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THE POLITICAL ECONOMY OF WEALTH AND INTEREST*

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We study the relationship between wealth redistribution and the allocation of firm-ownership. The economy's wealth distribution affects the equilibrium interest rate and the allocation of entrepreneurial rents when wealth determines agents' ability to borrow. This leads to an unconventional voting behaviour of the politically decisive middle class: the political preferences of middle and upper class voters coincide when redistribution only has an adverse interest-rate effect. Middle class voters vote with the lower class if redistribution gives access to entrepreneurial rents. Technology may strongly affect political outcomes. Greater inequality amplifies the interest-rate effect and may lead to less redistribution.

Many democracies are characterised by an unequal distribution of wealth.[1] The ownership of physical capital is particularly highly concentrated although redistribution of capital is an option available to voters politically. Why don't the poor take rich people's wealth? The conventional answer to this question points out that all agents take costly actions to reduce the burden of redistribution. As a consequence the base is eroded leaving fewer resources to be redistributed. [2] Thus redistribution may only yield relatively small benefits for the poor and middle class people who are supposed to benefit from it. At the same time these people pay part of the cost of distortionary taxation and tax avoidance. However, these adverse effects become less important the poorer these voters are, i.e. the more they rely on redistributive transfers. Hence, in more unequal societies the extent of political redistribution increases. This prediction in standard theory finds little support in recent empirical analysis. According to the data from cross-country analysis there is no such link between measures of inequality and measures of political redistribution.[3] Certainly, a theory that wants to explain limits to redistribution has to cope with the 'missing-link' phenomenon.

This article presents a unified explanation for both empirical observations: the limits to wealth redistribution and the missing link between inequality and redistribution. The connection between the wealth distribution and the economy's aggregate output

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[1] According to Wolff (1994), in 1983, the richest 1% of all US households owned 38% of the domestic wealth and 48% of net financial wealth. 84% of net financial wealth was concentrated in the hands of the top 5% of households. Similar figures hold for other industrialised countries as well, for example, see Lebergott (1976).

[2] For example, the redistribution of physical capital induces capital flight and distorts individual savings decisions. Politico-economic models that draw on the first effect are reviewed by Cremer *et al.* (1995); two papers that analyse the second effect are Persson and Tabellini (1994*a*, *b*).

[3] For example, Perotti (1996) finds the impact of inequality on redistribution to be statistically insignificant in a multi-country study.

lies at the core of our reasoning. A fundamental insight from the theory of corporate finance is that, generally, a firm's value is dependent on the way it is financed; for a survey of these issues see Harris and Raviv (1991). When capital markets are imperfect, a firm's ability and willingness to borrow depends on its owner's wealth. So, there exists a link between the personal wealth distribution, the allocation of entrepreneurial rents and firms' efficiency. Redistribution – or the reallocation of capital in general – changes agents' incentives to invest costly effort. As a consequence, redistribution of a given stock of capital changes the allocation of entrepreneurial rents (the rich may have to share them with the previously poor) and affects the economy's equilibrium interest rate.

In order to concentrate on the impact of capital redistribution on firm-ownership and incentives, we develop a formal framework in which the total amount of wealth is fixed and is not reduced by taxation. In such a framework it is a well-known result that resources are fully redistributed as long as median wealth is below average wealth. This changes in a world of asymmetric information where entrepreneurship is restricted to the richest agents. We provide conditions such that the moral hazard problem in production makes restricted capital redistribution politically desirable for a majority of voters. This happens when only agents who own more than average wealth become entrepreneurs. Then redistribution reduces the wealth of entrepreneurs so that they have to raise more funds on the capital market. With more external funds, entrepreneurial effort can only be made credible if interest payments to investors are reduced. This is why redistribution reduces the market return on investments. On the other hand redistribution provides better opportunities to agents who are initially excluded from entrepreneurship to become entrepreneurs. We call the first effect the *interest rate effect* and the second the *entrepreneurship effect* of redistribution. In this article we study how voters decide on redistribution when they take these two effects into account. Both effects may work in opposite directions and lead to an unconventional voting behaviour of the politically decisive middle class.

We find that the initial distribution of the capital stock and the available technology play a crucial role in determining whether the middle class's political preferences are aligned with either those of the upper or those of the lower class. If only the interest-rate-effect is at work, the middle class may own less than the average endowment and nevertheless oppose redistribution. If the entrepreneurship effect is also present, even middle class voters, who own more than the average endowment, vote in favour of redistribution. Whether or not the entrepreneurship effect exists depends on technological parameters. We show that technological change may induce dramatic changes in political outcomes and that greater inequality can lead to less redistribution. Moreover, inequality may reduce redistribution because a larger wealth gap between the entrepreneurial and the lower classes increases the interest-rate effect. Then inequality may be politically self-sustaining.

This article studies the political equilibrium in a fully specified model of the capital market with moral hazard in production. Our approach to the paradox of redistribution is closely related to Perotti's (1993) seminal work on inequality and growth. In Perotti's model agents can improve their future income by investing a fixed amount of wealth in human capital. These human capital investments are assumed to create positive spillovers in the future. Inequality may be politically sustainable if rich agents are the only ones who are able to invest initially and redistribution of wealth prevents any human capital investments. If the positive spillovers 'trickle-down' to the poor sturdily enough even the poor prefer the initial inequality to redistribution. Perotti's result depends crucially on the assumption of missing capital markets, because with capital markets the important trade-off that voters face disappears. Similar to Perotti's paper our model exhibits a threshold effect in investment and externalities. However, we derive the threshold level and the externalities endogenously as part of the capital market equilibrium. Another difference is that the amount of wealth in the economy is fixed in our model. We find that redistribution may be limited even if the total amount of wealth is not affected by taxation. Limits to redistribution partly arise due to the general equilibrium effects of wealth redistribution.

Alternative approaches to the paradox of redistribution can be found in recent papers by Benabou (2000), Corneo and Grüner (2000, 2002), Dalgaard *et al.* (2004), Galor *et al.* (2005), Piketty (1995) and Roemer (1998). Benabou's theory of unequal societies relies on two key assumptions. First, redistribution is assumed to generate efficiency gains, not losses as in the conventional approach. In his model redistribution of income serves as an imperfect substitute for missing capital markets and creates efficiency gains. Second, Benabou departs from the 'one man, one vote' assumption and assigns to the rich greater political power so that they can implement their preferred policy without gaining support of at least half of all agents. He then derives two equilibrium wealth distributions. One equilibrium is characterised by low inequality and a high degree of redistribution. In this equilibrium, even for the rich, the gains outweigh the direct losses of redistribution. The second equilibrium exhibits high inequality and a low degree of redistribution. In this equilibrium rich agents prefer to forgo the efficiency gains and they are sufficiently powerful to implement their preferred policy. Similarly to Benabou we find that the rich have to be sufficiently rich so that the equilibrium level of redistribution is low. In our article, this is due to the more pronounced interest-rate effect on middle class voters' income which makes them oppose redistributive policies. Dalgaard *et al.* (2003) develop a theory, and provide supporting evidence to their theory, that reconciles the standard theory, i.e., in more unequal societies there is more redistribution, with the data. See also Galor *et al.* (2005) for a theory about inequality and redistribution (via public schooling) that is consistent with the evidence.

This article studies the political equilibrium in a fully specified capital market with moral hazard in production. Related capital market models have been analysed by Banerjee and Newman (1991), Aghion and Bolton (1997), Galor and Moav (2004), Galor and Zeira (1993), and Piketty (1997). These authors investigate the dynamics of the wealth distribution and characterise its long-run equilibrium. Aghion and Bolton derive a unique stationary wealth distribution and show that permanent wealth redistribution improves production efficiency. However, they do not analyse whether this policy is supported by a majority of voters.

The article is organised as follows. Section 1 describes the basic features of our model and introduces the basic incentive problem. In Section 2 we derive optimal contracts in a partial equilibrium framework. Section 3 analyses the capital market equilibrium. Section 4 characterises agents' payoffs in an equal society and in Section 5 we finally analyse agents' preferences for redistribution. Section 6 concludes and outlines extensions.

1. The Model

Consider the following sequence of events. Agents are born with initial endowments of capital. These endowments can be changed by political action at date 0. At date 1 the capital market opens, agents either seek finance for risky investment projects or supply their initial endowments on the capital market. At date 2 investments' returns are realised and financial claims are settled.

1.1. *Agents and Endowments*

There is a continuum of agents of mass one. Agents are risk neutral, maximise date 2 income and differ only in their initial wealth w. Each agent belongs to one of three classes, $i = u,m$ or l. A fraction μ_i of all agents is endowed with wealth w_i with $w_u > w_m > w_l \geq 0$. Furthermore, no class constitutes a majority on its own. Let average wealth – which is equal to aggregate wealth – be denoted by $\bar{w}$.

Before the capital market opens agents vote on the level of a proportional wealth tax, taxes are collected and revenues are distributed among all agents via *per capita* grants. Given a wealth tax of $t \in [0,1]$,[4] an agent with initial wealth w_i owns $w_i(t) := (1-t)w_i + t\bar{w}$ units of capital afterwards.

1.2. *Technology*

All agents have access to the same technology. At date 1 each agent can invest in one project which requires an initial investment of $I > 0$ units of capital. We assume that no agent has wealth greater than I, so whoever wants to undertake the project has to approach investors for funds.

Each investment generates a risky financial return which can take one of the two values 0 or Y at date 2. This risk is idiosyncratic for each firm. There is no aggregate uncertainty and the probability distribution over output levels is determined by the entrepreneur's choice of effort. We use a simple moral hazard problem where the entrepreneur can choose privately between two effort levels; he can either work or shirk. By working hard the entrepreneur raises the probability of the high output Y from q to p. However, effort comes at a cost of B which is measured in monetary terms. Alternatively B can be thought of as a private benefit accruing to a shirking entrepreneur. We assume that

$$pY - B > qY. \tag{1}$$

Hence, working always generates a higher surplus than shirking even if private benefits are properly taken into account.

[4] Note that in this article political boundary solutions at $t = 0$ may obtain, i.e. the middle class may be willing to redistribute from the poor to the rich ($t < 0$) in order to increase the risk free lending rate on the capital market.

1.3. *Capital Markets*

An agent who sets up a firm is called an entrepreneur; an agent who provides funds to entrepreneurs is called an investor.[5] Since capital is scarce, i.e. $I \geq \bar{w}$ entrepreneurs compete for investors' funds in a capital market. In this market entrepreneurs and investors write financial contracts. Given our assumption of general risk-neutrality all contracts must yield the same expected return R to investors in equilibrium. We assume that the capital market is competitive such that all agents take the interest rate R as given. Depending on R agents decide whether to become investors or entrepreneurs. No agent can lend to or borrow from foreigners, so R is determined by equalising the desired capital market transactions of investors and entrepreneurs.

2. Financial Contracts

Entrepreneurs are protected by limited liability. Hence, they cannot end up with negative cash holdings at date 2. Agents' initial endowments, the use of credit and the output levels of the projects are observable and verifiable. An entrepreneur's effort is private information and contracts cannot be made contingent on it.

If effort were observable and verifiable an agent would prefer to become an entrepreneur and provide effort if profits are non-negative, i.e.

$$pY - B \geq RI. \tag{2}$$

Let $\bar{R} := (pY - B)/I$ denote the interest rate at which an agent is just indifferent between opening a high effort firm and investing I in the capital market. From inequality (1) we know that for all $R \leq \bar{R}$ an entrepreneur prefers effort to shirking if he can keep the entire surplus. An agent's optimal action for a given interest rate is simply:

Full-Information Financial Contracts:

(*i*) invest I units of capital and provide effort if $R \leq \bar{R}$ and

(*ii*) do not invest in the project otherwise but earn interest of R for each unit of initial wealth.

2.1. *Optimal Financial Contracts Under Moral Hazard*

Given that entrepreneurs choose their effort levels privately, financial contracts can only be made contingent on output. Let D_0 and D_Y denote investor's payments in the low and high output state, respectively. Investors have to take into account entrepreneurs' future opportunistic behaviour at the time financial contracts are written, i.e. financial contracts have to be incentive compatible.

For a given expected rate of return, an agent may choose one out of the following three alternatives:

[5] We will later show that it does not restrict generality to assume that agents become either investors or entrepreneurs, i.e. nobody can increase his payoffs by borrowing and lending at the same time.

(i) offer his or her initial endowment on the capital market,
(ii) borrow $I - w_i$ and offer a contract to investors which implements no effort, or
(iii) borrow $I - w_i$ and offer a contract which implements effort.

It is straightforward to show that it makes no difference whether the entrepreneur is allowed to borrow and lend simultaneously or forced into the above strategy. To see this, let an entrepreneur borrow more than he actually needs to finance his firm, say $I - w + w'$ with $w' > 0$ and call the new debt contract (payments to the bank) D'_Y and D'_0. The entrepreneur now invests w' in the capital market, earning a certain income Rw' which he can use as a collateral. The limited liability restrictions are: $D'_Y \leq Y + Rw'$ and $D'_0 \leq Rw'$. Instead of writing two contracts we can add the payments of each and get net-payments, e.g. in the high output state $D'_Y - Rw'$. Since the limited liability restrictions must also hold we conclude that these net-payments satisfy the same conditions as a pure borrowing contract.

For values of $R > \bar{R}$ all agents supply their initial endowment on the capital market. Among the class of contracts that implement effort the optimal one solves the following problem:

s.t.
$$\max_{D_0, D_Y} p(Y - D_Y) - (1 - p)D_0 - B \tag{3}$$

$$p(Y - D_Y) - (1 - p)D_0 - B \geq q(Y - D_Y) - (1 - q)D_0 \tag{4}$$

$$pD_Y + (1 - p)D_0 \geq R(I - w_i) \tag{5}$$

$$D_0 \leq 0 \tag{6}$$

$$D_Y \leq Y. \tag{7}$$

Inequality (4) is the incentive constraint; inequality (5) ensures that investors earn at least their outside option if the entrepreneur puts his entire wealth w_i in his enterprise. Inequalities (6) and (7) are then the limited liability restrictions for both output levels.

Effort can only be implemented if the set of contracts which satisfy the restrictions (4) to (7) is not empty. It is straightforward to show that if it is nonempty, then an optimal contract sets $D_0 = 0$ and $D_Y = R(I - w_i)/p$.[6] By substituting this particular contract into the incentive constraint we obtain the following crucial link between the entrepreneur's wealth w_i and the interest rate R:

$$w_i \geq \omega(R) := I - \frac{A}{R} \tag{8}$$

with $A := p[Y - B/(p - q)]$. So, if and only if $w_i \geq \omega(R)$ effort can be implemented. Since working is efficient, $A > 0$ and hence, $\omega(R)$ is a strictly increasing concave function. An entrepreneur can only credibly commit to providing effort if he owns at least $\omega(R)$. If the entrepreneur's endowment is less than this value he has to pay back $R(I - w_i)/q$ units of capital in the high output state. It follows from inequality (1) that an

[6] To see this, take one optimal contract with $D_0 < 0$. For every optimal contract the investors' participation constraint (5) is binding. Then it is straightforward to verify that the contract ($D_0 = 0$, $D_Y = R/p(I - w_i)$) also satisfies the incentive constraint. Since this contract satisfies the investors' participation constraint strictly – by construction – both contract yield the same entrepreneurial payoff.

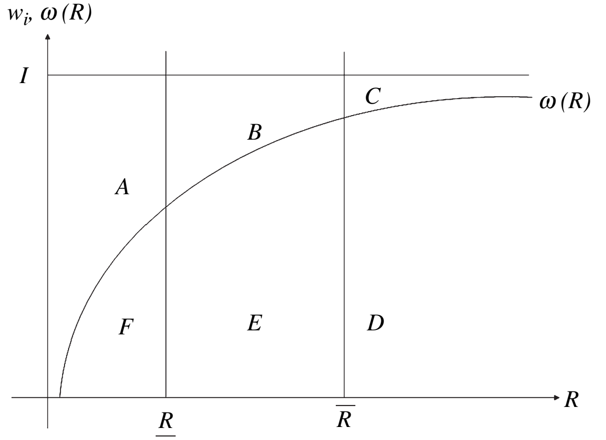

Fig. 1. *Individual Decision*

entrepreneur prefers a contract which implements effort to one which does not. Furthermore, for interest rates $R < \bar{R}$ a high-effort firm yields higher expected income than supplying initial endowments to the capital market. If $w_i < \omega(R)$ an agent can either open a low effort firm or invest in the capital market. He prefers the former to the latter if

$$qY \geq RI. \tag{9}$$

Let $\underline{R} := qY/I$ denote the highest risk-free interest rate such that shirking entrepreneurs earn at least as much as their opportunity cost of capital.[7] Then, an agent's optimal choice is characterised in:

LEMMA 1. *For a given risk-free interest rate R the solution of the individual contracting problem has the following properties:*

(*i*) *For $R > \bar{R}$ agents do not open firms;*
(*ii*) *for $\underline{R} < R \leq \bar{R}$ those agents with wealth of at least $\omega(R)$ open firms and all others are forced to become investors;*
(*iii*) *for $R < \underline{R}$ those agents with wealth of at least $\omega(R)$ borrow at a rate of R/p and all others at a rate of R/q.*

Proof. This follows directly from $w(R)$ and the definition of $\underline{R}$ and $\bar{R}$.

Figure 1 illustrates Lemma 1: for a given R agents with wealth above $\omega(R)$ can borrow at a rate of R/p (areas A and B). Agents with less wealth either do not borrow (area E) or borrow at a rate of R/q (area F). In area E, investment projects that are profitable under full information are not undertaken. For interest rates above $\bar{R}$ (region C and D) no agent opens a firm. In areas A, B, and F entrepreneurs earn at least their outside option and generally strictly more.

[7] Throughout the article we assume that agents who do not own any endowments strictly prefer shirking to working.

3. Capital Market Equilibrium

We now turn the capital market equilibrium. As a first step we derive gross aggregate supply and demand. Capital supply is fixed and equal to the average capital endowment $\bar{w}$. Aggregate capital demand $D(R)$ is the sum of all initial investments that entrepreneurs wish to undertake at interest rate R. Using Lemma 1, $D(R)$ can be derived in two steps. First note that agents of class i can credibly commit to effort if $w_i \geq \omega(R)$. Let

$$\mu(R) = \begin{cases} 0 & \text{if } w_u < \omega(R) \\ \mu_u & \text{if } w_m < \omega(R) \leq w_u \\ \mu_u + \mu_m & \text{if } w_l < \omega(R) \leq w_m \\ 1 & \text{if } \omega(R) \leq w_l \end{cases} \tag{10}$$

be the mass of individuals for whom the incentive constraint holds at interest rate R. For interest rates $R > \bar{R}$ those agents who can commit to effort at this interest rate strictly prefer to put their wealth on the capital market. This corresponds to area C in Figure 1. If $R < \underline{R}$ even those agents who cannot commit to effort strictly prefer entrepreneurship to the capital market (area D). Hence, aggregate capital demand is

$$D(R) = \begin{cases} 0 & \text{if } \bar{R} < R \\ \mu(R)I & \text{if } \underline{R} < R < \bar{R} \\ I & \text{if } R < \underline{R} \end{cases} \tag{11}$$

At the interest rate $\bar{R}$ agents who can commit to effort are indifferent between having an effort firm or becoming investors on the capital market, so $D(\bar{R}) \in [0, \mu(\bar{R})I]$. At $\underline{R}$ agents who can only have shirking firms are indifferent between this option and investment on the capital market whereas all those agents who can commit to effort strictly prefer to open firms, so $D(\underline{R}) \in [\mu(\underline{R})I, I]$. We know from the construction of capital demand that this demand correspondence might exhibit points of discontinuity. This is why we use the following equilibrium concept:

DEFINITION 1. *A capital market equilibrium is a rate of return R^*, a share of entrepreneurs α_i from each class and a contract c(i) for each entrepreneur in class i, such that:*

(*i*) $\sum \alpha_i \mu_i = \bar{w}/I$.
(*ii*) *Each entrepreneur prefers entrepreneurship with contract $c(i)$ to investment.*
(*iii*) *At the equilibrium rate of return R^* there does not exist another contract $c'(i) \neq c(i)$ which yields strictly higher entrepreneurial profits for agents in class i.*
(*iv*) *Each investor either*
   (*a*) *strictly prefers investment to entrepreneurship or*
   (*b*) *strictly prefers entrepreneurship to investment but cannot offer a contract that provides investors with a higher expected return than R^*.*

Condition 4 permits credit rationing. Some agents may not get credit althought they would be willing to accept current market contracts. In such cases condition 4 requires that they can not underbid their rival bidders. This condition implies that only members of that class are rationed who have the smallest wealth among all entrepreneurs. In equilibrium the incentive constraint is binding for this particular class. If an agent with higher wealth were credit rationed he could always offer a slightly more favourable contract to creditors without violating his incentive constraint. Hence, in equilibrium all agents who are richer than rationed agents are entrepreneurs, those who are poorer become investors. So at the equilibrium interest rate R^* the following conditions must hold:

(i) $D(R^*) \geq \bar{w}$ and
(ii) if $D(R^*) > \bar{w}$, then $D(R) < \bar{w}$ for all $R > R^*$.

We assume that the probability to open a firm is the same for all members of a rationed class. The following Lemma characterises the equilibrium interest rate of the economy:

LEMMA 2. *In equilibrium the number of firms is* $\bar{w}/I < 1$. *If the richest* $\bar{w}/I$ *agents own more than* $\omega(\bar{R})$ *each, then* $R^* = \bar{R}$. *Otherwise* $R^* = \max\{\omega^{-1}(w_i), \underline{R}\}$, *where the* $\bar{w}/I$ *th position in the wealth ranking lies within class i.*

Proof. The proof follows directly from the definition of the demand correspondence and the equilibrium definition.

As an illustration and for further reference we characterise all equilibria of our leading case in which the aggregate capital endowment is so small that not all rich agents can become entrepreneurs,[8] i.e. the case in which the gross capital demanded by all upper class members would exhaust total wealth, $\mu_u I > \bar{w}$. Three types of equilibria can exist: if $w_u > \omega(\bar{R})$ the equilibrium interest rate is $\bar{R} = (pY - B)/I$, and upper class agents do not earn entrepreneurial rents. If $\omega(\underline{R}) < w_u \leq \omega(\bar{R})$, the equilibrium interest rate is such that upper class entrepreneurs are just willing to provide effort, $R^* = \omega^{-1}(w_u)$. There is credit rationing among upper class members since they strictly prefer entrepreneurship to becoming investors. If $w_u < \omega(\underline{R})$, the risk free rate is $\underline{R} = qY/I$ and even the upper class cannot commit to effort and nobody earns rents. For the rest of this article we do not consider the first type of equilibrium but focus on the latter two instead.

Note that the capital market equilibrium is very different in an economy with symmetric information. Since effort is contractible, only investors' participation constraints are binding. Then the unique equilibrium interest rate is $\bar{R}$ and all entrepreneurs provide effort which is the first-best allocation of capital and effort. At this interest rate all firms make zero profits and entrepreneurs as well as investors cannot increase their income by switching occupations. Obviously, this equilibrium is independent of the initial wealth distribution contrary to market equilibria with private information in which R^* does depend on the distribution of wealth.

4. The Impact of Redistribution

In a full-information world redistribution changes initial endowments only. Hence, voters' preferences are single peaked at the tax rates $t = 0$ or $t = 1$ depending on their

[8] We restrict our analysis to this case because it contains all the effects that drive our results.

wealth level, and full redistribution obtains if and only if median wealth is less than average wealth. Under moral hazard, redistribution has two additional effects on agents' income which may change the political equilibrium contrary to conventional wisdom. These are

(*i*) an interest-rate-effect on agents' income and
(*ii*) an entrepreneurship-effect on the allocation of rents.

These effects lead to fundamentally different political outcomes depending upon the aggregate endowment of the economy.

Again, we use our leading case to discuss the interest rate effect. Note, that in this case a fraction of the upper class is credit rationed and that the equilibrium interest rate is a function of upper class wealth, namely $R^*(w_u) = \max\{\underline{R}, \omega^{-1}(w_u)\}$. Since the upper class owns more than average wealth its after tax income decreases in *t*. As a consequence the equilibrium interest rate is nonincreasing in the tax rate and it is strictly decreasing as long as $\underline{R} < \omega^{-1}[w_u(t)]$. Then a reduction of w_u violates the incentive constraint, reduces capital demand D(R), and the capital market does not clear. Upper class members can commit to effort only at lower interest rates. The equilibrium interest rate must be lower.

In addition to this interest-rate-effect full redistribution changes the access to entrepreneurship and associated rents. This matters to voters only if entrepreneurs earn strictly positive profits. Whether full redistribution eliminates entrepreneurial profits depends upon the economy's total capital endowment. We call an economy 'capital poor' if an agent, who is endowed with average wealth $\bar{w}$, cannot credibly commit to effort for interest rates larger than $\underline{R}$. Formally, in a capital-poor economy we have $\bar{w} < \omega(\underline{R})$. In such an economy full redistribution destroys everybody's incentives to provide costly effort and rents do not exist. Otherwise we call an economy 'capital rich'. In such an economy everybody can commit to effort after full redistribution. The following Lemma characterises the entrepreneurship-effect of full redistribution.

LEMMA 3. *After full redistribution all agent's income is*

(*i*) $\bar{w}\underline{R}$ *in a capital-poor economy and*
(*ii*) $\bar{w}\bar{R}$ *in a capital-rich economy.*

Proof. (*i*) After full redistribution, everybody's wealth is $\bar{w}$. A fraction $\bar{w}/I$ of individuals becomes entrepreneur. The interest rate is $\underline{R}$, firms' profits are zero and agents are indifferent between opening a low-effort firm and investing in the capital market.

(*ii*) After full redistribution, the interest rate is $\omega^{-1}(\bar{w})$. The expected income of the $\bar{w}/I$ entrepreneurs is

$$y^{entr.} = p\left[Y - \frac{\omega^{-1}(\bar{w})}{p}(I - \bar{w})\right] - B. \tag{12}$$

An investor's income is $y^{inv.} = \omega^{-1}(\bar{w})\bar{w}$. The expected income before rationing is therefore: $\bar{w}/I \; y^{entr.} + (1 - \bar{w}/I) \; y^{inv.} = \bar{w}\bar{R}$.

In a capital-rich economy full redistribution gives middle and lower-class agents access to entrepreneurial rents. We call the corresponding income increase the entrepreneurship-effect of redistribution. It amounts to

$$\bar{w}[\bar{R} - \omega^{-1}(\bar{w})]. \tag{13}$$

5. Political Equilibrium

In order to derive the political equilibrium of the economy it is necessary to determine the political preferences of all three classes. When deciding on the tax rate t at date 0 voters maximise their expected date 2 income and take into account the ensuing capital market equilibrium. We concentrate on the case where at $t = 0$ only a fraction of the upper class agents are entrepreneurs[9] and redistribution evokes an interest rate effect, i.e. $\omega(\underline{R}) \leq w_u \leq \omega(\bar{R})$. We have:

PROPOSITION 1. *Upper class preferences are single peaked at* $t = 0$, *lower class preferences are single peaked at* $t = 1$. *Hence the middle class is politically decisive, i.e. the middle class's preferred tax rate is the unique Condorcet winner.*

Proof. See Appendix.

5.1. *Limits to Redistribution*

What tax rate does a middle class voter prefer? In a capital-poor economy redistribution from the rich to the poor lowers the rate of return for all investors. The more the middle class owns before taxation, the lower are the direct gains from redistribution. If middle class wealth is sufficiently close to average wealth the negative interest-rate-effect of redistribution outweighs the wealth gain. So middle class's preferences are aligned with the upper class's political position even though the middle class owns less than average wealth. We have:

PROPOSITION 2. *Consider a capital-poor economy with average wealth* $\bar{w}$ *and with three classes of given size* $\mu_i, i = u, m, l$. *Given* w_l *there always exists a minimum middle class wealth* $\omega_{min} < \bar{\omega}$ *such that*

(*i*) *for all* $w_m \geq w_{min}$ *the equilibrium tax rate is zero and*
(*ii*) *for all* $w_m < w_{min}$ *the equilibrium tax rate is one.*

Proof. See Appendix.

For low tax rates, middle class income is subject to a positive wealth and a negative interest rate effect of redistribution. The interest rate effect dominates when middle class wealth is not too far away from the average wealth $\bar{w}$. In such cases middle class

[9] Cases in which poorer agents are entrepreneurs in equilibrium is discussed at the end of the Section.

income declines with the tax rate. When tax rates are high, production becomes inefficient and the risk free rate remains at $\underline{R}$. Further redistribution only has a positive wealth effect. Consequently, the middle class income has two local maxima, at $t = 0$ and at $t = 1$.

An important implication of our model is that a minimum degree of inequality may be required to stabilise the wealth distribution politically. More inequality implies that the equilibrium rate of return increases. If the difference between the rates of return before redistribution and after redistribution ($\omega^{-1}(\bar{w})$ and $\underline{R}$) is large enough for the interest rate effect to dominate the wealth effect then redistribution does not occur. We analyze this effect considering two alternative measures of initial inequality.[10]

Taking middle class wealth w_m, average wealth $\bar{w}$ and the shares μ_i as given a natural measure of inequality is the difference between upper and lower class wealth, $w_u - w_l$. The upper class must be sufficiently rich so that the middle class opposes redistribution. This is shown formally in:

Proposition 3. *Take middle class wealth w_m, average wealth $\bar{w}$ and the shares μ_i as given. In a capital-poor economy redistribution decreases with the amount of inequality as measured by $w_u - w_l$.*

Proof. See Appendix.

The intuition for this result is as follows. More inequality as measured by $w_u - w_l$ is associated with a higher upper class wealth. This means that the interest rate without redistribution is higher and the interest rate effect of redistribution is more pronounced.

The interest-rate effect is also at work if we consider mean preserving spreads of a given wealth distribution (w_u^0, w_m^0, w_l^0). Such a mean preserving spread can be constructed by fixing $w_i = (1 - z)w_i^0 + z\bar{w}$ with $z \in [0,1]$. The distance between average and median wealth decreases with z and smaller values of z characterise more unequal societies.

Proposition 4. *Consider a capital-poor economy with a parameterised wealth distribution $w_i(z) = (1 - z)w_i^0 + z\bar{w}$ with mean $\bar{w}$, where (i) $w_m^0 < \bar{w}$ and (ii) the original distribution (w_u^0, w_m^0, w_l^0) is such that no redistribution occurs. The equilibrium tax rate increases with equality as measured by z.*

Proof. See Appendix.

Note, that in Proposition 4 more inequality is associated with a poorer median voter and – at the same time – with a lower redistributive tax rate. This challenges the conventional politico-economic wisdom that a lower median income or wealth level should lead to more political redistribution. Recent empirical analyses have shown that

[10] There are many different measures of inequality. It should be noted that – from Proposition 2 we have that inequality as measured by $w_m - \bar{w}$ increases redistribution. Hence, the link between ineqaulity and redistribution depends upon the measure of inequality considered.

the standard view of inequality and redistribution is hardly supported by the data.[11] Our analysis may therefore contribute to explain why measures of inequality need not be related to political redistribution.[12]

5.2. *Comparative Statics*

The political equilibrium of capital rich economies differs substantially from that of capital poor economies. Full redistribution destroys entrepreneurial rents in a capital-poor but not in a capital-rich economy. This may alter middle class voters' political attitudes dramatically. In a capital rich economy, the moral hazard problem makes (full) redistribution desirable for middle class voters because this is their only chance of gaining access to entrepreneurial rents. So in contrast to a capital poor economy the middle class must own more than average wealth in order to oppose redistribution.

PROPOSITION 5. *Consider a capital-rich economy where the upper class determines the interest rate. Let* $\bar{w}$, w_u *and* μ_i *be given. Either there exists a minimum middle class wealth* w_{min} *with* $w_u > w_{min} > \bar{w}$ *such that*

(*i*) *for all* $w_m < w_{min}$ *the equilibrium tax rate is one and*
(*ii*) *for all* $w_m > w_{min}$ *the equilibrium tax rate is zero, or full redistribution always occurs.*

Proof. See Appendix.

Our definition of capital-poorness relies on the aggregate capital endowment and on technological parameters; an economy is capital-rich if $\bar{w} \geq \omega(\underline{R})$ or equivalently

$$\frac{\bar{w}}{I} \geq \kappa(Y, B, p, q) := 1 - \frac{p}{q}\left(1 - \frac{1}{p-q}\frac{B}{Y}\right). \tag{14}$$

Hence, only if the relative capital endowment $\bar{w}/I$ is small, do the political preferences of the middle class and the upper class coincide. It is an important feature of our model that not only the distribution of endowments but also technology affects the political outcome. Note that $\partial\kappa/\partial Y < 0$, $\partial\kappa/\partial p < 0$ $\partial\kappa/\partial q > 0$ and $\partial\kappa/\partial B > 0$. Given the relative endowment with capital a change of one of these parameters may turn a formerly capital poor into a capital rich economy. All changes that relax entrepreneurs' incentive problems make redistribution more likely. An increase of Y – interpreted as technological progress – may lead to more redistribution. The same holds for any changes that make entrepreneurial effort relatively more productive. An increase in the relative size of investment projects $I/\bar{w}$ by contrast may lead to a more conservative policy.

[11] See, e.g. Perotti (1996), who in a multi-country study finds the impact of inequality on political redistribution to be statistically insignificant.

[12] Note that our analysis suggests that the difference between median and mean wealth should increase redistribution. However, increased upper class wealth should reduce redistribution. The link between inequality and redistribution therefore depends upon the measure of inequality that is used.

Finally, a decrease of B also relaxes the incentive problem. One can interpret this parameter as a measure of capital market imperfection. If we follow the view that B is a private benefit accruing to a shirking entrepreneur, then any institutional change that leads to improved supervision of entrepreneurs reduces B. Obviously, as B vanishes the moral hazard problem in financial contracting disappears and the full-information political equilibrium obtains.[13]

5.3. *Social Welfare and the Efficiency of the Political Equilibrium*

In capital market models with moral hazard the traditional aggregation result does not hold, i.e. the economy's total output is not invariant with respect to the underlying distribution of wealth. In the present model, in which we assumed that all agents are risk-neutral, social welfare is maximised if and only if production in all firms is efficient. In a capital poor economy, inequality is needed to guarantee efficient production, while, in a capital rich economy, too much inequality leads to an inefficient equilibrium.

The political equilibrium of our model need not be efficient. This becomes obvious when we consider the redistribution of assets that may obtain in a capital poor economy. When the middle class is sufficiently poor it prefers redistribution and inefficient production to an unequal outcome with efficient production. In a capital rich economy the political equilibrium is instead always efficient.

6. Discussion

Politico-economic theory usually explains limits to redistribution with reference to the adverse effect of taxation on the size of the tax base. This article shows that an unequal wealth distribution may be politically stable even in a world where the size of the tax base remains unaffected by policy. With imperfect capital markets, redistribution of initial endowments reduces the ability of the rich to commit credibly to providing effort. Financial contracts must offer better conditions (lower interest rates) in order to induce the rich to effectively work as entrepreneurs. This has a negative impact on the income of investors.

We have derived conditions such that this effect prevents full redistribution in a democracy. Limits to redistribution require the existence of a large enough middle class endowed with a sufficient amount of wealth. Moreover, it must be guaranteed that there is no incentive for middle class agents to become entrepreneurs themselves. Middle class agents can become entrepreneurs if redistribution makes them

[13] For the sake of completeness we sketch the political equilibrium of economies where either the middle or lower class is credit rationed and determines the interest rate. First consider an economy where middle class agents' wealth sets the interest rate. In a capital poor economy the middle class prefers $t = 0$ to all other tax rates if and only $w_m > \bar{w}$ and it is straightforward to show that the upper class always prefers zero redistribution. Only if $w_m < \bar{w}$ full redistribution obtains. In a capital rich economy by contrast, the share of middle class members who have a firm at $t < 1$ is of crucial importance. If this share is sufficiently large, then the middle class opposes redistribution because at $t = 1$ they lose entrepreneurial rents to part of the lower class. Finally, in a capital rich economy where the poor determine the interest rate, the middle class accepts redistribution only if they own less than $\bar{w}$. Unlike the previous cases redistribution occurs up to the point at which lower class members are sufficiently wealthy to guarantee efficient production. Beyond this level the positive interest-rate effect reduces middle class income again.

competitive on the capital market. In a capital poor economy – where productive efficiency breaks down after redistribution – middle class voters are not interested in entrepreneurship. Since they benefit from high interest rates they support low redistribution. In a capital rich economy – where efficiency is maintained even at high tax rate – middle class members use redistribution of wealth as a mean of gaining access to entrepreneurial rents. Whether an economy with a given capital endowment is capital poor or rich depends on the characteristics of the available technology. Technology changes may therefore lead to significant changes in the political attitudes of the middle class and may dramatically change political outcomes.

We have finally shown that more inequality need not imply more redistribution. In our model inequality is politically self-sustaining because in an unequal society the negative interest rate effect is more pronounced.

This article may serve as a stepping stone for further theoretical and empirical work. Natural extensions on the theoretical side include:

(1) The study of different degrees of the development of the financial system. Our model does not consider the existence of financial intermediation and banks except in a very rudimentary way. A more detailed analysis will help to understand better how the organisation of capital markets affects political outcomes.
(2) The normative analysis of initial wealth distributions. It would be interesting to turn our positive analysis into a normative one, i.e. one that studies welfare maximising distributions of resources in an economy.[14]
(3) A richer intertemporal structure where voters take potential changes in the technological development into account.

On the empirical side it would be useful to test whether the middle class's voting behaviour varies with technological data – such as mean firm size, the economy's relative capital endowment, or the development of financial markets. Similarly, the importance of capital income for the middle class should play a role in shaping individuals' preferences for political redistribution. Moreover, the median voter should have less incentives to redistribute income or wealth in economies with a larger entrepreneurial sector. This should in particular be the case when small or medium enterprises (SMEs) such as the ones considered in our model play a major role in the economy. Figure 2 relates OECD and European data on the importance of SMEs with a measure of income inequality. Accordingly most of the very unequal OECD societies produce more than half of their output in SMEs. The positive relationship is significant for the European countries. Such a positive relationship is consistent with our prediction that the median voter opts for more ineqality in more entrepreneurial societies. Finally, according to our analysis risk free interest rates should react to the extend of wealth inequality; see Grüner (2001, 2003) for a discussion. Further empirical research along these lines can help to understand the role of inequality for the functioning of capital markets and political outcomes better.

[14] See Grüner (2003) for such an exercise in an adverse selection plus moral hazard environment with a different interest rate effect of wealth redistribution.

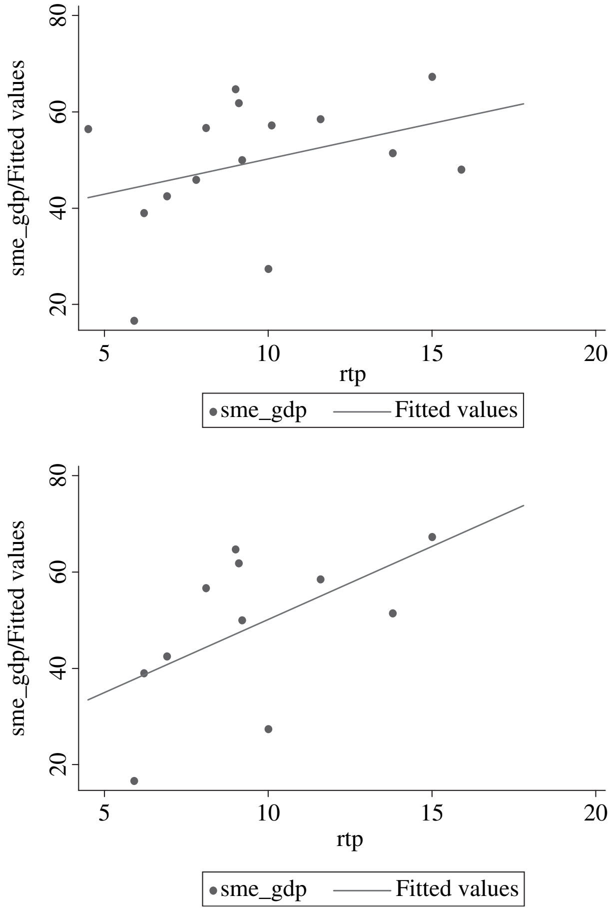

Fig. 2. *Relative SME Output and Inequality.*
The relation between the relative output in SMEs and a measure of economic inequality in OECD countries and in the European subset (*DEN, FRN, GER, GRC, ITA, LUX, NET, PRT, SLO, SPA, SWE, UK*). The relation for Europe is significant at a 7.4% level.
Variables: sme_gpd: SME sector's contribution to GDP by using the official country definition of SME.
Source: 'Small and Medium Enterprises across the Globe: A New Database' by M. Ayyagari, T. Beck and A. Demirgüç-Kunt, August 2003, World Bank.
Inequality measure: rtp: ratio richest 10% to poorest 10%.
Source: Human Development Report 2005 by UNDP Statistics Table 15.

Appendix

A.1. Proof of Proposition 1

Step 1: Single peakedness of upper class preferences.

In a capital-poor economy, there exists a tax rate $t^+ < 1$ above which production becomes inefficient. Formally t^+ solves $w_u(t^+) = \omega(\underline{R})$. The equilibrium rate of return R^* is determined by $\omega(R) = w_u$ for all $t \in [0,t^+]$ and is $R^* = \underline{R}$ for all $t \in [t^+,1]$. Entrepreneurs are indifferent between all $t \in [0,t^+]$. An entrepreneur's income is:

$$y_u^{entr.} = p\left\{Y - \frac{R^*[w_u(t)]}{p}[I - w_u(t)]\right\} - B. \tag{15}$$

Since $R^*[w_u(t)] = A/[I-w_u(t)]$, we have $y_u^{entr.} = pY - A - B$ which is independent of *t*. On the interval $[t^+,1]$ preferences of entrepreneurs are single peaked at t^+.

Preferences of agents who do not obtain credit in the credit market are single peaked with a maximum at $t = 0$. This follows from the definition of $y_u^{inv.}(t) = R^*[w_u(t)]w_u(t)$ and the fact that $R^*(t)$ is in non-increasing and $w_u(t)$ is strictly decreasing on [0,1]. Since voting over *t* takes place before capital markets open, members of class *i* prefer that *t* that maximises *ex ante* expected income:

$$\alpha y_i^{entr.}(t) + (1-\alpha)y_i^{inv.}(t). \tag{16}$$

This expression is maximised at $t = 0$ and decreases with *t*.

Step 2: Single peakedness of lower class preferences.

Two countervailing effects determine the political preferences of the lower class: the positive wealth and the negative interest rate effect of redistribution. The wealth effect must dominate the interest rate effect for all tax rates in order to verify single peakedness at $t = 1$. Given w_u, $\bar{w}$ and the μ_i lower class wealth cannot exceed $\tilde{w} := (\bar{w} - \mu_u w_u)/(1-\mu_u)$. We write the corresponding income as $\tilde{y}(t) = R[w_u(t)]\tilde{w}(t)$. It is useful to think of $\tilde{y}(t)$ as the lower class income in a two class society. Since $\tilde{w}(t) > w_l(t)$ for all $t \in [0,1]$ and $R'(w_u(t)) < 0$ on $[0,t^+]$, it follows that

$$\begin{aligned}\frac{\mathrm{d}y_l(t)}{\mathrm{d}t} &= R'[w_u(t)](\bar{w} - w_u)w_l(t) + R[w_u(t)](\bar{w} - w_l)\\ &> R'[w_u(t)](\bar{w} - w_u)\tilde{w}(t) + R[w_u(t)](\bar{w} - \tilde{w}) = \frac{\mathrm{d}\tilde{y}(t)}{\mathrm{d}t}\end{aligned}$$

on the interval $[0,t^+]$. Hence it remains to be shown that $\mathrm{d}\tilde{y}(t)/\mathrm{d}t > 0$. This is obvious from Step 1: in the interval $[0,t^+]$ aggregate income is constant while upper class income is strictly decreasing. Hence $\tilde{y}(t)$ must be increasing on this interval. Obviously $\tilde{y}(t)$ is also strictly increasing on $[t^+,1]$.

In a capital-rich economy $\omega(R) = w_u(t)$ determines the equilibrium rate of return R^* for all $t \in [0,1)$. Again, $\mathrm{d}\tilde{y}(t)/\mathrm{d}t > 0$. At $t = 1$, however, formerly poor agents gain access to entrepreneurial rents. From Lemma 3(*ii*) their income is $\bar{w}\bar{R}$ which is more than $\tilde{y}(0)$. Hence, lower class's preferences are always single peaked at $t = 1$ and the middle class is politically decisive.

A.2. *Proof of Proposition 2*

We proceed in two steps. In the first step we derive conditions such that middle class income is decreasing with the tax rate when upper class entrepreneurs provide effort, i.e. $t \in [0,t^+]$. In the second step, we analyse the low interest rate equilibrium, i.e. $t \in [t^+,1]$.

Step 1: Given that $\mu_u I > \bar{w}$ the interest rate is given by $R[w_u(t)] = A/[I-w_u(t)]$ in the interval $[0,t^+]$. In the interval $[t^+,1]$, the interest rate is $\underline{R} = qY/I$. The income of the middle class is given as

$$y_m(t) = A\frac{w_m(t)}{I - w_u(t)} \tag{17}$$

on $[0,t^+]$. Its derivative with respect to the tax rate is:

$$\frac{\mathrm{d}y_m(t)}{\mathrm{d}t} = A\frac{w_m'(t)[(I - w_u(t)] + w_u'(t)w_m(t)}{[I - w_u(t)]^2}. \tag{18}$$

This derivative is negative if

$$w_m > \bar{w}(I - w_u)/(I - \bar{w}). \tag{19}$$

Next, w_u is given by

$$w_u = \phi(w_m) := (\bar{w} - \mu_m w_m - \mu_l w_l)/\mu_u. \quad (20)$$

Hence, inequality (19) turns into an equality when w_m takes the value w_m^+ with

$$w_m^+ = \frac{\mu_u I - \bar{w} + \mu_l w_l}{\mu_u (I - \bar{w}) - \mu_m \bar{w}} \bar{w}. \quad (21)$$

Note, that w_m^+ is smaller than $\bar{w}$ and that the sign of the derivative of middle class income does not depend upon the tax rate t. Hence, on the interval $[0,t^+]$, middle class income is either increasing, decreasing or constant. Hence, for $t^+ = 1, w_m^+$ constitutes the lower bound of the Proposition.

Step 2: Next, consider the case where $t^+ < 1$. At t^+, middle class income $y_m(t)$ starts to increase, reaching a local maximum at $y_m(1)$. We know that $y_m(1) > y_m(t^+)$ iff $w_m < \bar{w}$. Hence middle class preferences are single peaked at $t = 0$ if and only if $y_m(0) \geq y_m(1)$; otherwise income is maximised at $t = 1$. Define $\Delta y_m(w_m) := y_m(0) - y_m(1)$. It remains to be verified that $\Delta y_m(w_m) \geq 0$ is feasible. Substituting in for R we have $\Delta y_m(w_m) \geq 0$ if and only if $R[w_u(0)]w_m - \underline{R}\bar{w} \geq 0$.

$$y_m(0) = A \frac{w_m}{I - w_u(w_m)}. \quad (22)$$

The derivative of $y_m(0)$ with respect to w_m at $t = 0$ is

$$\frac{\mathrm{d}y_m(0)}{\mathrm{d}w_m} = A \frac{w_m \phi'(w_m) + [I - \phi(w_m)]}{[I - \phi(w_m)]^2}. \quad (23)$$

Since μ_l and w_l are fixed $\phi'(w_m)$ equals $-\mu_m/\mu_u$. Then one can show that the middle class's income increases with initial wealth as long as $\mu_u I > \bar{w}$, which holds by assumption. Hence, $\Delta y_m(w_m)$ is increasing with w_m. Furthermore, $\Delta y_m(\bar{w}) > 0$ because with initial wealth of $\bar{w}$ only the interest rate effect works. From Step 1 we know that $\Delta y_m(w_m^+) < 0$. Since $\Delta y_m(w_m)$ is continuous in w_m, there exists a unique wealth level w_{min} such that $\Delta y_m(w_m) \geq 0$ for all $w_m \geq w_{min}$.

A.3. Proof of Proposition 3

In a first step we solve explicitly for w_{min} by setting $\Delta y_m(w_m) = 0$. This yields

$$w_{min} = \frac{qY(\mu_u I - \bar{w} + \mu_l w_l)}{AI\mu_u - qY\mu_m \bar{w}} \bar{w} \quad (24)$$

with $\mathrm{d}w_{min}/\mathrm{d}w_l > 0$. Consider now a situation where middle class wealth is sufficiently large to ensure non-redistribution for a given value of w_l. A larger value of w_l implies less inequality since it is associated with a smaller value of w_u. Moreover, since $\mathrm{d}w_{min}/\mathrm{d}w_l > 0$ we may have that there is a value of w_l such that $w_{min} > w_m$. In this case full redistribution obtains.

A.4. Proof of Proposition 4

Given the parameter z and some tax rate t, the net wealth of class i is given by:

$$w_i(t, z) = (1 - t - z + tz)w_i^0 + (t + z - tz)\bar{w} \quad (25)$$

$$= (1 - \hat{t})w_i^0 + \hat{t}\bar{w} \text{ with } \hat{t} := t + z - tz. \quad (26)$$

This directly implies that – with an initial wealth distribution $w_i(z) = (1 - z)w_i^0 + z\bar{w}$ – the incomes of all three classes at the tax rate t are the same as with the initial distribution w_i^0

and the tax rate $\hat{t} := t + z - tz$. Denoting the income of class i at rate t and distribution z by $y_i(t,z)$ we have that $y_i(t,z) = y_i[\hat{t}(t,z), 0]$. From the Proof of Proposition 2 we know that middle class income $y_m(\hat{t}, 0)$ is first decreasing in $\hat{t}$ and then increasing. Moreover, we have by assumption that $y_m(0,z) > \underline{R}\bar{w}$. Hence, there is a single value of z, z^+, with $1 > z^+ > 0$, at which the middle class is indifferent between a tax rate of zero and a tax rate of one. The distribution z^+ satisfies $y_i(0, z^+) = \underline{R}\bar{w}$. With inequality sufficiently large ($z<z^+$) non-redistribution obtains since $y_m(0,z) > \underline{R}\bar{w} = y_m(1,z)$. For more equal societies ($z > z^+$) full redistribution obtains.

A.5. Proof of Proposition 5

The middle class is politically decisive. Consider first the case where middle class members own $\bar{w}$. Taxation reduces middle class income since $R'(t) < 0$. Hence, on the interval [0,1), middle class preferences are single peaked at $t = 0$. However, at $t = 1$, all individuals have the same wealth level and entrepreneurial rents are available to middle class members. From Lemma 3, expected income of a middle class member is given by $\bar{w}\bar{R}$ which, given that $w_u < \omega(\bar{R})$, is more than $\bar{w}R^*(0)$. At $w_{min} = \bar{w}\bar{R}/R^*[w_u(0)]$ middle class members are indifferent between $t = 0$ and $t = 1$. w_{min} exceeds average wealth since $\bar{R} > R^*[w_u(0)]$. Full redistribution occurs if $w_u > w_{min} > w_m$ or if $w_{min} > w_u$ or if $w_l(w_{min}) = (\bar{w} - \mu_u w_u - \mu_m w_{min})/\mu_l < 0$.

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