) \rightarrow 0$, $w^h(\pi_{p=1}^*) \rightarrow w^l(\pi_{p=1}^*) = [\pi_{p=1}^* + (1 - \pi_{p=1}^*)]A - r = B$, and $\frac{d\pi^*}{dp} \rightarrow 0$. It thus follows that

$$\begin{aligned} \lim_{p \rightarrow 1} \frac{dVar(w)}{dsm(p)} &= \lim_{p \rightarrow 1} \frac{\frac{d}{dp} \left[2(1 - \varphi)^2 A^2 (1 - p) \int_{\pi^*}^1 \pi(1 - \pi)g(\pi)d\pi \right]}{\frac{d}{dp} \left[\frac{d\pi^*}{dp} g(\pi^*) \right]} \\ &= 2 \int_{\pi_{p=1}^*}^1 \pi(1 - \pi)g(\pi)d\pi \frac{v(B) + Av'(B)}{\pi_{p=1}^* (1 - \pi_{p=1}^*) g(\pi_{p=1}^*) v''(B)} < 0, \end{aligned}$$

since $v'' < 0$ for any CRRA utility function.

B CLOSED ECONOMY

B.1 THE DYNAMICS

The dynamics of the closed economy satisfies equations (4) and (5):

$$\pi_t^* v(w_t^h(\pi_t^*), r_{t+1}) + (1 - \pi_t^*) v(w_t^l(\pi_t^*), r_{t+1}) = v(B\chi_t, r_{t+1})$$

$$K_{t+1} = \frac{1}{1+\beta} \{G(\pi_t^*) B \chi_t + A \chi_t \int_{\pi_t^*}^1 [\pi + (1-\pi) \varphi] g(\pi) d\pi - [1 - G(\pi_t^*)] r_t\}.$$

As noticed in section 4, earnings depend on factor prices, which are functions of π_t^* and capital employed in the final sector, $K_{Yt} = K_t - 1 + G(\pi_t^*)$. This implies that the threshold ability π_t^* becomes an implicit function of K_t and the analytical characterization of the dynamic equilibrium becomes awkward. Therefore, I proceed by means of numerical solutions. The main results are displayed in Figures 4-5. In all simulations, I adopt the following parametrization: $A = 120$, $B = 100$, $\alpha = 0.33$, $\beta = 0.17$ (equivalent to a six per cent annual discount for thirty years, i.e. a generation), and G uniform in $[0, 1]$.

Figure 4 describes the dynamics of an economy that starts with a very low capital endowment, K_0 , and an intermediate degree of investor protection, $p = 0.5$. When K_0 is too low ($K_0 < \alpha B / (1 - \alpha)(A - B)$), the interest rate is so high relative to the price of the intermediate good that no young agent chooses the risky technology. Hence, there is no stock market and inequality is zero. As capital is accumulated, the interest rate falls and the price of intermediates rises. When the ratio r/χ becomes low enough, some young agents prefer the risky project and raise capital through equities. This requires a shift of capital out of the final good sector, which in turn tends to raise r and lower χ . As a result, with capital accumulation and an expanding stock market, r/χ falls by less than it would in the absence of the risky technology. Also, a positive stock market size implies that some income inequality arises due to the “market size” effect, as in the model of sections 2-3. Moreover, the ratio between factor prices, r/χ , also affects inequality by changing the earnings differentials between safe and risky entrepreneurs. The lower the ratio, the wider the earnings differentials, the higher inequality (“relative factor prices” effect). This implies that, with endogenous prices, inequality may vary even if stock market size does not. The adjustment of capital and prices continues until the steady state is reached. Decreasing marginal productivity of capital guarantees the existence of the steady state.

Figure 5 shows the adjustment after a policy change that increases investor protection from $p = 0$ to $p = 0.05$, starting from the steady state. Due to the convexity of π_t^* in p , the risky intermediate sector expands remarkably in response to the policy change. The marginal productivity of capital rises sharply both because some capital is shifted to the risky sector and because the production of intermediates increases. This causes an overshooting of the interest rate, that gradually declines with capital accumulation to its new (higher) steady state level. Inequality immediately jumps up and oscillates around its new (higher) steady state level until capital and prices are stable.

If the policy change occurs at high levels of investor protection, the effect on produc-

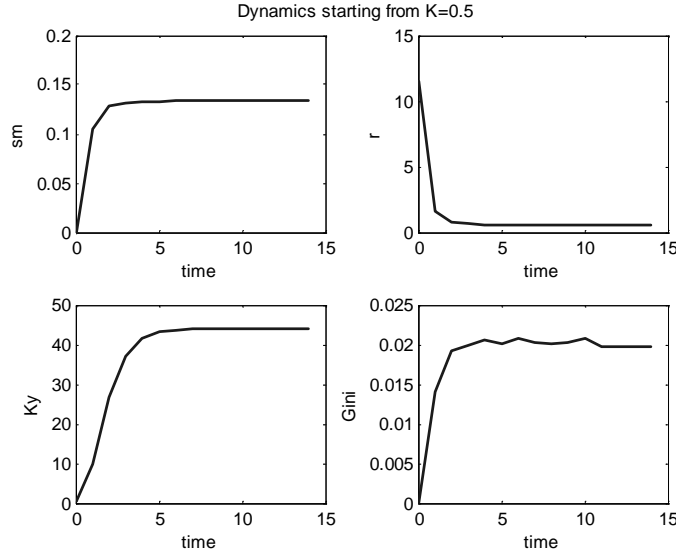


Figure 4: Dynamics from a low initial capital endowment ($K=0.5$) to the steady state, given $p=0.5$.

tivity of factors (hence prices) is weaker. An increase in p induces a small shift of capital from the final to the risky intermediate sector, and has almost no effect on the interest rate. Inequality falls, since the “risk sharing” effect outweighs the “market size” effect at high levels of investor protection.

B.2 THE STEADY STATE

In the steady state, $K_{t+1} = K_t = K$ and $\pi_{t+1}^* = \pi_t^* = \pi^*$. The equilibrium is the solution to the system:

$$\begin{aligned}
 VV &\equiv \pi^* v(w^h(\pi^*), r) + (1 - \pi^*) v(w^l(\pi^*), r) - v(B\chi, r) = 0 \\
 KK &\equiv (1 + \beta) K - G(\pi^*) B\chi - \int_{\pi^*}^1 [\pi w^h(\pi) + (1 - \pi) w^l(\pi)] g(\pi) d\pi = 0.
 \end{aligned}$$

The risky intermediate sector is active, at least in the presence of perfect investor protection, provided that $A - B > \left(\frac{1+\beta}{1-\alpha}\right)^{\frac{1}{1-\alpha}} \frac{\alpha}{1-\alpha}$. Comparative statics for p in the steady state are depicted in Figure 6 showing that Lemmas 1-3 and Propositions 1-2 continue to hold in the closed economy. In fact, the “relative factor prices” effect, that affects inequality along the dynamics, is irrelevant in the steady state. Therefore, the comparative statics on investor protection is driven by the “market size” and “risk sharing” effects only, as in the small open economy.

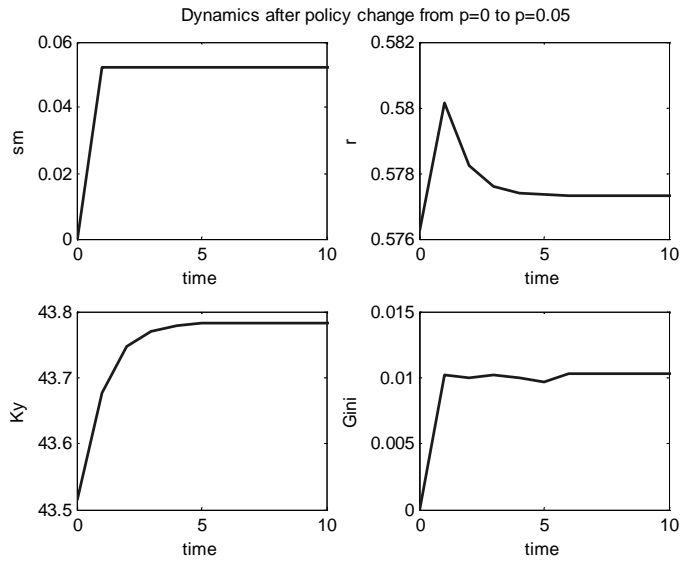


Figure 5: Dynamic adjustment after a policy change from $p=0$ to $p=0.05$.

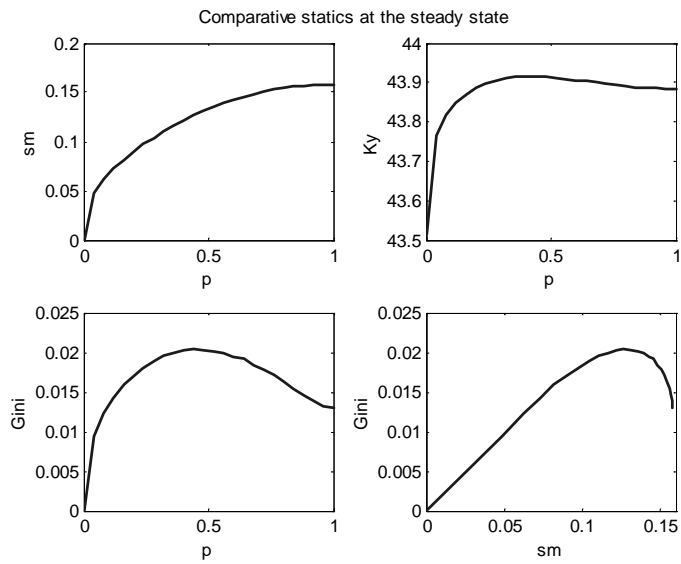


Figure 6: Comparative statics for investor protection in the steady state.

Table A
Countries and Samples

Country	CL	CS	PL	PS	Country	CL	CS	PL	PS
Australia	y	y	y	y	Kenya	y	y		
Austria	y				Korea	y	y	y	y
Bangladesh	y		y	y	Malaysia	y	y	y	y
Barbados	y				Mauritius	y		y	
Belgium	y	y	y		Mexico	y	y	y	y
Bolivia	y				Nepal	y			
Botswana	y				Netherlands	y	y	y	y
Bulgaria			y		New Zealand	y	y	y	y
Brazil	y	y	y	y	Norway	y	y	y	y
Canada	y	y	y	y	Pakistan	y	y	y	y
Chile	y	y	y		Panama	y			
China	y		y		Paraguay	y			
Colombia	y	y	y		Peru	y	y	y	y
Costa Rica	y		y	y	Philippines	y	y	y	
Denmark	y	y	y	y	Poland	y		y	y
Ecuador	y	y	y		Portugal	y	y	y	
Egypt	y	y	y		Romania	y			
El Salvador	y				Russia			y	y
Finland	y	y	y	y	Singapore	y	y	y	y
France	y	y	y	y	Slovak Republic			y	
Germany	y	y	y	y	South Africa	y	y		
Ghana	y		y	y	Spain	y	y	y	y
Greece	y		y		Sri Lanka	y	y	y	y
Guatemala	y				Sweden	y	y	y	y
Honduras	y				Switzerland	y			
Hong Kong	y	y	y	y	Taiwan	y	y	y	y
Hungary	y		y		Thailand	y	y	y	y
India	y	y	y	y	Trinidad and Tobago	y		y	y
Indonesia	y	y	y	y	Tunisia	y		y	
Iran	y				Turkey	y	y	y	
Ireland	y				United Kingdom	y	y	y	y
Israel	y	y			United States	y	y	y	y
Italy	y	y	y	y	Uruguay	y	y		
Jamaica	y		y		Venezuela	y	y	y	y
Japan	y	y	y	y	Zambia	y			
Jordan	y	y	y	y	Zimbabwe	y	y		

Note: C and P stand for cross-sectional and panel datasets, respectively.
L and S for large and small samples.

Table 2. Stock market development and income inequality

cross-section - 1980-2000										
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
<i>smcap</i>	.110 (.030)	.192 (.085)			.098 (.029)	.125 (.09)			.104 (.033)	
<i>smcap</i> ²		-.093 (.097)				-.031 (.095)				
<i>smpr</i>			.073 (.033)	.179 (.055)			.067 (.034)	.186 (.059)		.068 (.034)
<i>smpr</i> ²				-.083 (.048)				-.091 (.049)		
sec25	-.214 (.057)	-.233 (.059)	-.191 (.053)	-.199 (.052)					-.156 (.091)	-.128 (.092)
<i>gh_15</i>					.158 (.057)	.164 (.058)	.151 (.06)	.179 (.064)	.052 (.089)	.063 (.095)
<i>GDP</i>	-.159 (.128)	-.169 (.128)	-.053 (.141)	-.085 (.139)	-.075 (.134)	-.073 (.135)	.054 (.145)	.013 (.143)	-.137 (.136)	-.025 (.150)
<i>GDP</i> ²	.175 (.183)	.188 (.187)	.084 (.204)	.117 (.201)	-.022 (.18)	-.025 (.181)	-.126 (.198)	-.079 (.192)	.124 (.198)	.026 (.216)
R ²	.550	.554	.546	.575	.519	.520	.521	.554	.543	.538
Obs	69	69	68	68	68	68	67	67	68	67

The dependent variable is the average Gini coefficient between 1980 and 2000. GDP and education are the initial values, stock market development is the average. All regressions include a dummy for Latin America. Coefficients are estimated with Ordinary Least Squares. Robust standard errors within parenthesis, 5% and 10% significant coefficients in bold and italics, respectively.

Table 3. Stock market size, investor protection and income inequality

cross-section - 1980-2000					
	OLS	OLS	OLS	OLS	OLS
<i>investor_pr</i>	.006 (.003)	.003 (.003)	-.001 (.004)	-.0001 (.004)	-.007 (.004)
<i>smcap</i>		.070 (.042)			
<i>smpr</i>				.121 (.041)	
<i>smcap * investor_pr</i>			.012 (.064)		
<i>smpr * investor_pr</i>					.018 (.005)
sec25	-.174 (.065)	-.156 (.061)	-.141 (.059)	-.174 (.063)	-.145 (.057)
<i>GDP</i>	-.086 (.258)	.035 (.128)	.031 (.121)	-.203 (.216)	.031 (.118)
<i>GDP</i> ²	.053 (.368)	-.008 (.017)	-.008 (.018)	.229 (.317)	-.007 (.018)
R ²	.512	.548	.565	.629	.637
Obs	43	43	43	42	42

The dependent variable is the average Gini coefficient between 1980 and 2000. GDP and education are the initial values, stock market development is the average. All regressions include a dummy for Latin America. Coefficients are estimated with Ordinary Least Squares. Robust standard errors within parenthesis, 5% and 10% significant coefficients in bold and italics, respectively.

Table 4. Stock market development and income inequality

	IV - cross-section - 1980-2000							
	IV 1	IV 1	IV 1	IV 1	IV 2	IV 2	IV 2	IV 2
<i>smcap</i>	.238 (.085)	1.246 (.873)			<i>.090</i> (.05)	<i>.281</i> (.487)		
<i>smcap</i> ²		-1.158 (.993)				- <i>.213</i> (.492)		
<i>smpr</i>			<i>.142</i> (.047)	<i>.205</i> (.441)			.097 (.048)	- <i>.039</i> (.217)
<i>smpr</i> ²				- <i>.057</i> (.401)				<i>.109</i> (.186)
<i>sec25</i>	- .236 (.07)	- .462 (.218)	- .191 (.064)	- .197 (.075)	- .168 (.069)	- <i>.221</i> (.152)	- .167 (.066)	- .148 (.070)
R ²	.429	-.228	.465	.505	.555	.509	.623	.639
Obs	69	69	68	68	43	43	42	42
<i>F - Test</i> (<i>p-value</i>)	4.22 (.009)	4.22 (.009)	5.91 (.001)	5.91 (.001)	19.20 (.000)	14.48 (.000)	11.44 (.000)	6.85 (.000)
<i>S arg an</i>	.203	.751	.249	.084	.305	.485	.278	.411

The dependent variable is the Gini coefficient between 1980 and 2000, the regressors are initial GDP, GDP² and sec25, and the period average stock market development. Coefficients are 2SLS estimates, stock market development instrumented with [uk, ge, fr legal origins] and [investor_pr, eff_jud, (*investor_pr*)², (*eff_jud*)²] respectively in IV 1 and IV 2. Standard errors within parenthesis, 5% and 10% significant coefficients in bold and italics, respectively. P-values are reported for the first stage F-test and for the Sargan test of overidentifying restrictions. Latin America dummy included in all equations.

Table 5. Investor protection and stockmarket development

OLS - cross-section - 1980-2000				
	<i>smcap</i>		<i>smp</i>	
	OLS	OLS	OLS	OLS
<i>sec25</i>	.197 (.253)	-.345 (.260)	.196 (.368)	-.222 (.325)
<i>GDP</i>	1.328 (.503)	1.831 (.596)	.115 (.744)	1.007 (.752)
<i>GDP</i> ²	<i>-1.310</i> (.741)	-2.368 (.880)	-.896 (.1.105)	-1.739 (1.116)
<i>Investor_pr</i>		.051 (.010)		.052 (.012)
<i>eff_jud</i>		.046 (.017)		<i>.036</i> (.020)
<i>uk_lo</i>	.189 (.077)		.339 (.112)	
<i>fr_lo</i>	.024 (.085)		.099 (.124)	
<i>ge_lo</i>	.099 (.099)		-.002 (.154)	
R ²	.419	.661	.244	.436
Obs	69	43	68	42

The dependent variable is stock market development between 1980 and 2000. Coefficient estimates from the first stage of columns 1, 5, 3, and 7 of Table 4. Standard errors within parenthesis, 5% and 10% significant coefficients in bold and italics, respectively.

Table 6. Stock market development and income inequality Sensitivity analysis

	1	2	3	4	5	6	7	8
	OLS	OLS	OLS	OLS	IV 1	IV 1	IV 1	IV 1
<i>smcap</i>	.102 (.034)	.064 (.098)			.229 (.085)	1.123 (.848)		
<i>smcap</i> ²		<i>.043</i> (.110)				-.097 (.927)		
<i>smp</i>			<i>.063</i> (.036)	.171 (.061)			.146 (.052)	.266 (.515)
<i>smp</i> ²				-.084 (.055)				-.112 (.471)
R ²	.515	.516	.506	.533	.409	-.213	.401	.477
Obs	66	66	65	65	66	66	65	65
<i>F - test</i> (<i>p-value</i>)					5.14 (.003)	5.14 (.003)	6.09 (.001)	6.09 (.001)
Sargan					.261	.693	.413	.167

The dependent variable is the latest available observation of Gini coefficient after 1985. GDP and education are initial values. Stock market development is 1980-2000 average. Cols 5-8 report 2SLS estimates with stock market development instrumented by [uk, fr, ge legal origins]. Robust standard errors within parenthesis, 5% and 10% significant coefficients in bold and italics, respectively. P-values are reported for the first stage F-test and for the Sargan test. Latin America dummy included in all equations.

Table 6b. Stock market development and income inequality Sensitivity analysis

	OLS	OLS	OLS	OLS
<i>smcap</i>	.148 (.047)	-.033 (.125)		
<i>smcap</i> ²		.304 (.224)		
<i>smpr</i>			.093 (.036)	.044 (.092)
<i>smpr</i> ²				.055 (.117)
R ²	.609	.625	.632	.635
Obs.	44	44	40	40

The dependent variable is the average Gini over 1985-2000. GDP and education are initial values. Stock market development is 1985 value Robust standard errors within parenthesis, 5% and 10% significant coefficients in bold and italics, respectively. Latin America dummy included in all equations.

Table 7. Stock market development and income inequality

Robustness analysis - cross-section - 1980-2000

	OLS	OLS	OLS	OLS	IV 1	IV 1	IV 1	IV 1
<i>smcap</i>	.124 (.036)	.227 (.097)			.293 (.108)	1.273 (.989)		
<i>smcap</i> ²		-.116 (.111)				-1.111 (1.109)		
<i>smpr</i>			.078 (.036)	.195 (.055)			.158 (.055)	.267 (.414)
<i>smpr</i> ²				-.089 (.049)				-.098 (.369)
<i>gov</i>	-.026 (.082)	-.058 (.097)	-.076 (.073)	-.088 (.073)	-.061 (.151)	-.371 (.293)	-.151 (.112)	-.147 (.106)
<i>open</i>	-.029 (.033)	-.028 (.035)	-.005 (.027)	-.015 (.027)	-.085 (.072)	-.073 (.089)	-.023 (.033)	-.028 (.038)
R ²	.557	.564	.551	.584	.379	-.133	.452	.526
Obs	69	69	68	68	69	69	68	68
<i>F - test</i> (<i>p-value</i>)					3.21 (.029)	3.21 (.029)	4.88 (.004)	4.88 (.004)
Sargan					.286	.537	.271	.088

Dependent variable is the average Gini coefficient over 1980-2000. The other control variables are GDP, GDP² and *sec25*. Coefficients in cols IV 1 are 2SLS estimates with stock market development instrumented by [uk, fr, ge legal origins]. Robust standard errors within parenthesis, 5% and 10% significant coefficients respectively in bold and italics. P-values are reported for the first stage F and the Sargan tests

Table 8. Stock market development and income inequality

static panel - 1976-2000

	FE	RE	FE	RE	FE	RE
<i>smcap</i>	.147 (.036)	.132 (.031)	.111 (.041)	.104 (.035)		
<i>smcap</i> ²	-.041 (.016)	-.036 (.015)	-.028 (.018)	-.025 (.016)		
<i>smpr</i>					.029 (.016)	.026 (.005)
<i>smpr</i> ²					-.001 (.016)	
sec25	-.172 (.064)	-.145 (.048)	-.194 (.072)	-.164 (.052)	-.149 (.068)	-.177 (.049)
GDP	-.168 (.105)	-.163 (.068)	-.179 (.106)	-.147 (.071)	-.078 (.119)	-.129 (.106)
GDP ²	.102 (.057)	.087 (.045)	.109 (.058)	.085 (.047)	.088 (.064)	.109 (.048)
R ²	.227	.236	.239	.241	.243	.236
Observations	157	157	157	157	144	144
Hausman Test		.755		.807	.026	.425
Time FE (<i>F-test</i>)	No	No	Yes (.162)	Yes (.182)	No	No

The dependent variable is the Gini coefficient. Sample of 52 (50) countries, non overlapping five-year observations spanning 1976-2000. GDP and sec25 are initial values, *smcap* and *smpr* are average ones. Standard errors in parenthesis, 5% and 10% significant coefficients in bold and italics, respectively. P-values of the Hausman tests are reported below RE estimates. P-values of the F-test for time fixed effects are reported in parenthesis.

Table 9. Stock market development and income inequality

Dynamic Panel Data - 1976-2000								
	<i>GMM</i>	<i>GMM</i>	<i>GMM</i>	<i>GMM</i>	<i>GMM</i>	<i>GMM</i>	<i>GMM</i>	<i>GMM</i>
$d \log(smcap)$.079 (.029)	<i>.058</i> (.030)	.039 (.055)	-.062 (.105)				
$d[\log(smcap)]^2$.048 (.055)	.110 (.066)				
$d \log(smpr)$.062 (.022)	.065 (.022)	.202 (.066)	.158 (.062)
$d[\log(smpr)]^2$							-.121 (.048)	-.075 (.045)
$d \log(sec25)$	-.186 (.139)	-.110 (.106)	-.167 (.136)	-.062 (.105)	-.137 (.104)	-.094 (.088)	-.138 (.93)	-.079 (.077)
$d \log(Gini_{t-1})$.519 (.141)	.615 (.118)	.518 (.139)	.624 (.123)	.596 (.111)	.657 (.089)	.569 (.115)	.649 (.100)
$d \log(GDP)$	-.027 (.179)	.185 (.157)	-.065 (.179)	.087 (.184)	.178 (.189)	<i>.336</i> (.205)	.123 (.178)	.237 (.193)
$d[\log(GDP)]^2$.025 (.225)	-.221 (.218)	.056 (.224)	-.137 (.213)	-.166 (.225)	-.347 (.225)	-.124 (.200)	-.259 (.212)
Sargan	.617	.645	.702	.974	.551	.987	.739	.985
m_2	.940	.908	.774	.622	.344	.868	.363	.770
Observations	84	84	84	84	84	84	84	84
Time FE <i>F-test</i>	No	Yes (.068)	No	Yes (.002)	No	Yes (.153)	No	Yes (.007)

Dependent variable is the log difference of Gini. Sample of 36 (32) countries, non-overlapping 5-year observations spanning 1976-2000. Estimation was performed with Arellano-Bover two-step system-GMM procedure. All regressors in difference are instrumented with their lagged levels, all levels with lagged differences. Coefficient estimates are from the first step. Standard errors are reported within parenthesis, 5% and 10% significant coefficients are respectively in bold and italics. P-values for F-test, Sargan and m_2 tests are from the second step.

Table 10. Stock market development and income inequality

static panel - 36 countries - 1976-2000

	FE	FE	FE	RE
<i>smcap</i>	.103 (.045)	.08 (.033)		
<i>smcap</i> ²	-.021 (.035)			
<i>smpr</i>			.043 (.041)	.051 (.014)
<i>smpr</i> ²			.008 (.035)	
sec25	- .164 (.063)	- .154 (.060)	- .176 (.069)	- .212 (.052)
<i>GDP</i>	-.151 (.120)	-.139 (.118)	-.139 (.132)	-.045 (.085)
<i>GDP</i> ²	.146 (.099)	.135 (.097)	.196 (.111)	.090 (.090)
<i>R</i> ²	.163	.159	.158	.139
Observations	125	125	112	112
Country FE	Yes	Yes	Yes	No
Hausman Test	.029	.014	.015	.127

The dependent variable is the Gini coefficient. Sample of 36 countries, non-overlapping five-year observations spanning 1976-2000. GDP and sec25 are initial values, smcap is the period average. Standard errors are reported within parenthesis, 5% and 10% significant coefficients are in bold and italics, respectively. P-values for the Hausman tests.

Table 11. Stock market development and income inequality - Robustness analysis

	FE	FE	FE	FE	GMM	GMM	GMM	GMM
<i>smcap</i>	.124 (.047)	.065 (.026)			.79 (.063)	.077 (.031)		
<i>smcap</i> ²	-.058 (.038)				.002 (.054)			
<i>smpr</i>			.061 (.039)	.043 (.017)			.172 (.062)	.075 (.021)
<i>smpr</i> ²			-.018 (.035)				-.085 (.045)	
<i>gov</i>	-.097 (.093)	.060 (.090)	.069 (.102)	.073 (.102)	.054 (.195)	.058 (.118)	.029 (.073)	.045 (.082)
<i>trade</i>	.095 (.040)	.076 (.039)	.137 (.044)	.748 (.286)	-.021 (.030)	-.019 (.029)	-.037 (.019)	-.041 (.022)
<i>R</i> ²	.224	.203	.260	.257				
<i>S arg an</i>					.996	.999	.993	.943
<i>m</i> ₂					.793	.842	.462	.454
Obs	125	125	112	112	84	84	84	84

Dependent variable is Gini in FE and RE columns, log difference of Gini in GMM. Samples of non-overlapping 5-year observations spanning 1976-2000. The regressors of equations in FE (GMM) are the same as in Table 8 (9) plus (log difference of) government expenditure, trade and private credit as a ratio of GDP. FE are fixed and random effects regressions, chosen on the basis of specification tests, whose statistics are available upon request. GMM are Arellano-Bover two-step system-GMM estimations, where differences of all regressors are instrumented with lagged levels and levels with lagged differences. Coefficients are from the first step, p-values for Sargan and m_2 tests are from the second. Standard errors are reported within parenthesis, 5% and 10% significant coefficients in bold and italics.

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