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Nº 330 **THE INEQUALITY-CREDIT NEXUS**

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The Inequality-Credit Nexus

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Abstract

This paper explores the inequality-credit nexus from both a theoretical and an empirical perspective. The paper develops an overlapping generation model in which the effect of income inequality on private credit depends on the countries' per capita income and on the quality of laws protecting creditor rights. The model predicts that greater inequality leads to higher levels of private credit in countries with low per capita incomes and weak legal rights, whereas the reverse is true in countries with high incomes and strong legal rights. Using a panel dataset of 155 countries over the 1982 to 2015 period, the paper shows empirical evidence that is robust and consistent with the model's predictions. The paper's major finding suggests a credit channel through which inequality may affect economic outcomes.

JEL classification: F34; G15; G21; G38.

Keywords: financial development, inequality, legal rights, private credit

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1 Introduction

How does income inequality affect private credit? In light of the ample evidence of a link between finance and economic growth, this is a fundamental question in economics. Despite a rich body of literature examining the effects of income inequality, the study of a credit channel through which inequality may retard or accelerate economic growth remains in its infancy. An early strand of the theoretical literature suggests that inequality promotes growth by channeling resources towards wealthy individuals whose marginal propensity to save is higher (Lewis, 1954; Kaldor, 1957; Bourguignon, 1981). Modern theory suggests that, in the presence of imperfect credit markets, inequality adversely affects growth due to the negative effect on investment in human capital (Galor and Zeira, 1993). Recent empirical articles have started to explore the relationship between inequality and credit (Bordo and Meissner, 2012; Perugini et al., 2015). However, these studies have focused mainly on either advanced economies or the recent periods of financial distress.

This paper contributes to the literature on the effects of inequality by examining, from both a theoretical and an empirical perspective, whether the relationship between inequality and private credit is shaped by countries' per capita income level and strength of creditor rights. We develop an overlapping generations model with income inequality and endogenous credit constraints to explore this relationship, using a modified version of the model in Matsuyama (2004). Firms produce a single final good using labour and physical capital. Factor markets are competitive, and thus, both wages and physical capital price evolve endogenously according to the dynamics of capital formation. Individuals live for two periods. In the first period young agents are endowed with heterogeneous units of labour. They work and allocate their income to finance old-age consumption. At the end of the first period, they have two options: first, they can deposit the savings to earn the international interest rate and consume their savings when old; second, they can ask for a loan—if they satisfy the minimum credit requirement—and invest in a risky project that produces physical capital in period 2 that can be sold to firms to finance consumption.

Credit market imperfections arise from the fact that banks are not perfectly protected against default. There are two reasons for default: entrepreneurs do not repay their debt because they abscond with the loan an use it for consumption (as in Burkart and Ellingsen, 2004, which we denote ex ante—or malicious—default), or because their project fails (denoted ex post default). In both cases, only a fraction of the loan is recovered by the legal system and repaid to banks. Both the severity of credit constraints and income inequality determine the mass of agents with access to the credit market, and, thus, capital

formation in the next period. The model predicts that a more unequal income distribution in an economy in which credit constraints are binding (i.e., an economy with low aggregate income and/or weak creditor protection) leads to higher credit penetration and aggregate debt, while this effect is reversed in economies with high aggregate income and strong credit protection.

We empirically test the main prediction of our model by using a panel dataset that covers 155 countries from 1982 to 2015. Consistent with the model's prediction, our empirical analysis suggests that within-country increases in income inequality lead to a higher ratio of private credit to GDP in economies with low incomes and weak legal rights, while this effect vanishes and even becomes negative in economies with high incomes and strong legal rights. These results are statistically significant even after controlling for the standard determinants of private credit. Moreover, they are robust to the inclusion of country and time fixed effects; to alternative measures of income inequality (Gini index and the income share held by the top 10%); to alternative sub-samples of countries; and to control for potential endogeneity problems.

The estimated magnitudes of the effects obtained from our baseline regressions are economically meaningful. For example, an increase of one standard deviation in the Gini index for economies with a GDP per capita and a strength of legal rights index in the 25th percentile increases private credit to GDP by 513 basis points. Meanwhile, in economies with GDP per capita and a strength of legal rights index in the 75th percentile, an increase of one standard deviation in the Gini index decreases private credit to GDP by 527 basis points.

The study of a causal interpretation between inequality and growth is not trivial due to endogeneity biases generally stemming from potential omitted variables and reverse causality (Demirgüç-Kunt and Levine, 2009). Although the relationship between inequality and credit can be interpreted as capturing the effect of inequality on credit, there is evidence suggesting that credit may also improve the distribution of wealth and income (Beck et al., 2007). We aim to mitigate potential endogeneity concerns by estimating panel models with country and time fixed effects, and by using instrumental variables estimations. Finally, it is important to highlight that the sign change in the effect of inequality on credit, which we test empirically, is consistent with our theoretical framework and is not only a data-driven correlation. According to Bazillier and Hericourt (2017), the next step on the literature is to bring the theories to the data in order to understand the different potential channels between finance and inequality relationship and, thus, assess the relevance of each theoretical argument.

This study contributes to our understanding of the inequality-finance nexus in at least three ways. First, this article suggests that arguments in favor of a positive relationship between inequality and pri-

vate credit are incomplete, as we find conditions under which increases in inequality may lead to a negative effect on credit. Our analysis helps to explain the mixed evidence reported in international empirical studies that estimate the average effect of income inequality on private credit (see, e.g. Bordo and Meissner, 2012; Perugini et al., 2015). Second, this article introduces a novel channel (the credit channel) through which inequality may affect economic outcomes. While the finance-growth and inequality-growth relationships have received considerable attention in the literature, the study of the mechanisms through which inequality affects finance are less understood. Empirical work on the finance-growth relationship suggest a positive effect of finance on growth. Calderón and Liu (2003) shows that financial development leads to economic growth and that this effect is particularly important in developing economies. Rioja and Valev (2004) find that improvements in financial markets have an uncertain effect on growth in countries with low levels of financial development, a strong positive effect in countries with moderate levels of financial depth, and a small positive effect in countries where financial markets that are too big. The evidence on the inequality-growth relationship is more mixed. Although a number of empirical studies find a positive effect of inequality on growth (Li and Zou, 1998; Forbes, 2000), more recent evidence suggests that more inequality reduces economic growth (Panizza, 2002; Easterly, 2007). Brueckner and Lederman (2015) find, consistent with our findings and credit channel, that inequality has a negative effect on the economic growth of high income economies, but a positive effect on the growth of poor economies. Finally, in contrast to studies that focus on the U.S. or high-income OECD economies, this article utilizes a dataset covering a broader range of countries to gain a better understanding of a more general relationship between inequality and private credit under different economic conditions.

The paper proceeds as follows. Section 2 presents a brief literature review. Section 3 describes our theoretical model. Section 4 describes the data and reports the summary statistics for the overall sample. Section 5 presents our empirical strategy and main results on the effect of inequality on private credit. Section 6 reports a set of additional robustness checks. Section 7 concludes.

2 Literature Review

Since the 2008 financial crisis, several papers have attributed the crisis to excessive lending to bad-quality debtors and its relation to inequality. Their argument is that the relationship between credit penetration (or leverage) and increased income inequality is one in which top earners who accumulate financial wealth lend a large fraction of that wealth to low earners who desire to increase their consumption lev-

els. According to Rajan and Myers (2010), this movement was exacerbated by government policies that proactively led to overextension of loans to non-creditworthy borrowers as a means to reduce inequality by, for instance, pushing for easier access to mortgages by subprime borrowers. Acemoglu (2011) argues, on the other hand, that Reagan's and other right-wing policies were not attempts to reduce inequality but drivers of inequality, which eventually led to the policies described by Rajan and Myers (2010). Before the crisis, some papers, such as Krueger and Perri (2006), detected that the changes in inequality of incomes did not result in inequality of wealth. They describe and calibrate a model with endogenous default, but the calibrations show too little lending; thus, they speculate that a model with costly default (i.e., intermediate between one with no default and one with endogenous default) might fit the data better. Kumhof et al. (2015) study a model with two classes of agents and endogenous default and suggest that calibrated simulations show that the model matches the income distribution, the debt-to-income ratio and the crisis risk for the three decades prior to 2008. Iacoviello (2008) develops and simulates a model for the period 1963-2003 that shows that the increase in household debt during the 1980s and 1990s can be explained only by increased inequality. Atkinson et al. (2009) document the large increase in inequality since the 1980s.

According to Demirgüç-Kunt and Levine (2009) there are few studies on the influence of formal financial policies, such as bank regulations, on the relation between access to credit and inequality. Banerjee and Newman (1993) show the importance of capital market imperfections for the relation between inequality and access to credit, and how they affect the productive structure of the economy. Similarly, Galor and Zeira (1993) show that capital market imperfections interact with income (or wealth) distributions to alter the future distribution and accumulation of human capital. For other models showing the interaction between inequality and growth, see also Durlauf (1996); Fernandez and Rogerson (1996); Benabou (2000); Mookherjee and Ray (2003). Matsuyama (2004) studies a dynamic model in which capital market imperfections interact with initial inequality to limit the access of agents to a productive technology. In a static model, Balmaceda and Fischer (2010) study the effect of changes in formal financial policies (bankruptcy and ex ante credit protection) on the interaction between inequality and access to credit and thus on the performance of an economy.

3 The Model

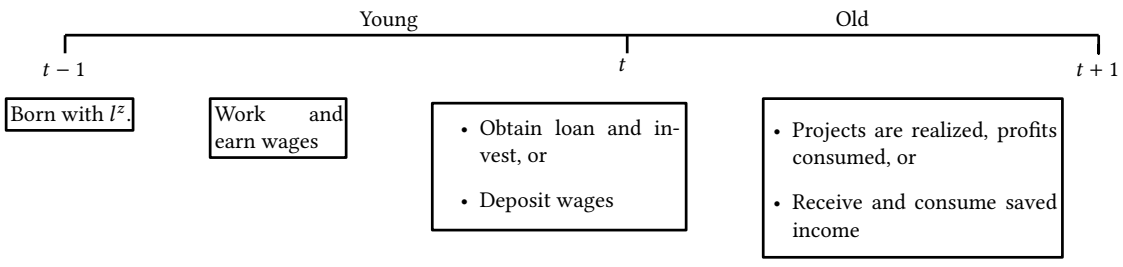
We develop a Diamond overlapping generation model along the lines of Matsuyama (2004), as it provides a tractable framework in which to analyze the effects of income inequality in a dynamic model.

Agents live for two periods. Each generation is assumed to receive earnings only when young. Thus, when young, agents work and at the end of the first period they allocate their income to finance old age consumption. They have two alternatives: i) they may deposit their earnings in the banking system and receive the fixed international gross rate per unit or ii) they may apply for a loan in order to invest in a risky project that produces physical capital that can be sold to firms. Capital cannot be consumed and fully depreciates in one period. Firms produce a single final good taking as input labour and physical capital supplied by the young and old generations respectively.

Each period, a continuum of young, risk neutral agents indexed by $z \in [0,1]$ is born, endowed with l^z units of observable labour.[1] Labor can be understood as human capital or labor capacity. Labour is distributed according to the cumulative probability function $\Gamma(l^z)$ with support $[0, l_{max}]$ and mean L^e (and density function $\gamma(l^z)$) which is also the aggregate labor supply each period. Earnings of agent z are given by $w_t l^z$, where w_t is the equilibrium wage in period t. Thus, $\Gamma(l^z)$ is the fraction of agents who earn less than $w_t l^z$. We normalize $L^e = 1$ to simplify notation. Therefore, the mean income of the distribution is w_t.

At the end of the first period t, young agents have two options. They can deposit their saved wages in the banking system and receive the international interest rate $(1+\rho^*)$. Then their second-period consumption is $(1+\rho)w_t l^z$. The second option is to apply for a loan to invest in a risky project that transforms output into physical capital that can be sold at a price p_{t+1} to firms at the beginning of the second period. See figure 1 for a timeline of the model. Lenders face moral hazard (*ex-ante* default) and bankruptcy (*ex-post* default) risk. The legal-institutional system provides imperfect protection against those risks. Thus, banks impose credit constraints that exclude poorer agents from the credit market and charge differentiated interest rates.

Figure 1: Lifecycle of agent z



The capital production technology requires one unit of output. If the project succeeds, with independent probability θ, $\kappa > 1$ units of physical capital are produced. If the projects fails, the legal sys-

[1] Risk neutrality is assumed for simplicity. In addition, we normalize the discount factor to one. All results still hold with a concave utility function and a discount factor lower than one.

tem recovers only a fraction $\upsilon \in [0,1]$ of the total investment. Thus, υ is a measure of the quality of the bankruptcy system, or alternatively, it can be interpreted as the liquidation value of the project. Lenders appropriate the entire liquidation value in the case of failure.

Total physical capital produced in the economy determines total production of the output good. The technology of the consumption good is a standard linear homogeneous production function $Y_t = F(K_t, L_t)$, where L_t and K_t are aggregate labor and capital respectively. If there is a fraction η_t of young agents investing in a capital producing project at t, then total expected output at $t+1$ will be given by $F(\theta\kappa \cdot \eta_t, L_{t+1})$, where η_t measures credit penetration—i.e., the fraction of young agents who obtain a loan to invest in a capital-producing project at t.

We may then write the production function in per capita terms as $f(k_t)$, which satisfies $f'(k_t) > 0$, $f''(k_t) < 0$, $f(0) = 0$, $f''(0) = \infty$ and where $k_t \equiv \theta\kappa \cdot \eta_{t-1}$. The factor markets are competitive, thus the price of capital is $p_t = f'(k_t)$, and wages are $w_t = f(k_t) - k_t f'(k_t)$. As in Matsuyama (2004), we assume that $w(\theta\kappa) l_{max} < 1$—i.e. all agents need to borrow to start a project.

The future expected profit of a young agent z who becomes an entrepreneur at period t and obtains a loan $D_t^z = 1 - w_t l^z$ is:

$$\pi_{t+1}^z = \theta\kappa p_{t+1} - (1 + r_t^z)(1 - w_t l^z), \tag{1}$$

where r_t^z is the interest rate charged by lenders to entrepreneur z, which differs among agents.

Entrepreneurs who obtain a loan may decide to abscond instead of investing. In the second period they enjoy a private benefit from absconding given by $A(\phi, D_t^z)$ where ϕ measures the degree to which collateral laws protect creditors. We make the reasonable assumption that $A_1 < 0$, $A_2 > 0$ and $A_{22} < 0$, —i.e., better collateral protection (measured by ϕ) reduces the benefit from absconding, while the benefits of absconding increase in the size of the loan, at a decreasing rate. [2] Note that $A(\cdot)$ incorporates collateral laws in a very general sense.

The optimal contract must satisfy the incentive compatibility condition (IC) of agents, or the bank will not make a loan:

$$\pi_{t+1}^z \geq A(\phi, 1 - w_t l^z), \quad \forall l^z \geq \hat{l}_t(\phi, \upsilon), \tag{2}$$

where $w_t \cdot \hat{l}_t(\phi, \upsilon)$ is the minimum income needed to access the credit market at t. Therefore, $\Gamma(\hat{l}_t)$ is the measure of young agents who cannot access the credit market.

We assume that banks are competitive and have unlimited access to international funds at the gross rate $1+\rho^*$. A bank's expected future profits from lending to a young agent z who satisfies the IC constraint

[2] This means that the legal system is more efficient in pursuing the assets of agents who abscond with larger loans.

are:[3]

$$\Pi^z_{t+1} = [\theta(1 + r^z_{t+1}) - (1 + \rho^*)](1 - w_t l^z) + (1 - \theta)\, v. \tag{3}$$

3.1 Equilibrium

Since banks are competitive, $\Pi^z_{t+1} = 0$, the interest rate charged to an entrepreneur z in the second period is:

$$(1 + r^z_t) = \frac{1 + \rho^*}{\theta} - \frac{(1 - \theta)\, v}{\theta(1 - w_t l^z)}, \tag{4}$$

and substituting this into the profit function of entrepreneurs leads to $\pi^z_{t+1} = \theta\kappa p_{t+1} + (1 - \theta)\, v - (1 + \rho^*)(1 - w_t \hat{l}_t)$. Young agents become entrepreneurs only if the expected return is higher than for depositing their savings in the banking system—i.e., only if the following participation constraint (PC) is satisfied:

$$\theta\kappa p_{t+1} + (1 - \theta)\, v \geq (1 + \rho^*), \tag{5}$$

The fact that banks lend only to agents who do not abscond determines the minimum labour endowment required for a loan $\hat{l}_t$ at t:

$$\theta\kappa p_{t+1} + (1 - \theta)\, v - (1 + \rho^*)(1 - w_t \hat{l}_t) - A(\phi, 1 - w_t \hat{l}_t) = 0. \tag{6}$$

Finally, in order to ensure that agents can always repay their debt in the case of success, we impose the condition that the capital producing project be sufficiently productive.

Assumption 1. $\theta\kappa f'(\theta\kappa) \geq (1 + \rho^*)[1 - w(\theta\kappa)\hat{l}(\theta\kappa)] - (1 - \theta)\, v$

Under Assumption 1, the agent $\hat{l}_t$ who has the largest loan can always repay his debt in the case of success.[4]

[3] Banks use the expected value, even though they can differentiate among agents, due to the fact that the shock θ is independent of individual income and by the Law of Large Numbers (since we have a continuum of agents).

[4] Here $\hat{l}(\theta\kappa)$ is the solution to (6) when all agents have access to credit and the return to entrepreneurs (the price of capital) is lowest. In the assumption, the economy has the highest possible level of capital per worker: $k_t = \theta\kappa$.

3.2 Dynamics and Steady State

We assume that the initial capital per capita is $k_0 > 0$. The dynamics of this model are completely described by the capital formation curve

$$k_{t+1}(k_t) = \begin{cases} \Upsilon(k_t) & \text{if } k_t < \hat{k}(\phi, \upsilon) \\ f'^{-1}\left(\frac{(1+\rho^*)-(1-\theta)\upsilon}{\theta\kappa}\right) & \text{if } k_t \geq \hat{k}(\phi, \upsilon), \end{cases} \tag{7}$$

where $k_{t+1} = \Upsilon(k_t)$ arises from the unique solution to $k_{t+1} = \theta\kappa[1 - \Gamma(\hat{l}(k_t, k_{t+1})]$ and $\hat{l}(k_t, k_{t+1})$ is the solution to equation (6).

The critical per capita level at which capital formation remains constant $\hat{k}(\phi, \upsilon)$ is defined implicitly by the solution to $\theta\kappa p(\Upsilon(\hat{k}(\phi, \upsilon))) + (1-\theta)\upsilon = (1+\rho^*)$. The participation constraint (5) starts to bind if $k_t \geq \hat{k}(\phi, \upsilon)$, while the incentive constraint binds below this value. Thus, to the left of $\hat{k}(\phi, \upsilon)$, investment is constrained by borrowing restrictions, while to the right of this value the effects of credit market imperfections vanish. Note that the capital formation curve starts above the diagonal—i.e.,

$$k_{t+1}(0) = f'^{-1}\left(\frac{(1+\rho^*) + A(\phi, 1) - (1-\theta)\upsilon}{\theta\kappa}\right) > 0,$$

because $w = 0$ when $k = 0$. This fact has implications for the dynamics of the model.

The critical value $\hat{k}(\phi, \upsilon)$ decreases as legal protection measures ϕ, υ increase.[5] Therefore, as the legal framework for credit improves, the incentive compatibility constraint becomes less restrictive and less capital is necessary to have access to credit.

The capital formation curve is increasing in k_t for $k_t < \hat{k}(\phi, \upsilon)$. In fact, differentiating this condition with respect to k_t we obtain:

$$\frac{\partial k_{t+1}}{\partial k_t} = -\frac{k_t \hat{l}_t f''(k_t)}{\frac{w_t}{\theta\kappa\gamma(\hat{l}_t)} - \frac{\theta\kappa f''(k_{t+1})}{(1+\rho^*+A_2(\phi, 1-w_t\hat{l}_t))}} > 0. \tag{8}$$

This is explained by a credit multiplier effect: higher domestic investment increases the wages of young agents, which allows a larger fraction of them to invest in the capital producing project for the next period. This, in turn, leads to higher future wages and to a higher proportion of young agents having access to credit.[6] From equation (8), it is straightforward to see that the minimum labour required for a

[5] Since $\frac{\partial \hat{k}(\phi,\upsilon)}{\partial x} = -\underbrace{\frac{\partial \Upsilon}{\partial x}}_{>0} / \underbrace{\frac{\partial \Upsilon}{\partial k}}_{>0} < 0, x = \phi, \upsilon.$

[6] A well-known issue of these types of models is that they can have multiple steady states, even without credit market imper-

loan decreases as capital per capita increases $\frac{\partial \tilde{l}_t}{\partial k_t} < 0$.

3.3 Financial Market Improvements and Income Redistribution Effects

In this section, we use the model to derive the results that we test empirically in the second part of the paper. We begin with the comparative statics of improvements in institutional variables such as credit protection, measured by ϕ and the efficiency of bankruptcy procedures, measured by v.

Lemma 1. *An improvement in the quality of laws that protect creditors or in the efficiency of bankruptcy procedures leads to a loosening of credit constraints,—i.e, $\hat{l}_t$ shifts left.*[7]

Proof. See the Appendix. □

Thus, we deduce that $\frac{\partial k_{t+1}}{\partial \phi} > 0$, $\frac{\partial k_{t+1}}{\partial v} > 0$. That is, a better legal framework for loans accelerates capital formation through credit channels.

As a second topic, we examine the effects of income redistribution at t on credit penetration and on total debt. In the next proposition we describe the effect of an income redistribution of young agents on credit penetration and aggregate debt of the next period.

Recall that credit penetration is defined as the percentage of agents that can access the credit market at t, $\eta_t \equiv 1 - \Gamma(\hat{l}_t)$. We define aggregate debt as follows:

$$\mathscr{D}_t = \int_{\hat{l}_t}^{l_{max}} (1 - w_t l^z) \partial \Gamma(l^z). \tag{9}$$

In order to isolate income distribution from income effects, we consider pure income redistributions—i.e., Mean Preserving Spreads (MPS).[8] Since an MPS preserves the mean, total income among the young $\int w_t l^z \partial \Gamma(l^z) = w_t$ remains constant after an MPS of their incomes. In our setting, redistribution among the young at the beginning of period t does not change wages at t but will impact outcomes at $t+1$ through changes in credit access at t. Moreover, these effects are persistent.

Proposition 1. *Consider two countries,1 and 2, that are identical in all respects, except that the young of country 1 have an income distribution at t that is an MPS of that of country 2. If $w_t \hat{l}_t(\phi, v) >> w_t$, credit penetration and aggregate debt is higher in country 1 at t. The results are reversed if $w_t \hat{l}_t(\phi, v) << w_t$.*

fections (e.g. see Acemoglu, 2008, p. 332). The dynamics of the model are very similar to those of Matsuyama (2004, section 7.1). Since $\Upsilon(0) > 0$, there exist at least one crossing with the 45° line from above, that is, there is at least one stable steady state. See Matsuyama (2004) for the detailed analysis of the dynamics of this type of model.

[7] Note that at t, k_t is fixed because it was decided by young agents at $t-1$.

[8] A Mean Preserving Spread can be characterized by: Γ_1 is an MPS of Γ_0 if $\Gamma_1(l^z) > \Gamma_0(l^z)$ when $w_t l^z < w_t$ and $\Gamma_1(l^z) < \Gamma_0(l^z)$ when $w_t l^z > w_t$.

Proof. See the Appendix. □

The proposition shows that the effects of inequality depend on the relationship between the minimum wage income required for a loan and the current average income of the young. In economies in which a young agent with average labor capacity does not have the wage income necessary to access credit (*credit-constrained countries*: $w_t\hat{l}_t >> w_t$), a regressive redistribution among the young leads to higher credit penetration and debt. A regressive redistribution has the opposite effect in a country in which a young agent with average labor capacity has access to credit, ($w_t\hat{l}_t << w_t$). Conversely, progressive redistribution reverses these effects in both credit constrained and credit-unconstrained countries.

Note that a change in income distribution among the young has two effects: it changes the mass of agents that have access to the credit market, and it changes the future cost of capital in the opposite direction due to the adjustment in the future supply of capital. This second effect modifies period t credit requirements measured by $\hat{l}_t$. The directions of these effects depend on whether a country is credit-constrained or credit-unconstrained. Equation (13) in the Appendix displays these two opposite effects.

Figure 2: Effects of an MPS in a wealthy country

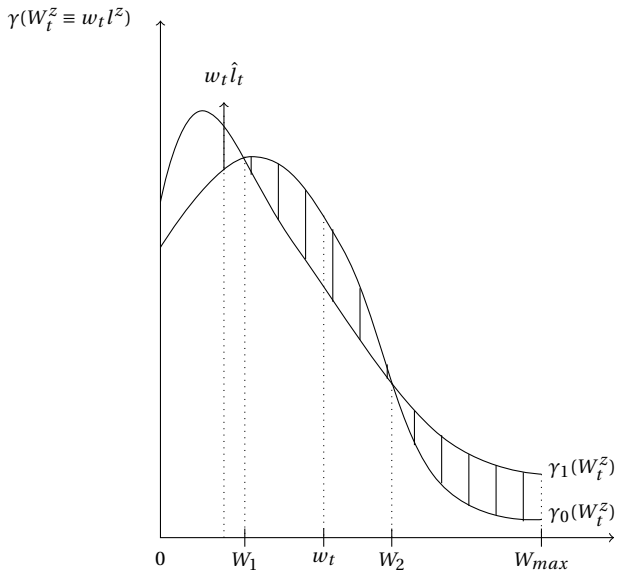


Figure 2 shows the effects of an MPS in a high income country (note that $w_t\hat{l}_t << w_t$). We can see from the figure that there are fewer agents with access to credit, as the mass of agents to the left of $w_t\hat{l}_t$ is larger. Moreover, since there are fewer agents in the range W_1, W_2 (who ask for larger than average loans), and there is more mass among the high income agents (which ask for smaller-than-average loans), total

loan volume decreases.[9] A similar figure can be drawn to show that the effects of an MPS in a poor economy would increase not only access to credit but also the total volume of debt[10]

Finally, note that if we consider two countries with the same income but different levels of legal rights, we could have that in the country with better legal rights, $w_t \hat{l}_t << w_t$. Thus, inequality reduces credit penetration and total credit. On the other hand, in the country with weaker institutions, it could be that $w_t \hat{l}_t >> w_t$, and, thus, increased inequality has the opposite effect.

Apart from the short-run effects of a transitory increase in inequality, we can distinguish two kinds of long-run effects. First, the transitory changes in income distribution will persist through a credit multiplier type effect. The initial effect of increased inequality is to have higher credit penetration at period t, which raises capital formation and output at $t+1$. In turn, this raises the wages of the young at $t+1$. The young, face loosened credit constraints, thus increasing the number of agents who invest in the capital production technology, and these effects continue until the model converges to the steady state. Similar effects operate in the opposite direction when there is increased inequality in a high-income country.

Second, there can be jumps from the basin of attraction of one steady state to the basin of attraction of a higher stable steady state when there are multiple steady states. Conversely, more inequality in a high-income country can have a detrimental effect with, potentially, a shift to a lower steady state. Thus, transitory changes in the income distribution can have persistent effects along the entire transition path, and even lead to different equilibria in the long-run.

3.4 Mapping to Data

From Lemma 1, we know that the minimum income to obtain a loan is smaller in countries with better laws to protect creditors. Thus, a credit-constrained country can be understood as an economy in which initial aggregate income (w_t) is low relative to the quality of institutions that protect creditors (ϕ, V).

In the empirical analysis aggregate income is measured by GDP per-capita, while the pair (ϕ, V) is measured by the strength of legal rights according to the World Bank's strength of legal rights index (SLR), which measures the degree to which collateral and bankruptcy laws protect lenders. In the analysis, we test the effect of inequality on credit penetration of the next period; that is, we test the effect presented in Proposition 1.

[9] This figure is simplified, since there is also a small movement in $\hat{l}_t$ in response to the MPS.

[10] The effect of an MPS results from the combined effect of the change in the mass of agents with access to credit and the change in the mass of agents with a given income. Even when there is no change in credit penetration, a redistribution of income may have an effect on aggregate debt. The change in the extensive market is not a requirement for our results.

4 Data

To empirically test the predictions of Proposition 1, we employ a large panel of 155 emerging and advanced economies over the years 1982 to 2015, which we construct by using data from the World Bank's World Development Indicators (WDI) and other sources. Our dependent variable is the level of private credit by deposit money banks and other financial institutions as a fraction of GDP. This measure has been used mainly as a continuous proxy for the size of domestic private credit (see, e.g., Gennaioli et al., 2014).

In line with our model, our key explanatory variables of interest are income inequality, average income, and the quality of collateral laws and of bankruptcy legislation (the pair (ϕ, υ) in the model). We measure income inequality by using both the Gini index and the income share held by the top 10%. According to Leigh (2007), the top 10% income share represents a suitable alternative proxy to measure broader income inequality. We proxy for a country's average income using GDP per capita and for the quality of creditor protection using the strength of legal rights (SLR) index. The SLR index measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders. The SLR index ranges from 0 to 12. Higher scores indicate that these laws are better designed to expand access to credit.[11]

For robustness purposes, we also control in some specifications for a large set of variables that may directly affect private credit: population, population density, abundance of natural resources, inflation, the share of GDP generated by the manufacturing sector, economic growth, the ratio of secondary to primary school enrollment, and the net interest margin. These same variables have been used to study the links between financial development and growth (Levine, 2005) and the determinants of financial development and inclusion (Allen et al., 2014; Fischer and Valenzuela, 2013). Finally, we employ a number of variables as instruments for income inequality, average income, and the quality of collateral laws and of bankruptcy legislation. Specifically, we instrument inequality with three measures of ethnic, linguistic and religious fractionalization (Alesina et al., 2003) and with the European settlers' mortality rates (Frankema, 2006). We also instrument inequality and GDP per capita with the residual variation in inequality that is not due to private credit to GDP. The Legal Rights Index is instrumented with the countries' legal origins (La Porta et al., 2008).

Table 1 reports summary statistics for the overall sample. The Appendix presents the description and sources of all the variables (Table A.1) and provides the list of countries included in our sample (Table

[11] The data on SLR index start only in 2004. Our baseline estimations reported in Table 2 utilizes the earliest value available. This procedure may be satisfactory because the SLR index exhibits substantial persistence over time.

A.2).

5 Empirical Strategy and Main Results

In this section, we perform panel data regression analyses to check whether the data support Proposition 1 of our model. That is, we test whether the effect of inequality on private credit depends on the levels of GDP per capita and the strength of legal rights. Thus, our baseline econometric model takes the following form:

$$\begin{aligned} Private\ Credit_{i,t} = \alpha_i + \nu_t + \beta_1 Inequality_{i,t-1} + \beta_2 GDPpc_{i,t-1} + \beta_3 Legal\ Rights_{i,t-1} \\ \beta_4 Inequality_{i,t-1} \times GDPpc_{i,t-1} + \beta_5 Inequality_{i,t-1} \times LegalRights_{i,t-1} + \epsilon_{i,t}, \end{aligned} \tag{10}$$

where $Private\ Credit_{i,t}$ is the level of private credit by deposit money banks and other financial institutions as a fraction of GDP in country i at time t; $Inequality_{i,t-1}$ is the lagged value of either the Gini index or the income share held by the top 10%; $GDPpc_{i,t-1}$ is the lagged value of GDP per capita; and $Legal\ Rights_{i,t-1}$ is the lagged value of the SLR index. We include the two interaction terms to examine whether, consistent with Proposition 1, the direction of the effect of inequality on private credit depends on the capital constraints of individual countries. We lag all of our independent variables to attenuate potential biases associated with reverse causality.

To attenuate potential endogeneity biases associated with omitted variables, all of our regressions include country and time fixed effects. The term α_i represents country fixed effects that control for all time-invariant country-specific factors affecting both private credit and inequality. The term ν_t captures time fixed effects that control for common shocks affecting all countries such as global financial crises or changes in the world business cycle.

According to the model presented in equation (10), the effect of income inequality on private credit at different levels of GDP per capita and legal rights can be calculated by examining the following partial derivatives:

$$\frac{\partial PrivateCredit_{i,t}}{\partial Inequality_{i,t-1}} = \beta_1 + \beta_4 GDPpc_{i,t-1} + \beta_5 LegalRights_{i,t-1}. \tag{11}$$

Based on Proposition 1, we expect that $\beta_1 > 0$, $\beta_4 < 0$ and $\beta_5 < 0$. In other words, greater within-country income inequality leads to higher private credit in economies with low GDP per capita and weak legal rights, but this effect vanishes and even becomes negative in economies with high GDP per capita and strong legal rights.

Table 2 reports our main results from estimating various specifications of equation (10) using ordinary least squares (OLS) regressions with standard errors clustered by country. In columns 1 to 3, we measure income inequality using the Gini index, while in columns 4 to 6, we measure income inequality with the income share held by the top 10%. In some columns—1, 2, 4 and 6—we consider only one of the two interaction terms at a time (setting $\beta_4 = 0$ or $\beta_5 = 0$). In columns 3 and 6, we simultaneously include the two interaction terms of interest.

As expected, our two measures of income inequality (the Gini index and the income share held by the top 10%), GDP per capita, and the the SLR index enter with positive and statistically highly significant coefficients in all of our regressions. Moreover, in line with Proposition 1, the interaction term between inequality and GDP per capita and the interaction between inequality and the SLR index enter in our regressions with negative coefficients that are also highly statistically significant. Overall, the significant positive coefficient on inequality and the negative coefficients on the interaction terms confirm that greater within-country income inequality leads to higher private credit in capital-constrained economies, but that this effect vanishes and even becomes negative in capital-unconstrained economies. As reported in columns 3 and 6, our results are robust to simultaneously including the two interaction terms. Although our baseline regressions are very parsimonious, it is important to highlight that, due to the inclusion of country and time fixed effects, they are able to explain a very large proportion of the variance in private credit to GDP, as shown by the adjusted R-squared.

Figures 3 to 6 show graphically the marginal effect of the two measures of inequality on private credit to GDP conditional on values of the natural logarithm of GDP per capita and on the SLR index, respectively.[12] The figures also report 95% confidence bands. Consistent with the prediction of our theoretical model, the figures clearly show that the marginal effect of increased income inequality on credit is positive and statistically significant in economies with low GDP per capita and weak legal rights, while this effect is negative and statistically significant in economies with high GDP per capita and strong legal rights.

6 Robustness

In this section, we test whether our main empirical findings are robust to a set of additional robustness checks, including using instrumental variables estimations, different sub-samples of countries and a comprehensive set of country-level time-variant control variables.

[12] We conduct this exercise using the results reported in columns 1, 2, 4 and 5 of Table 2.

6.1 Instrumental Variables Estimation

Although country and time fixed effects mitigate potential endogeneity concerns associated with omitted variables, they do not correct for endogeneity biases associated with reverse causality. This is an important concern, given a potential effect running from private credit to inequality. Demirgüç-Kunt and Levine (2009) emphasize that improvements in domestic financial markets are likely to expand economic opportunities and, thus, reduce inequality.

To attenuate potential endogeneity associated with reverse causality, we employ instrumental variables estimations. Given the lack of suitable country-level time-varying instruments to address potential endogeneity in our context, we use these estimations as a robustness test—one that needs to be interpreted with caution. Specifically, to clean the potential effect of private credit to GDP on inequality, we follow three different strategies. First, we construct an inequality variable that contains all of the dimensions of inequality that are unrelated to expansions of private credit to GDP. For this purpose, we follow an instrumental variables strategy similar to that of Brückner (2013) and Brueckner and Lederman (2015). We do so by first regressing inequality on private credit to GDP (together with country and time fixed effects) and by then computing the residual variation in inequality that is not due to private credit to GDP. [13] Brückner (2013) utilizes this instrumental variables strategy to explore the effect of foreign aid on economic growth, while Brueckner and Lederman (2015) use it to examine the effect of inequality on output. Second, we instrument inequality using measures of ethnic, linguistic and religious fractionalization provided by Alesina et al. (2003). This is consistent with the idea that fractionalization may accentuate between-groups differences and conflicts, leading to persistent national inequality. Third, we use the European settlers' mortality rates as an instrument for inequality measures. According to Frankema (2006), settlers' mortality rates are expected to be negatively related to post-colonial land inequality, which, in turn, is positively correlated with current income inequality. This is consistent with the idea that settlers did not pretend to intervene in areas where the local environment was unfavorable for settlement. In fact, in vast parts of Sub-Saharan Africa, institutional traditions were largely preserved. Moreover, European intervention was not devised to impact daily agricultural production and did not modify land distribution. Instead, settlers shipped African slaves to work on American plantations. In contrast, in regions that were more propitious for settlement—as was a large part of America— , a coercive institutional system was designed: a white minority elite was established, and unequal land redistribution was used as a control mechanism. Therefore, land inequality was a result of highly extractive

[13] Blanchard and Perotti (2002) and Fatás and Mihov (2003) employ an equivalent strategy to construct instruments in the literature on fiscal policy.

colonial institutions.[14] Finally, we instrument GDP per capita with the residual variation in GDP per capita that is not due to private credit to GDP and the SLR index with countries' legal origins (see La Porta et al., 2008).

Table 3 reports our results from re-estimating our baseline models using instrumental variables regressions. In columns 1 and 4 of Table 3, we instrument the Gini index and GDP per capita using the residual variation of each variable that is not due to private credit to GDP. In columns 2 and 3, we instrument the Gini index with the previously mentioned measures of fractionalization and the log of settlers' mortality rates, respectively. Given that some of our instruments are time-invariant, when we employ those time-invariant instruments we do not consider country fixed effects. Overall, our previous results remain qualitatively unchanged. For space considerations, we report our instrumental variables estimation including both interactions terms. We obtain similar results when we consider one interaction term at the time. That is, within-country increases in income inequality lead to a higher ratio of private credit to GDP in economies with low incomes and weak legal rights, while this effect disappears and even becomes negative in economies with high incomes and strong legal rights.

The findings from our instrumental variables regressions are robust to measuring income inequality using the 10% top income share variable (Table A.3 in the Appendix). Additionally, in unreported estimations, first-stage regressions report that instruments are strong ($F >> 10$). Economic-based instruments coefficients are, in general, consistent with proposed theories and also statistically significant.[15]

6.2 Sub-Samples

Table 4 replicates our baseline regressions (columns 1, 2, 4 and 5 of Table 2) while excluding Africa and Latin American countries (LAC), respectively. The regressions in columns 1 to 4 exclude African countries, while those in columns 5 to 8 exclude LAC. It is well-documented that some African and LAC countries are characterized by capital markets highly constrained and/or by very high levels of inequality. Therefore, these estimations offer a robustness test to the private credit regressions estimated using the whole sample because they ensure that potential outliers are not driving our main results. Table 5 separates our sample into two groups of countries based on income level: 1) low- and lower-middle income economies; and 2) upper-middle and high-income economies. These estimations offer an additional

[14] In British North American colonies, cooperative institutions prevailed. Consistent with their favorable settlement conditions, these regions where set as European immigrant colonies and land was equally distributed in order to attract European settlers. Therefore, the theoretical negative relation between settler mortality rates and land inequality is not longer satisfied. As a consequence, we do not consider these countries when conducting this instrumental variables strategy.

[15] For example, settlers' mortality rates have a significant negative correlation with current inequality measures and French legal origin systems are found to have a significant negative effect on the current strength of the legal rights index relative to others legal systems.

robustness test to our baseline regressions because they focus on more homogeneous samples of countries in terms of economic development. Once again, our previous results are robust to the mentioned sub-sample of countries, as the signs on the coefficients on all our variables of interest are in the expected direction, and most of them are statistically highly significant. The loss of significance on a few coefficients is expected, given the smaller sizes of the samples.

6.3 Additional Control Variables

As a final test, Table 6 reports the results from estimating our baseline regression, controlling for a comprehensive set of variables that are commonly accepted as determinants of the private credit (see, e.g., Allen et al., 2014; Fischer and Valenzuela, 2013). These variables include population; population density; abundance of natural resources; inflation; the share of GDP generated by the manufacturing sector; economic growth; the ratio of secondary to primary school enrollment; and the net interest margin.[16] All of our previous main findings remain qualitatively unchanged. We have decided not to include all of these control variables in all of our regressions because, then, the sample size drops dramatically from 1,341 to 572 observations (i.e., a 57% drop).

7 Conclusions

Although rich bodies of research and economic history highlight a close relationship between inequality and credit, whether inequality improves or weakens access to credit remains an open question. In this paper, we explore this relationship from both a theoretical and an empirical perspective. We develop an overlapping generation model in which the effect of income inequality on private credit depends on the countries' per capita income and on the quality of laws protecting creditor rights, and we provide empirical evidence that is consistent with the main prediction of the model.

In our model, credit market imperfections arise from the fact that banks are not perfectly protected against default. In the case of default, only a fraction of the loan is recovered by the legal system and repaid to banks. A credit-constrained country is understood as an economy in which initial aggregate income is low relative to the quality of institutions that protect creditors. In this framework, both the severity of credit constraints and income inequality determine the mass of agents with access to the credit market and, thus, capital formation in the next period. The general lesson from our model is that a more-unequal income distribution in an economy with binding credit constraints (because of

[16] Due to scarce schooling panel data, primary and secondary measures were interpolated for some countries. Nevertheless, the results remain qualitatively unchanged if we conduct the estimation with available schooling data.

low aggregate income and/or weak creditor protection) leads to higher credit penetration and aggregate debt. By contrast, a more-unequal income distribution in an economy in which credit constraints are not binding leads to smaller credit penetration and aggregate debt.

Using panel data models for a large number of developed and emerging economies over the last three decades, in this paper, we additionally show empirical evidence consistent with our theoretical arguments. Our empirical analysis suggests that within-country increases in income inequality lead to a higher ratio of private credit to GDP in economies with low incomes and weak legal rights, while this effect vanishes and even becomes negative in economies with high incomes and strong legal rights. The main empirical finding of our paper is robust to the inclusion of country and time fixed effects, to alternative measures of income inequality, to alternative sub-samples of countries, and to controlling for potential endogeneity problems.

Our analysis point towards a mechanism through which economic development and legal institutions may shape the impact of inequality on financial markets. In light of the ample evidence for a linkage between economic and financial development, we believe that our main finding also contributes to the growth literature by suggesting a novel channel (i.e., the credit channel) through which inequality may affect economic growth.

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Figure 3: Marginal effect of the Gini index on private credit to GDP conditional on the values of GDP per capita (in logs). The dotted lines are 95% confidence bands. This exercise was conducted using the results reported in column (1) of Table 2.

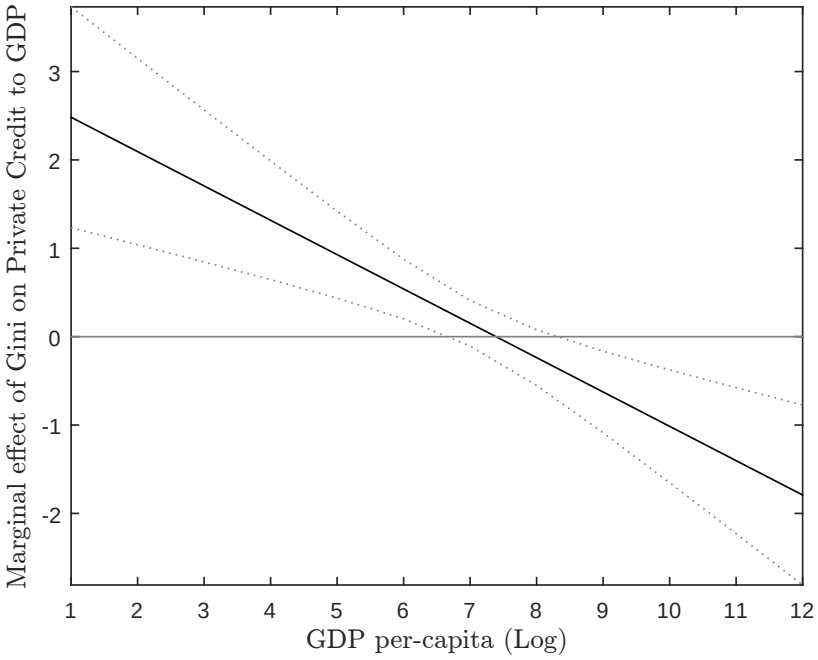

Figure 4: Marginal effect of 10% top income share on private credit to GDP conditional on the values of GDP per capita (in logs). The dotted lines are 95% confidence bands. This exercise was conducted using the results reported in column (4) of Table 2.

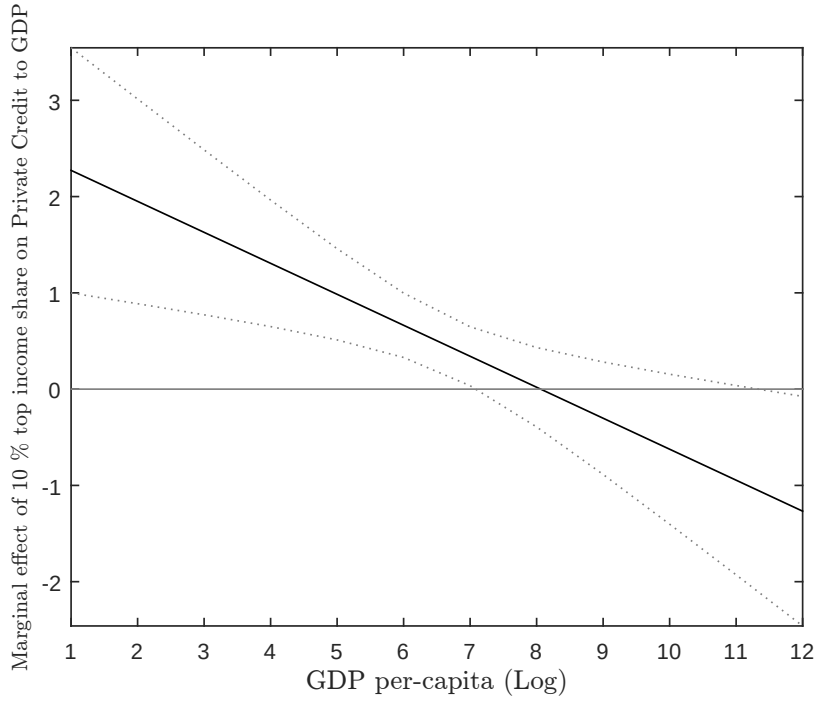

Figure 5: Marginal effect of the Gini index on private credit to GDP conditional on the values of the Legal Rights Index. The dotted lines are 95% confidence bands. This exercise was conducted using the results reported in column (2) of Table 2.

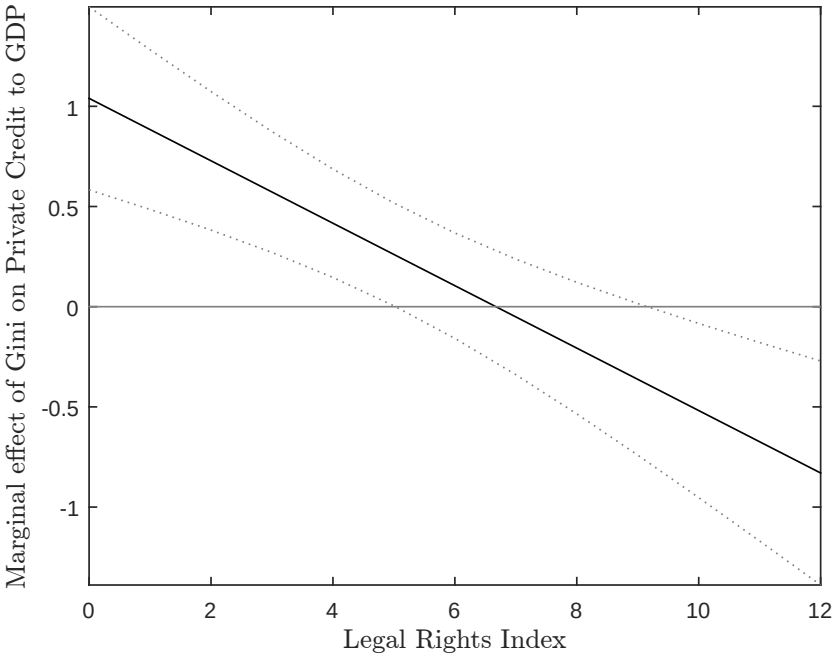

Figure 6: Marginal effect of the 10% top income share on private credit to GDP conditional on the values of the Legal Rights index. The dotted lines are 95% confidence bands. This exercise was conducted using the results reported in column (5) of Table 2.

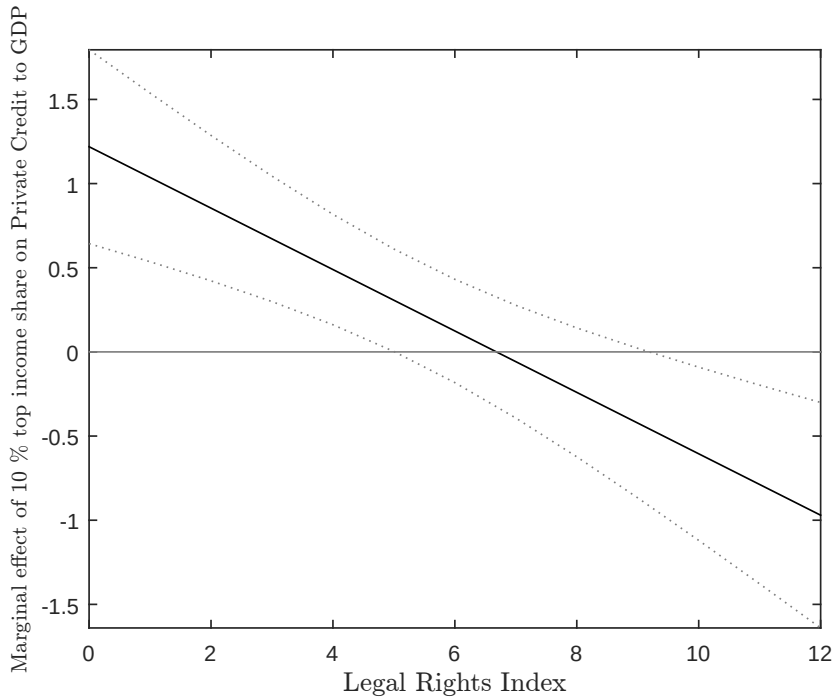

Table 1: Descriptive Statistics

VARIABLES	**Obs.**	**Mean**	**S.D.**	**Min.**	**Max.**
Private credit / GDP	1341	50.45	44.87	0	312.2
Gini	1341	39.72	9.978	16.23	74.33
10% top income share	1339	31.19	7.759	17.14	65
Log(GDP per capita)	1341	8.245	1.514	4.782	11.64
Legal rights index	1341	5.397	2.374	0	12
Log(Population)	1341	16.25	1.575	11.29	21.02
Log(Population density)	1337	4.028	1.170	0.392	7.090
Natural resources	1340	6.503	10.20	0	71.90
Inflation	1317	23.39	179.3	-10.07	4735
Manufacturing/GDP	1238	16.36	6.348	0.382	43.54
Growth GDP per capita	1335	2.710	4.511	-29.14	30.34
Sec./Prim. school enrollment	903	0.751	0.232	0.0780	1.134
Net interest margin	791	4.993	3.300	0.125	21.29
Ethnic fractionalization	1296	0.404	0.234	0	0.930
Linguistic fractionalization	1258	0.340	0.268	0.00800	0.923
Religious fractionalization	1290	0.398	0.214	0.00230	0.860
Legal Origin: Socialist	1294	0.270	0.444	0	1
Legal Origin: UK	1294	0.188	0.391	0	1
Legal Origin: German	1294	0.0263	0.160	0	1
Legal Origin: Scandinavian	1294	0.0471	0.212	0	1
Legal Origin: French	1294	0.469	0.499	0	1
Log(Settler mortality)	1182	2.322	2.385	0	7.986

Table 2: Inequality, Capital Constraints and Private Credit

Private credit to GDP	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Gini	2.281***	1.040***	2.607***			
	(0.640)	(0.233)	(0.641)			
10% top income share				2.594***	1.219***	3.036***
				(0.758)	(0.294)	(0.756)
Log(GDP per capita)	25.87***	15.16***	24.12***	24.84***	15.30***	23.44***
	(4.158)	(2.251)	(4.193)	(3.853)	(2.250)	(3.868)
Legal Rights Index	1.434***	7.569***	6.528***	1.411***	7.125***	6.350***
	(0.464)	(1.688)	(1.696)	(0.465)	(1.668)	(1.672)
Gini x Log(GDP per capita)	-0.286***		-0.239**			
	(0.0922)		(0.0933)			
Gini x Legal Rights Index		-0.156***	-0.128***			
		(0.0372)	(0.0376)			
10% top income share x Log(GDP per capita)				-0.322***		-0.275**
				(0.111)		(0.111)
10% top income share x Legal Rights Index					-0.182***	-0.156***
					(0.0463)	(0.0467)
Observations	1,341	1,341	1,341	1,342	1,342	1,342
R-squared	0.890	0.890	0.890	0.890	0.890	0.890
Country fixed effects	YES	YES	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES	YES	YES

Table 3: Instrumental Variables Estimation

Private credit to GDP	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Gini	4.979***	4.480***	7.651***	2.180***	1.257*
	(0.636)	(1.727)	(1.342)	(0.760)	(0.728)
Log(GDP per capita)	38.91***	32.05***	50.04***	-6.930	23.04***
	(4.096)	(6.753)	(5.413)	(5.740)	(2.675)
Legal Rights Index	7.767***	15.41***	3.817	7.213***	4.669
	(1.608)	(3.818)	(2.576)	(1.748)	(3.516)
Gini x Log(GDP per capita)	-0.608***	-0.442**	-0.950***	-0.152	-0.153**
	(0.0910)	(0.187)	(0.146)	(0.110)	(0.0713)
Gini x Legal Rights Index	-0.156***	-0.315***	-0.0226	-0.132***	0.0478
	(0.0360)	(0.0955)	(0.0611)	(0.0394)	(0.0844)
Observations	1,324	1,254	1,164	1,324	1,294
Adjusted R-squared	0.890	0.456	0.468	0.873	0.495
Instrument for Gini index: Statistic	YES	NO	NO	NO	NO
Instrument for Gini index: Fractionalization	NO	YES	NO	NO	NO
Instrument for Gini index: Log of Settler Mortality	NO	NO	YES	NO	NO
Instrument for Gini index: Residual variation	NO	NO	NO	YES	NO
Instrument for Legal Rights Index: Legal Origins	NO	NO	NO	NO	YES
Country fixed effects	YES	NO	NO	YES	NO
Time fixed effects	YES	YES	YES	YES	YES

Table 4: Sub-Samples by Region

	Excluding Africa				Excluding LAC			
Private credit to GDP	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Gini	2.817***	1.092***			0.741	0.911***		
	(0.834)	(0.280)			(0.782)	(0.328)		
10% top income share			3.589***	1.261***			0.994	1.076***
			(1.044)	(0.373)			(0.882)	(0.380)
Log(GDP per capita)	27.45***	14.81***	27.51***	14.91***	16.65***	13.77***	16.96***	13.87***
	(4.932)	(2.638)	(4.716)	(2.644)	(5.136)	(2.928)	(4.661)	(2.940)
Legal Rights Index	1.697***	7.915***	1.687***	7.349***	1.722***	6.782***	1.707***	6.272***
	(0.521)	(1.934)	(0.521)	(2.055)	(0.628)	(2.202)	(0.628)	(2.111)
Gini x Log(GDP per capita)	-0.343***				-0.0864			
	(0.114)				(0.116)			
Gini x Legal Rights Index		-0.162***				-0.141***		
		(0.0438)				(0.0545)		
10% top income share x Log(GDP per capita)			-0.431***				-0.114	
			(0.143)				(0.133)	
10% top income share x Legal Rights Index				-0.188***				-0.158**
				(0.0597)				(0.0633)
Observations	1,144	1,144	1,144	1,144	985	985	985	985
R-squared	0.880	0.880	0.880	0.880	0.904	0.905	0.905	0.904
Country fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES	YES	YES	YES	YES

Table 5: Sub-Samples by Income Level

	Low and Lower Middle Income Economies				Upper Middle and High Income Economies			
Private credit to GDP	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Gini	1.876**	0.500**			3.355***	1.200***		
	(0.728)	(0.241)			(1.076)	(0.401)		
10% top income share			2.270**	0.659**			4.153***	1.298**
			(0.904)	(0.268)			(1.316)	(0.536)
Log(GDP per capita)	30.02***	17.13***	29.71***	17.60***	28.00***	14.68***	27.30***	14.49***
	(5.144)	(2.577)	(5.152)	(2.532)	(5.902)	(3.010)	(5.466)	(3.019)
Legal Rights Index	2.720***	7.827***	2.651***	7.752***	0.692	7.236**	0.742	5.793*
	(0.583)	(1.934)	(0.584)	(1.810)	(0.794)	(3.251)	(0.800)	(3.423)
Gini x Log(GDP per capita)	-0.321***				-0.377***			
	(0.115)				(0.139)			
Gini x Legal Rights Index		-0.133***				-0.158**		
		(0.0418)				(0.0707)		
10% top income share x Log(GDP per capita)			-0.390***				-0.456***	
			(0.147)				(0.169)	
10% top income share x Legal Rights Index				-0.165***				-0.158
				(0.0475)				(0.0962)
Observations	435	435	436	436	906	906	906	906
Adjusted R-squared	0.822	0.823	0.822	0.824	0.878	0.877	0.878	0.877
Country fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES	YES	YES	YES	YES

Table 6: Additional Control Variables

Private credit to GDP	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Gini	3.479**	0.752**	3.530**			
	(1.577)	(0.371)	(1.574)			
10% top income share				3.534*	0.822**	3.545*
				(1.983)	(0.407)	(1.985)
Log(GDP per capita)	34.77***	20.24***	33.86***	31.46***	20.40***	30.99***
	(8.525)	(4.904)	(8.702)	(8.544)	(4.979)	(8.574)
Legal Rigths Index	1.502**	4.507**	3.477	1.382**	3.346	2.368
	(0.605)	(2.166)	(2.273)	(0.611)	(2.489)	(2.492)
Gini x Log(GDP per capita)	-0.400*		-0.373*			
	(0.209)		(0.217)			
Gini x Legal Rights Index		-0.0887*	-0.0526			
		(0.0515)	(0.0543)			
10% top income share x Log(GDP per capita)				-0.383		-0.366
				(0.262)		(0.264)
10% top income share x Legal Rights Index					-0.0742	-0.0331
					(0.0760)	(0.0746)
Log(Population)	-396.2***	-322.3***	-370.7***	-407.6***	-348.5***	-392.2***
	(111.4)	(117.3)	(113.7)	(115.5)	(123.6)	(120.7)
Log(Population density)	375.8***	294.6**	352.3***	385.7***	319.2***	371.3***
	(109.2)	(115.6)	(111.5)	(113.5)	(121.1)	(118.5)
Natural resources	-0.304**	-0.306**	-0.309**	-0.300**	-0.298**	-0.301**
	(0.121)	(0.120)	(0.120)	(0.118)	(0.120)	(0.118)
Inflation	0.0207	0.0501	0.0208	0.0268	0.0473	0.0269
	(0.0513)	(0.0499)	(0.0511)	(0.0501)	(0.0495)	(0.0500)
Manufacturing/GDP	-1.100**	-1.093**	-1.079**	-1.136**	-1.131**	-1.128**
	(0.524)	(0.527)	(0.527)	(0.528)	(0.529)	(0.530)
Growth GDP per capita	-0.670***	-0.736***	-0.664***	-0.691***	-0.741***	-0.686***
	(0.205)	(0.209)	(0.205)	(0.205)	(0.210)	(0.205)
Sec./Prim. school enrollment	-7.332	-10.24	-5.302	-6.390	-9.378	-5.437
	(17.25)	(17.89)	(17.93)	(17.35)	(18.07)	(18.18)
Net Interest Margin	-1.292***	-1.283**	-1.309***	-1.257**	-1.248**	-1.265**
	(0.498)	(0.502)	(0.497)	(0.498)	(0.501)	(0.497)
Observations	572	572	572	572	572	572
Adjusted R-squared	0.953	0.953	0.953	0.953	0.953	0.953
Country fixed effects	YES	YES	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES	YES	YES

Appendix

A Additional Tables

Table A.1: Description of Variables

Variable	Description	Source
Private credit / GDP	Domestic credit to private sector (% of GDP)	WDI (2015)
Gini	GINI index (World Bank estimate)	WDI (2015)
10% top income share	Income share held by highest 10%	WDI (2015)
Log(GDP per capita)	Log of GDP per capita (current US$)	WDI (2015)
Legal rights index	Index of collateral and bankruptcy laws protection of borrowers and lenders (0-12).	WDI (2015)
Log(Population)	Total Population (in number of people)	WDI (2015)
Log(Population density)	Population density (people per sq. km of land area)	WDI (2015)
Natural resources	Total natural resources rents (% of GDP)	WDI (2015)
Inflation	Inflation, consumer prices (annual %)	WDI (2015)
Manufacturing/GDP	Manufacturing, value added (% of GDP)	WDI (2015)
Growth GDP per capita	GDP growth (annual %)	WDI (2015)
Sec./Prim. school enrollment	School enrollment (% net), secondary to primary ratio	WDI (2015)
Net interest margin	Accounting value of bank's net interest revenue as a share of its interest-bearing (total earning) assets.	Financial Development and Structure (2013)
Ethnic fractionalization	Degree of ethnic fractionalization (0-1)	Alesina et al. (2003)
Linguistic fractionalization	Degree of linguistic fractionalization (0-1)	Alesina et al. (2003)
Religious fractionalization	Degree of religious fractionalization (0-1)	Alesina et al. (2003)
Legal origin: Socialist	Socialist legal origin	La Porta et al. (2008)
Legal origin: UK	British legal origin	La Porta et al. (2008)
Legal origin: German	German legal origin	La Porta et al. (2008)
Legal origin: Scandinavian	Scandinavian legal origin	La Porta et al. (2008)
Legal origin: French	French legal origin	La Porta et al. (2008)
Log of settler mortality	Log of historical European settler mortality	Acemoglu et al. (2001)

Table A.2: List of Countries in Sample

Africa	**Asia**		
Algeria	Afghanistan	Georgia	St. Lucia
Angola	Bangladesh	Germany	Suriname
Benin	Bhutan	Greece	Trinidad and Tobago
Botswana	Cambodia	Hungary	Uruguay
Burkina Faso	China	Iceland	Venezuela, RB
Burundi	India	Ireland	
Cabo Verde	Indonesia	Italy	**Northern America**
Cameroon	Iran, Islamic Rep.	Latvia	Canada
Central African Republic	Iraq	Lithuania	United States
Chad	Israel	Luxembourg	
Comoros	Japan	Macedonia, FYR	**Oceania**
Congo, Dem. Rep.	Jordan	Moldova	Australia
Congo, Rep.	Kazakhstan	Montenegro	Fiji
Cote d'Ivoire	Kyrgyz Republic	Netherlands	Micronesia, Fed. Sts.
Djibouti	Lao PDR	Norway	Papua New Guinea
Egypt, Arab Rep.	Malaysia	Poland	Samoa
Ethiopia	Maldives	Portugal	Solomon Islands
Gabon	Mongolia	Romania	Tonga
Gambia, The	Nepal	Serbia	Vanuatu
Ghana	Pakistan	Slovak Republic	
Guinea	Philippines	Slovenia	
Guinea-Bissau	Russian Federation	Spain	
Kenya	Sri Lanka	Sweden	
Lesotho	Syrian Arab Republic	Switzerland	
Liberia	Tajikistan	Ukraine	
Madagascar	Thailand	United Kingdom	
Malawi	Timor-Leste		
Mali	Turkey	**Latin America and the Caribbean**	
Mauritania	Vietnam	Argentina	
Mauritius	West Bank and Gaza	Belize	
Morocco	Yemen, Rep.	Bolivia	
Mozambique		Brazil	
Namibia	**Europe**	Chile	
Niger	Albania	Colombia	
Nigeria	Armenia	Costa Rica	
Rwanda	Austria	Dominican Republic	
Sao Tome and Principe	Azerbaijan	Ecuador	
Senegal	Belarus	El Salvador	
Seychelles	Belgium	Guatemala	
Sierra Leone	Bosnia and Herzegovina	Guyana	
South Africa	Bulgaria	Haiti	
Sudan	Croatia	Honduras	
Swaziland	Cyprus	Jamaica	
Tanzania	Czech Republic	Mexico	
Togo	Denmark	Nicaragua	
Tunisia	Estonia	Panama	
Uganda	Finland	Paraguay	
Zambia	France	Peru	

Table A.3: Instrumental Variables Estimation (10% top income share)

Private credit to GDP	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
10% top income share	6.161***	7.092***	9.670***	2.461***	2.060**
	(0.794)	(2.318)	(1.656)	(0.867)	(0.894)
Log(GDP per capita)	38.41***	36.03***	50.11***	-7.866	23.63***
	(3.927)	(7.278)	(5.322)	(5.281)	(2.744)
Legal Rights Index	8.211***	16.62***	3.865	7.070***	6.329*
	(1.621)	(4.060)	(2.592)	(1.714)	(3.345)
10% top income share x Log(GDP per capita)	-0.750***	-0.709***	-1.200***	-0.165	-0.213**
	(0.115)	(0.252)	(0.179)	(0.127)	(0.0922)
10% top income share x Legal Rights Index	-0.212***	-0.444***	-0.0291	-0.163***	0.00768
	(0.0461)	(0.130)	(0.0789)	(0.0487)	(0.103)
Observations	1,325	1,254	1,164	1,325	1,295
Adjusted R-squared	0.890	0.453	0.476	0.873	0.497
Instrument for 10% top income share: Statistic	YES	NO	NO	NO	NO
Instrument for 10% top income share: Fractionalization	NO	YES	NO	NO	NO
Instrument for 10% top income share: Log of Settler Mortality	NO	NO	YES	NO	NO
Instrument for GDP per capita: Statistic	NO	NO	NO	YES	NO
Instrument for Legal Rights Index: Legal Origins	NO	NO	NO	NO	YES
Country fixed effects	YES	NO	NO	YES	NO
Time fixed effects	YES	YES	YES	YES	YES

B Proofs

Lemma 1. *An improvement in the quality of laws that protect creditors or in the efficiency of bankruptcy procedures leads to a loosening of credit constraints,—i.e, $\hat{l}_t$ shifts left.*

Proof. From condition (6) and the fact that k_t is given at t we have:

$$\frac{\partial \hat{l}_t}{\partial \phi} = \frac{A_1(\phi, 1 - w_t \hat{l}_t)}{1 + \rho^* + A_2(\phi, 1 - w_t \hat{l}_t) - (\theta\kappa)^2 \gamma(\hat{l}_t) f''(k_{t+1})} < 0$$
$$\frac{\partial \hat{l}_t}{\partial v} = -\frac{(1-\theta)}{1 + \rho^* + A_2(\phi, 1 - w_t \hat{l}_t) - (\theta\kappa)^2 \gamma(\hat{l}_t) f''(k_{t+1})} < 0$$

□

Proposition 1. *Consider two countries,1 and 2, that are identical in all respects, except that the young of country 1 have an income distribution at t that is an MPS of that of country 2. If $w_t \hat{l}_t(\phi, v) >> w_t$, credit penetration and aggregate debt is higher in country 1 at t. The results are reversed if $w_t \hat{l}_t(\phi, v) << w_t$.*

Proof. We concentrate the proof on MPSs whose densities cross the original distribution only twice. It is easy to deal with the case of more crossings, but the proofs are more cumbersome. Since the average income remains unchanged after an MPS, we can obtain the effect of a labour redistribution on the interest variables and then scale the results in terms of income.

Let $\Gamma_1(l^z)$ be an MPS of $\Gamma(l^z)$ and define the convex combination as $\Gamma_\lambda = \lambda\Gamma_1 + (1-\lambda)\Gamma_0$. Differentiation of condition (6) with respect to λ leads to (income distribution of young agents at t does not impact w_t):

$$\frac{\partial \hat{l}_t}{\partial \lambda} = -(\theta\kappa)^2 \frac{f''(k_{t+1}) \frac{\partial \eta_t}{\partial \lambda}}{(1 + \rho + A_2) w_t} \tag{12}$$

Differentiation of credit penetration leads to:

$$\frac{\partial \eta_t}{\partial \lambda} = \Gamma_0(\hat{l}_t) - \Gamma_1(\hat{l}_t) - \gamma(\hat{l}_t) \frac{\partial \hat{l}_t}{\partial \lambda} \tag{13}$$

Thus, replacing condition (12), we obtain:

$$\frac{\partial \eta_t}{\partial \lambda} = \frac{\Gamma_0(\hat{l}_t) - \Gamma_1(\hat{l}_t)}{1 - (\theta\kappa)^2 \frac{f''(k_{t+1})\gamma(\hat{l}_t)}{(1+\rho+A_2) w_t}} \tag{14}$$

By definition of an MPS, if $\hat{l}_t > 1$, then $\Gamma_0(\hat{l}_t) - \Gamma_1(\hat{l}_t) > 0$. Since $f'' < 0$, the denominator of the RHS is positive, and, thus, $\frac{\partial \eta_t}{\partial \lambda} > 0$, and by substituting into (12), $\frac{\partial \hat{l}_t}{\partial \lambda} > 0$. With higher credit penetration, the future cost of capital falls $\frac{\partial p_{t+1}}{\partial \lambda} < 0$. Note that in the case of a reversed MPS (less inequality), we have $\frac{\partial \hat{l}_t}{\partial \lambda} > 0$, and it may be that $\hat{l}_t < 1$ for the economy with less inequality. In order to guarantee that this does not happen, we require that $\hat{l}_t >> 1$ (i.e., $w_t \hat{l}_t >> w_t$).

On the other hand, if $\hat{l}_t < 1$, then $\Gamma_0(\hat{l}_t) - \Gamma_1(\hat{l}_t) < 0$ and $\frac{\partial \eta_t}{\partial \lambda} < 0$, $\frac{\partial p_{t+1}}{\partial \lambda} > 0$ and $\frac{\partial \hat{l}_t}{\partial \lambda} < 0$. By the same arguments used in the paragraph above, we need to impose the condition $\hat{l}_t << 1$ to guarantee that the result is not overturned[17].

In the case of the result for debt, note that we can rewrite condition (9) as follows:

$$\mathscr{D}_t = (1 - \Gamma(\hat{l}_t)) - \int_{\hat{l}_t}^{l_{max}} w_t l^z \partial \Gamma(l^z) = (1 - \Gamma(\hat{l}_t)) + \int_0^{\hat{l}_t} w_t l^z \partial \Gamma(l^z) - w_t$$

Differentiating debt with respect to λ leads to:

$$\frac{\partial \mathscr{D}_t}{\partial \lambda} = \int_0^{\hat{l}_t} w_t l^z \partial(\Gamma_1 - \Gamma_0) + w_t \hat{l}_t \gamma(\hat{l}_t) \frac{\partial \hat{l}_t}{\partial \lambda} + \left(\Gamma_0(\hat{l}_t) - \Gamma_1(\hat{l}_t) - \gamma(\hat{l}_t) \frac{\partial \hat{l}_t}{\partial \lambda} \right) \tag{15}$$

Recall that we assumed that the MPS distributions cross at only two points l_1, l_2 and that $l_1 < 1 < l_2$. Assume first that $\hat{l}_t < l_1$. We have that $\frac{\partial \eta_t}{\partial \lambda} = \Gamma_0(\hat{l}_t) - \Gamma_1(\hat{l}_t) - \gamma(\hat{l}_t) \frac{\partial \hat{l}_t}{\partial \lambda} < 0$, so the last term in (15) is negative. In addition, we showed that $\frac{\partial \hat{l}_t}{\partial \lambda} < 0$, so the middle term is also negative. However, the first term is positive. When $\hat{l}_t < l_1$, an upper bound for (15) is:

$$\begin{aligned}
\frac{\partial \mathscr{D}_t}{\partial \lambda} &< -w_t \hat{l}_t \left[\Gamma_0(\hat{l}_t) - \Gamma_1(\hat{l}_t) - \gamma(\hat{l}_t) \frac{\partial \hat{l}_t}{\partial \lambda} \right] + \left(\Gamma_0(\hat{l}_t) - \Gamma_1(\hat{l}_t) - \gamma(\hat{l}_t) \frac{\partial \hat{l}_t}{\partial \lambda} \right) \\
&= [1 - w_t \hat{l}_t] \left(\Gamma_0(\hat{l}_t) - \Gamma_1(\hat{l}_t) - \gamma(\hat{l}_t) \frac{\partial \hat{l}_t}{\partial \lambda} \right) \\
&= \underbrace{[1 - w_t \hat{l}_t]}_{>0} \underbrace{\frac{\partial \eta_t}{\partial \lambda}}_{<0} \\
&< 0
\end{aligned}$$

Thus, when $\hat{l}_t < l_1$, more inequality leads to lower aggregate debt. When $\hat{l}_t \in (1, l_2)$, we obtain a positive

[17] Note that it could be the case that $\hat{l}_t = 0$ or $\hat{l}_t \to l_{max}$. In these particular cases an MPS may not have any affect on η_t, because $\Gamma_0(\hat{l}_t) - \Gamma_1(\hat{l}_t) = 0$. Nevertheless, based on the proof we present below, there still would exist an effect on aggregate debt.

lower bound using the logic of the first case:

$$\frac{\partial \mathscr{D}_t}{\partial \lambda} > \underbrace{[1 - w_t \hat{l}_t]}_{>0} \underbrace{\frac{\partial \eta_t}{\partial \lambda}}_{>0} > 0$$

When $\hat{l}_t \in (l_1, 1)$ or when $\hat{l}_t > l_2$ it is straightforward to see that is $\frac{\partial \mathscr{D}_t}{\partial \lambda}$ negative or positive, respectively.

We conclude that $\frac{\partial \mathscr{D}_t}{\partial \lambda} > 0$ if $\hat{l}_t > 1$ and that $\frac{\partial \mathscr{D}_t}{\partial \lambda} < 0$ if $\hat{l}_t < 1$. Note, finally, that since w_t is unchanged by the value of λ, these results can be expressed more conveniently in terms of the minimum income required to have access to credit, $w_t \hat{l}_t$. Additionally, this proof applies to a numerable crossing points.

□

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