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ABSTRACT

Redistribution as a Selection Device*

This paper studies the role of the wealth distribution for the market selection of entrepreneurs when agents differ in talent. It argues that the redistribution of initial endowments can increase an economy’s surplus because more talented individuals get credit for their risky investment projects. Moreover, the redistribution of initial endowments may lead to a Pareto-improvement although all agents are non-satiable. In my model an agent’s entrepreneurial ability is his private information. Moral hazard in production creates rents for entrepreneurs if they are believed to be both talented and willing to provide entrepreneurial effort. I find conditions such that unproductive rich entrepreneurs crowd out productive poor ones on the capital market. Then redistribution of initial endowments leads to the selection of better entrepreneurs, increases the economy's surplus, and – in some cases – makes all agents better off.

JEL Classification: D31, H23 and H32
Keywords: education, firm-ownership, general equilibrium with moral hazard and adverse selection and selection of entrepreneurs

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NON-TECHNICAL SUMMARY

It is a widely held position that redistribution from the rich to the poor reduces the size of the pie that is available in an economy. This position is usually based upon the argument that various types of incentive costs arise when wealth or income are redistributed. Redistribution reduces individual incentives to engage in costly effort and hence reduces the economy's total surplus. In this paper I argue that redistribution has a positive effect on production efficiency when it equalizes opportunities and makes the most talented individuals conduct risky investment projects. There are cases where redistribution also leads to a Pareto-improvement.

I consider an economy where all individuals are potential entrepreneurs. Agents differ in their ability to successfully conduct a project. The project's success also depends upon the unobservable effort of the entrepreneur. Moral hazard creates rents for those agents who are rich enough so that they can credibly commit to providing effort. In this economy productive efficiency requires that only the most talented individuals become entrepreneurs. Untalented wealthy individuals may, however, find it profitable to pretend that they are talented in order to obtain credit from investors. This may lead to a situation where low-ability rich entrepreneurs crowd out better poor ones. Redistribution then enables productive poor agents to obtain finance for their projects on the capital market. This increases the economy's total surplus.

The investment project in the model may be interpreted in various ways. One interpretation is that agents open firms and that entrepreneurs differ in their ability to manage an enterprise. An alternative interpretation of the investment project is the costly acquisition of human capital, e.g. in a private university. Agents differ in their learning ability and education requires the individual's unobservable effort. A third interpretation is that investments are made to generate technological innovations. Research success is uncertain and the researcher's ability (or the quality of his ideas) and effort are unobservable. In all these cases the distribution of initial funds determines the quality of the projects undertaken.

We show that there are cases where the overall effect from redistribution is positive for all agents. The redistribution of wealth from rich to poorer agents may be associated with more efficient production and hence with a higher rate of return for investors. Poorer agents, therefore, gain both from a higher wealth level and from the higher rate of return. Rich agents, however, suffer a loss of wealth. Moreover, the (risk-free) rate of return at which rich entrepreneurs borrow rises. On the other hand, the payments of high-ability entrepreneurs to investors (if their project succeeds) become smaller because the entrepreneurs' average ability is improved. Investors know that entrepreneurs are better on average, hence, they demand lower payments if an entrepreneur's project succeeds. Moreover, former rich low-ability entrepreneurs now get a high return on their investment. We show that these two effects may over-compensate all rich agents for their loss of wealth. Redistribution of initial endowments then changes the capital market equilibrium in a way that makes everybody better off. Pareto-improving redistribution is possible despite the fact that all agents are non-satiable.

1 Introduction

It is a widely held position that redistribution from the rich to the poor reduces the size of the pie that is available in an economy. This position is usually based upon the argument that various types of incentive costs arise when wealth or income are redistributed. Redistribution reduces individual incentives to engage in costly effort and hence reduces the economy's total surplus. In this paper I argue that redistribution has a positive effect on production efficiency when it equalizes opportunities and makes the most talented individuals conduct risky investment projects. There are cases where redistribution also leads to a Pareto-improvement.

I consider an economy where all individuals are potential entrepreneurs and differ in their ability to effectively conduct a project. The project's success depends upon the unobservable effort of the entrepreneur. Moral hazard creates rents for those agents who are rich enough so that they can credibly commit to providing effort. In this economy productive efficiency requires that only the most talented individuals become entrepreneurs. However, untalented wealthy individuals may find it profitable to pretend that they are talented in order to obtain credit from investors. This can lead to a situation where low-ability rich entrepreneurs crowd out better poor ones. Redistribution of initial endowments then enables productive poor agents to obtain finance for their projects on the capital market. This increases the economy's total surplus. Moreover, redistribution of initial endowments may change the capital market equilibrium in a way that everybody is made better off. Hence, there exists Pareto-improving redistribution despite the fact that all agents are non-satiable.

Besides the result on Pareto-improving redistribution, our paper also shows that multiple equilibria may exist for particular distributions of initial endowments.

The investment project in the model may be interpreted in various ways. One interpretation is that agents opens firms and that entrepreneurs differ in their ability to manage an enterprise. An alternative interpretation of the investment project is the costly acquisition of human capital, e.g. in a private university. Agents differ in their learning ability and education requires the individual's unobservable effort. A third interpretation is that investments are made to generate technological innovations. Research success is uncertain and the researcher's ability (or the quality of his ideas) and effort are unobservable. In all these cases the distribution of initial funds determines the quality of the projects undertaken.

Our paper is closely related to two seminal contributions by Loury (1981) and Hoff and Lyon (1995). Both papers show that redistribution may increase an economy's output and lead to Pareto-improving outcomes. Loury (1981) studied the impact of egalitarian policies on human capital investment in an economy with no capital market. In his model parents cannot borrow to finance human capital investments of their children. In this setting redistributive measures may make all current members of society better off. In the present paper the capital market is not assumed away and capital market imperfections are derived endogenously. Hoff and Lyon (1995) proof the existence of Pareto-improving income redistribution in an adverse selection model à la De Meza and Webb (1987) and Bernanke and Gertler (1990). In their model, poor lenders use future government transfers as a collateral in their debt contracts. Our model differs in three respects form the one in Hoff and Lyon. First, we consider the redistribution of initial endowments with wealth and not the redistribution of income of individuals in one wealth class. Individuals favor redistribution even when they know that redistribution reduces their wealth. Second, in our model individuals know their type when they evaluate redistributive policies. In Hoff and Lyon individuals evaluate income redistribution before they know their type and their realized income. Third, the riskless rate of return is endogenous in our model which is cricual for the establishment of the main result.

The way in which redistributive policies affect output and productive efficiency has received renewed interest in the literature. There are a number of recent contributions that emphasize that inequality may be desirable from an ex-ante point of view when production functions are (locally) convex [c.f. Friedman 1953, Freeman, 1996, and Rosen, 1996]. In such cases, inequality is generated voluntarily by agents who exchange initial endowments against lottery tickets. Moreover, the gambling behavior of agents offsets any political attempt to redistribute and equalize initial endowments. There also is a literature that studies the impact of ex-post redistribution and social insurance on the risk-taking behavior of individuals. Sinn (1995) e.g. shows that the impact of social security on total output may be positive or negative, depending upon whether when it encourages or discourages individuals to take risk. The present paper is also related to the work of Aghion and Bolton (1997), Banerjee and Newman (1993), Benabou (1996a), and Piketty (1997). These authors emphasize the importance of the initial distribution of wealth in presence of entrepreneurial moral hazard or under incomplete insurance markets [see Benabou (1996b) for a survey of this literature]. In models with moral hazard redistribution may increase the number of entrepreneurs who own enough wealth so that they can credibly commit to providing effort. This article views the question of redistribution and productive efficiency from a different angle, emphasizing the role of the distribution of initial resources for the market selection of entrepreneurs when agents differ both in wealth and talent.

The model I use is a static version of the capital market equilibrium models under moral hazard previously studied in Aghion and Bolton (1997) and Piketty (1997). It is extended for the case where individuals differ in their (unobservable) abilities.

The paper is organized as follows: Section 2 presents the model. In Section 3 we define the capital market equilibrium and we derive some properties of separating and pooling equilibria. We will see that there are no separating equilibria. In Section 4 the individual maximization problem under a pooling contract is solved. In Section 5 I derive the capital market equilibrium for the case with one single wealth class. Section 6 has the main propositions on the impact of redistribution on the economy's surplus. Section 7 discusses Pareto-improving redsitribution and Section 8 concludes. All proofs of propositions are gathered in the appendix.

2 The Model

2.1 Agents, Endowments and the Sequence of Events

I consider an economy with a continuum of agents of total mass one. I denote the set of agents with $A = [0, 1]$. All agents are potential entrepreneurs. They are born at date 0 endowed with their entrepreneurial ability and their initial wealth w. Average wealth - which is equal to aggregate wealth - is denoted by $\bar{w}$. At date 1 the capital market opens. Agents either choose to become entrepreneurs or lend their initial endowments to financial intermediaries (banks). Those agents who decide to become entrepreneurs may borrow from banks to finance their risky investment projects. At date 2 entrepreneurs choose their entrepreneurial effort, investments' returns are realized and financial claims are settled.

Agents are risk neutral and maximize date 2 income.

2.2 Technology and Entrepreneurial Ability

Each agent can invest in one entrepreneurial project which requires a fixed initial capital outlay $I > 0$. No agent has wealth greater than I, so whoever wants to undertake the project has to borrow an amount of $I - w > 0$.

The uncertain revenue from an investment project can take one of two values 0 or Y. The risk is idiosyncratic for each firm. The probability distribution over output levels can be influenced by the entrepreneur's effort. Agents differ in their entrepreneurial ability. High ability individuals (indexed by h) can raise the probability of success from q to p by working hard. However, this effort comes at a cost c which is measured in monetary units. For low ability individuals (indexed by l) c is prohibitively high. Hence, a low-ability entrepreneur never engages in effort which leads to a probability of success q. For high-ability agents c assumes a positive but finite value B. The distribution of c is independent of the wealth level, i.e. high-ability and low-ability agents are equally likely in all wealth classes. The probability that an individual's ability is high is denoted by $\alpha > 0$:

$$c = \begin{cases} B > 0 & \text{with probability } \alpha \\ +\infty & \text{with probability } 1 - \alpha. \end{cases} \tag{1}$$

Wealth can only be used for the type of project described above. The surplus created by an entrepreneur is therefore measured by the expected output minus the cost of effort. A high-ability entrepreneur who works generates a higher surplus than a shirking or a low ability entrepreneur:

$$pY - B > qY. \tag{2}$$

The surplus of the economy is the aggregate of all individual entrepreneurial surpluses.

2.3 Information

An agent's ability is his/her private information, the endowment with capital is public information. Entrepreneurial effort is not observable. The use of capital in the firm and the firm's output are verifiable and thus contractible.

2.4 Financial Intermediation and the Capital Market

An agent who sets up a firm is called an entrepreneur; an agent who provides funds to entrepreneurs is called an investor. Both investors and entrepreneurs write contracts with risk-neutral financial intermediaries (banks). Investors lend capital to the bank at a riskless rate of return R, i.e. an investment of one unit at date 1 yields a return of R units of money at date 2. All agents take the rate of return R as given and therefore depending on R decide whether to become investors or entrepreneurs. Banks take the rate of return as given and compete by choice of the contracts they offer to the different wealth classes.

A contract between a bank and an entrepreneur specifies payments D to the bank which are conditioned both on the verifiable outcome of production (0 or Y) and on the announced type (high- or low ability). I denote the payments of the high ability type by $\left(D_Y^h, D_0^h\right)$ and those of the low-ability type by $\left(D_Y^l, D_0^l\right)$. Entrepreneurs are protected by limited liability, i.e. they can not end up with negative cash holdings at date 2. Without restricting generality, I assume that entrepreneurs cannot simultaneously borrow and lend on the capital market. Hence, an entrepreneur with wealth w borrows an amount $I-w$ and his limited liability constraints are written $D_Y^h, D_Y^l \leq Y$ and $D_0^h, D_0^l \leq 0$.[1]

[1] It is straightforward to see that it makes no difference if one allows the entrepreneurs to simultaneously borrow and lend. Consider the case where an entrepreneur writes two contracts. He borrows

Like in Diamond (1984), Green (1987), or Aghion and Bolton (1997) I assume free entry to the financial intermediation sector. Hence all profits from the intermediation activity will be competed away.

3 Capital Market Equilibrium

Given the rate of return R, and the contracts offered by banks, agents decide whether to become entrepreneurs or investors. All agents who decide to become entrepreneurs choose the financial contract which offers them the highest expected payoff. I assume that agents who are indifferent between contracts offered by two banks pick each of them with equal probability. In an equilibrium of the economy capital supply and capital demand are equalized. Moreover, I require that the equilibrium contracts are the outcome of Bertrand competition among banks.

Formally an equilibrium of the economy is defined as follows:

Definition 1 *A capital market equilibrium consists of an rate of return R, a contract $C(w) = \left(D_Y^h(w), D_0^h(w), D_Y^l(w), D_0^l(w)\right)$ for each wealth class offered by more than one bank in the market, and a set of entrepreneurs $E \subset A$ such that:*

1. *The capital market clears, i.e. E has mass $\overline{w}/I$.*

2. *All entrepreneurs $e \in E$ weakly prefer opening a firm to investing in the capital market.*

an amount $I - w + w'$ with $w' > 0$. Denote the payments to the bank specified in this debt contract by D'_Y and D'_0 (contract 1). The entrepreneur can now invest w' in the capital market (contract 2) and use the certain return $R \cdot w'$ as a collateral. The payments to the bank in the debt contract must satisfy $D'_Y \leq Y + R \cdot w'$ and $D'_0 \leq R \cdot w'$. We can summarize both contracts in one single contract. The (net-) date 2 payments of this contract are given by $D_Y = D'_Y - R \cdot w'$ and $D_0 = D'_0 - R \cdot w'$. They still satisfy the constraints $D_Y \leq Y$ and $D_0 \leq 0$. Moreover the net amount borrowed at date 1 is still given by $I - w$. Hence, the combination of the two contracts generates payments that can always be generated by a single contract where the entrepreneur borrows exactly $I - w$.

3. *All investors $i \in A \setminus E$ weakly prefer not to open a firm.*

4. *Banks maximize profits with $C(w)$.*

5. *Given that the banks in the market offer $C(w)$ there is no incentive for new banks to enter the market.*

The first three conditions ensure that there is no excess demand or supply of capital. The fourth condition means that I only consider Bertrand equilibria among banks where the banks simultaneously choose $C(w)$, taking the rate of return R as given. An immediate consequence of the last condition is that the banks in the market do not make positive profits in an equilibrium[2]. Hence:

Lemma 1 *In equilibrium all banks make zero profits at all wealth levels.*

3.1 Separating Equilibrium

One can easily exclude that there are separating equilibria in which banks make positive profits with one of the two types of entrepreneurs. From Lemma 1 it would follow that banks make losses with the other type in this equilibrium. This cannot be an equilibrium because intermediaries would refuse to offer contracts to those agents. Hence:

Lemma 2 *In a separating equilibrium banks make zero profits with both types.*

A consequence of this is:

Lemma 3 *There is no separating equilibrium where both types participate and high-ability agents provide effort.*

[2] Free entry is not necessary to ensure that there are no equilibria where a bank makes positive profits in a wealth class.

PROOF Consider an equilibrium contract $\left(D_Y^h, D_0^h, D_Y^l, D_0^l\right)$ for wealth class w at an rate of return R which separates both types. From Lemma 2 we know that the contract must fulfill the two zero profit conditions of the bank. The bank makes zero profits with a high-ability agent who provides effort if:

$$
\begin{aligned}
pD_Y^h + (1-p)D_0^h &= R(I-w) \Leftrightarrow & (3)\\
D_Y^h &= \frac{R(I-w)}{p} - \frac{1-p}{p}D_0^h. & (4)
\end{aligned}
$$

The bank makes zero profits with a low-ability agent if:

$$
\begin{aligned}
qD_Y^l + (1-q)D_0^l &= R(I-w) \Leftrightarrow & (5)\\
D_Y^l &= \frac{R(I-w)}{q} - \frac{1-q}{q}D_0^l. & (6)
\end{aligned}
$$

Figure 1 displays the bank's break-even lines (4) and (6) in the $\left(D_Y^h, D_0^h\right)$ and $\left(D_Y^l, D_0^l\right)$-space. The profits of a low-ability entrepreneur are given by $\pi^l = q(Y - D_Y^l) - (1-q)D_0^l - Rw$. An isoprofit line of a low-ability entrepreneur is described by:

$$
D_Y^l = Y - \frac{\pi^l + Rw}{q} - \frac{1-q}{q}D_0^l. \qquad (7)
$$

These isoprofit lines have the same slope as the break–even line (6). Figure 1 then shows that it is impossible to find a menu of contracts such that (i) the zero profit conditions (4) and (6) hold and (ii) the low-ability entrepreneurs do not prefer the high-ability contract. Q.E.D.

- Figure 1 here -

Hence, a capital market equilibrium must either be a pooling equilibrium (where both high and low-ability agents participate) or an equilibrium where only one type participates. In both cases, agents only accept one single contract per wealth class.

In what follows we may therefore drop the indices h and l for the payments and write $D_Y^h = D_Y^l =: D_Y$ and $D_0^h = D_0^l =: D_0$.

3.2 Pooling Equilibrium

In a pooling equilibrium entrepreneurs with a given wealth w are supposed to deliver the high output level Y with some probability $s(w) \in [q, p]$. I now derive two general properties of pooling equilibria.

In a pooling equilibrium where high-ability agents provide effort banks do not pay money to entrepreneurs if their project fails. To see this consider Figure 2 which depicts a situation where the equilibrium contract offers a payment $D_0 < 0$ (point H). The lines hh and ll are the isoprofit lines of the two types that pass through H. The isoprofit lines of low-ability entrepreneurs and high-ability entrepreneurs (who provide effort) are given by

$$D_Y = Y - \frac{\pi^l + Rw}{q} - \frac{1-q}{q} D_0, \tag{8}$$

and

$$D_Y = Y - \frac{\pi^h + B + Rw}{p} - \frac{1-p}{p} D_0, \tag{9}$$

respectively. The isoprofit-lines of the low-ability entrepreneurs are steeper than those of the high-ability entrepreneurs. Any bank may deviate and offer a contract in the area between hh and ll to the right of point H. In this case all high-ability agents accept the contract and the bank can make positive profits. Hence, in a pooling equilibrium $D_0 = 0$ and, from the zero-profit condition, $D_Y = R/s \cdot (I - w)$.

- Figure 2 here -

Figure 2 also shows that, in an equilibrium with $D_0 = 0$, it is not possible to deviate and offer an alternative contract such that only the high-ability agents participate. To see this consider point P. The high-ability entrepreneurs are only made better off by a contract in the area below the isoprofit line of type h, passing through P. In this area the low-ability entrepreneurs are made better off too. This fact will be important for the proof of the existence of a pooling equilibrium below.

4 Individual Decisions

So far, we have seen that in a pooling equilibrium D_0 is zero and that $D_Y = R/s \cdot (I - w)$. In order to verify whether a pooling equilibrium exists one also has to derive the optimal behavior of an individual who is offered a contract $(D_Y, D_0) = (R/s \cdot (I - w), 0)$. I begin by studying the choice of low-ability individuals.

4.1 Low-Ability Agents

A low-ability agent can choose among two actions: (i) accept the pooling contract and (ii) invest in the capital market. Given an rate of return R and a perceived probability of success s, the former is better than the latter if:

$$q\left(Y - \frac{R}{s}(I - w)\right) \geq Rw \Leftrightarrow$$

$$w \leq \phi(R, s) := \frac{q}{s - q}\left[-I + \frac{sY}{R}\right]. \qquad (10)$$

A low ability entrepreneur sees his ability overestimated by the bank, i.e. $s > q$. The bank is therefore willing to provide him with credit at a price which is actually too low. If he is sufficiently wealthy he internalizes the fact that he is a low-ability individual whose return is below the market return R and he prefers to invest. He will only chose to invest if a sufficiently large part of the investment I is provided by the bank. This leads us to:

Lemma 4 *The optimal choice of a low-ability agent is: open a firm if $w_i \leq \phi(R,s)$. Otherwise invest the money in the capital market.*

4.2 High-Ability Agents

Given a market rate of return R, a high-ability agent may choose among the following three alternatives: (i) offer his initial endowment on the capital market, (ii) accept the contract and provide effort or (iii) accept the contract and do not provide effort. First note that the payoffs of a high-ability entrepreneur who does not provide effort are the same as those of a low-ability entrepreneur. Hence, a high-ability agent prefers opening a firm and not providing effort to investing if $w \geq \phi(R,s)$. Next, I want to determine the wealth level which is just sufficient to ensure that a high-ability individual who opens a firm engages in effort. The incentive constraint of an entrepreneur is

$$p(Y - D_Y) - (1-p)D_0 - B \geq q(Y - D_Y) - (1-q)D_0. \tag{11}$$

We know that in a pooling equilibrium $D_0 = 0$ and $D_Y = R(I-w)/s$. This yields for the incentive constraint:

$$w \geq \omega(R,s) := I - s\frac{Y - B/(p-q)}{R}. \tag{12}$$

Given the riskless rate of return R and the capital market's perception s, a high-ability entrepreneur provides effort if he owns at least $\omega(R,s)$. If the entrepreneur's endowment is less than $\omega(R,s)$ then he will not provide effort because a too large share of output has to be returned to the bank. For the same reason the amount of wealth needed to credibly commit to providing effort increases with the rate of return.

Finally we have to check when a high-ability agent is willing to offer his endowment on the capital market instead of opening a firm and providing effort. The participation constraint of a high-ability entrepreneur is:

$$p\left(Y - \frac{R}{s}(I-w)\right) - B \geq Rw \Leftrightarrow$$

$$w \geq \upsilon(R,s) := \frac{s}{p-s}\left[\frac{p}{s}I - \frac{pY-B}{R}\right]. \tag{13}$$

The bank underestimates the ability of a high-ability entrepreneur, i.e. $s < p$. Therefore the true expected return on the borrowed amount $I - w$ is above the market return R. If a high-ability entrepreneur has to borrow too much then the excess payments to the bank reduce his profits to zero. This is why a high-ability agent must own a sufficient amount of wealth, $\upsilon(R,s)$, in order to prefer entrepreneurship to investment. The following Lemma characterizes the properties of the three functions $\omega(R,s)$, $\upsilon(R,s)$, and $\phi(R,s)$ (see also Figure 3).

Lemma 5 *(i) Participation constraint of low-ability agents: $\phi(R,s)$ is decreasing and strictly convex in R for $s \in \,]q,p]$. For $s = q$, $\phi(R,s)$ is vertical at $\underline{R} := qY/I$.*

(ii) Participation constraint of high-ability agents: $\upsilon(R,s)$ is increasing and strictly concave in R for $s \in [q,p[$. For $s = p$, $\upsilon(R,s)$ is vertical at $\overline{R} := (pY-B)/I$.

(iii) Incentive compatibility constraint: $\omega(R,s)$ is increasing and strictly concave in R.

(iv) For a given value of s, $\omega(R,s)$, $\phi(R,s)$ and $\upsilon(R,s)$ have one single intersection at

$$R^+(s) = \frac{sY - \frac{s-q}{p-q}B}{I}, \tag{14}$$

and

$$w^+(s) = \frac{B}{s(p-q)Y - (s-q)B} \cdot qI \tag{15}$$

(v) $R^{+\prime}(s) > 0$*,* $w^{+\prime}(s) < 0$*, and* $w^+(p) > 0$*.*

Proof see appendix.

It is easy to understand why the participation constraint of low-ability agents $\phi(R, s)$ passes through the intersection of the incentive and participation constraint of high ability agents, $\omega(R, s)$ and $\upsilon(R, s)$. To see this take some perceived probability s as given and consider a high-ability entrepreneur who is indifferent between shirking and working. Suppose that he is also indifferent between working and investment. Opening a firm yields a low-ability agent who owns the same amount of wealth exactly the payments of a shirking high-ability entrepreneur. Therefore the low-ability agent must also be indifferent between entrepreneurship and investment.

- Figure 3 here -

Lemma 5 permits a simple graphical illustration of the optimal choice of both types of agents (Figure 3). For a given perceived probability of success s and some rate of return R low-ability agents with wealth above $\phi(R, s)$ invest in the capital market (areas B, C and D) and otherwise become entrepreneurs (areas A, F, and E). High-ability agents with wealth above $\omega(R, s)$ would be willing to provide effort as entrepreneurs (areas A, B and C). However, they only choose to open a firm in areas A and B. High-ability individuals open firms in areas E and F but they do not provide effort. In areas C and D high ability agents invest in the capital market.

5 The Case of a Single Wealth Class

We can now solve for the capital market equilibrium of the economy. In order to do this we have to consider (besides the participation and incentive constraints from section 4) that capital supply and demand are equalized. I begin with the case where all individuals own the same amount of wealth $\overline{w}$. For the rest of the paper, I will assume that there are not enough talented individuals to exhaust the economy's capital stock, i.e. $\alpha < \overline{w}/I$. However, there are enough low-ability agents to exhaust the capital stock: $1-\alpha > \overline{w}/I$. Hence equilibrium always involves that there are some low-ability entrepreneurs. Moreover, at least one of the two types has to be indifferent between entrepreneurship and investment in order to equalize capital supply and demand.

With a single wealth class one can distinguish three types of equilibria: First, there is the surplus maximizing solution where all the high-ability agents open a firm and provide effort. The economy's remaining capital is used by some low-ability entrepreneurs. In such an equilibrium low-ability agents must be indifferent between entrepreneurship and investment. The probability of success is given by:

$$\widehat{s} := \frac{\alpha p + (\overline{w}/I - \alpha)q}{\overline{w}/I}. \tag{16}$$

Secondly there is the case that no entrepreneur provides effort. The probability of success is then given by $s = q$. Thirdly it may be the case that the participation constraint of both high and low-ability agents is binding and only some agents of both types become entrepreneurs. The first main result is that the market generates the surplus maximizing solution if the economy is endowed with a sufficient amount of capital.

Proposition 1 *Consider an economy where all individuals own the same amount of wealth* $\overline{w}$*. The market optimally solves the entrepreneurial selection problem if and only if the economy is endowed with a sufficient amount of capital.*

- Figure 6 here -

The intuition for the proof becomes clear if we again consider the agents' participation and incentive constraints (see Figure 6). Suppose that the perceived probability of success s corresponds to the surplus maximizing solution, i.e. $s = \hat{s}$. A consequence of Lemma 5 is that, for a wealth level that does not satisfy $\bar{w} \geq w^{+}(\hat{s})$, high ability agents only participate if low-ability agents strictly prefer to participate. Hence, for a low value of $\bar{w}$ it is impossible to make only some of the low-ability agents participate. For wealth levels that satisfy $\bar{w} \geq w^{+}(\hat{s})$, the situation is different. There are rate of returns such that low-ability agents do not open firms while high-ability agents do. An equilibrium is achieved when the participation constraint of the low-ability agents is just binding. This is the case for the rate of return R^{*} which satisfies $\bar{w} = \phi(R^{*}, \hat{s})$.

6 Redistribution as a Selection Device

In this section I show by example that redistribution of initial wealth may increase society's surplus. I consider a society with two wealth classes of mass μ_u and μ_l. An individual's wealth in the upper- and lower class is denoted by w_u and w_l respectively with $w_u > w_l$. Redistribution is a policy which endows all individuals with the same amount of wealth $\overline{w}$ before the capital market opens. In this economy too much initial inequality is not compatible with productive efficiency. This is established in the following Proposition.

Proposition 2 *In a two class society where the lower class is sufficiently large and sufficiently poor there is no capital market equilibrium where all high ability agents open firms.*

If lower class agents are too poor then the high-ability agents in this class only accept contracts that also attract all low-ability agents. If there are too many agents with a low wealth endowment then this leads to an excess demand on the capital market.

If the gap between the rich and the poor is too large then wealthy low-ability agents crowd out more talented poor agents on the capital market. In such a situation, an equal opportunity policy that provides everybody with the same initial (financial) endowment leads to a better selection of entrepreneurs. We have:

Proposition 3 *Consider a two class society with an aggregate capital stock that satisfies $\overline{w} \geq w^{+}(\hat{s})$. Assume that the upper class is sufficiently large to exhaust the capital stock: $\mu_u I > \overline{w}$. There is a capital market equilibrium where only rich individuals open firms if (i) the moral hazard-problem is sufficiently severe (i.e. B is sufficiently large) and (ii) the lower class is sufficiently poor. Redistribution of initial endowments raises the number of high-ability entrepreneurs from $\mu_u \cdot \alpha$ to α.*

If the lower class is sufficiently poor then only upper class agents open firms in equilibrium. Only a fraction μ_u of the talented individuals obtains credit on the capital market. The redistribution of initial endowments enables all talented agents to obtain credit for their projects on the capital market.

The redistribution of initial endowments can only play an efficiency-enhancing role if the economy as a whole is endowed with a sufficient amount of wealth. It is a standard result of capital market models with moral hazard that otherwise redistribution eradicates incentives to provide effort for all agents. This is why in an economy where there is not enough capital the surplus maximizing distribution of initial wealth is unequal:

Proposition 4 *Consider an economy with an aggregate capital stock that satisfies* $\overline{w} < w^{+}(\hat{s})$*. In this economy redistribution eradicates incentives to provide effort for all entrepreneurs. The surplus maximizing distribution of capital involves inequality of initial endowments.*

Whether or not equality is surplus maximizing depends on the endowment with capital. If the economy's endowment with capital is small, redistribution leads to a breakdown of incentives for all entrepreneurs. Otherwise, redistribution enables the most talented agents to obtain credit for their projects and increases the economy's surplus.

7 Pareto-Dominated Market Equilibria

In the previous Section we have seen that there are cases where redistribution from a richer to a poorer wealth class may increase the economy's surplus. Can the redistribution of initial endowments in a market economy also lead to a Pareto improvement? The redistribution of wealth from rich to poorer agents may be associated with more efficient production and hence with a higher rate of return. Therefore poorer agents gain both from a higher wealth level and from the higher rate of return. Rich agents however suffer a loss of wealth. Moreover, the rate of return at which rich entrepreneurs borrow rises. On the other hand, the payments of high-ability entrepreneurs to investors may be smaller. Moreover, former low-ability entrepreneurs now get a high return on their investment. The next proposition states that there are cases where the overall effect is positive for all agents.

Proposition 5 *The set of market equilibria contains Pareto-dominated elements. Redistribution from the rich to the poor may strictly increase the expected income of all agents.*

In the present model redistribution may lead to a Pareto-improvement because in the new equilibrium the market is endogenously better informed about the quality of upper-class entrepreneurs. This does not necessarily imply that the rich deliberately give money to the poor. Suppose that there was a first stage where all agents may independently give away wealth. It is easy to see that no agent would have an incentive to do so. However, a cooperative arrangement, where rich agents simultaneously give money to the poor may increase their payoff. The present model therefore provides a reason why agents may want to collectively provide charity to the poor even in absence of altruistic motivations.

8 Conclusion

In this paper it was shown that inequality of initial endowments may lead the market to inefficiently select entrepreneurs. The redistribution of initial wealth may lead to a better quality of the projects which are undertaken in an economy. In some cases it leads to a Pareto-improvement. This provides a rationale for equal opportunity policies from a productive efficiency rather than a distributive-justice perspective.

The investment project in the model can be interpreted in different ways. Besides opening a firm it may consist of an investment in private education or in the investment in a risky research project. Accordingly, a more equal distribution of the initial funds that are available for those projects improves the talent of pupils and students, or the quality of research and innovation.

An interesting feature of the present model is the very different role of ex-ante and ex-post redistributive measures. Ex-post redistribution - say in the form of a fully redistributive income tax - would reduce all effort levels to zero in the present model. An equal opportunity policy may instead increase the surplus without eliminating incentives or individual risk. This result may have important implications for the design of distributive policies, especially for the optimal choice of the tax base and for the timing of taxation. A complete evaluation of this issue must take the accumulation decision of those assets into account that were treated as given in the present model. While clearly beyond the scope of the present paper, this project is worth to be undertaken in future research.

9 Appendix

9.1 Proof of Lemma 5

(i) (ii) and (iii) are immediate from (10), (12) and (13).

(iv) The intersection of $\omega(R,s)$ and $\phi(R,s)$ is given by:

$$\begin{aligned} I - s\frac{Y - B/(p-q)}{R} &= \frac{q}{s-q}\left[-I + \frac{sY}{R}\right] \Leftrightarrow \\ \frac{s}{s-q}I &= \frac{s/(s-q)\cdot sY - sB/(p-q)}{R} \Leftrightarrow \\ R &= R^{+}(s) = \frac{sY - \frac{s-q}{p-q}B}{I}. \end{aligned}$$

The intersection of $\omega(R,s)$ and $\upsilon(R,s)$ is derived from

$$I - s\frac{Y - \frac{B}{p-q}}{R} = \frac{p}{p-s}I - \frac{s}{p-s}\frac{pY - B}{R}.$$

Solving for R again yields equation (14).

(v) The derivative of R^+ with respect to s is $dR^+/ds = \left(Y - \frac{B}{p-q}\right)/I > 0$. Q.E.D.

9.2 Proof of Proposition 1

More formally, I state Proposition 1 as follows: There is a threshold wealth level $\tilde{w}$ such that (i) for all $\overline{w} \geq \tilde{w}$ there exists a surplus-maximizing equilibrium and (ii) for all $\overline{w} < \tilde{w}$ there is no surplus-maximizing equilibrium. For $\overline{w}$ sufficiently large, the surplus maximizing equilibrium is unique.

The proof will proceed in four steps. I show that

1. For average capital endowments that satisfy $\overline{w} \geq w^+(\hat{s})$ there exists an equilibrium where all high-ability agents open firms and provide effort. Some of the low-ability agents open firms. The others invest in the capital market (Step 1).

2. For average capital endowments that satisfy $\overline{w} < w^+(\hat{s})$ there is no equilibrium where all high-ability agents open firms and provide effort. (Step 2).

3. For all α, there is a unique wealth level $\tilde{w}$ such that $\overline{w} \geq w^+(\hat{s})$ if and only if $\overline{w} \geq \tilde{w}$ (Step 3).

4. For $\overline{w}$ sufficiently large, the surplus maximizing equilibrium is the unique equilibrium (Step 4).

STEP 1 Consider the case where all high-ability agents open firms and provide effort. The remaining capital is used by low-ability agents. The probability of success is then given by $\widehat{s}$ as defined in (16). We know that an equilibrium contract must be a pooling contract. Moreover, the low-ability agents must be indifferent between opening a firm and investing. Otherwise there would be excess demand on the capital market. Hence, the equilibrium rate of return R^* must satisfy $\widehat{s} = \phi(\overline{w}, R^*)$. From Lemma 5 it follows that at R^*, high-ability agents open a firm and provide effort, provided that average wealth $\overline{w}$ exceeds $w^+(\widehat{s})$.

It remains to be shown that it does not pay for financial intermediaries to deviate and propose another contract which yields positive profits. The pooling contract fixes payments $(D_0^*, D_Y^*) = (0, R^*/\widehat{s} \cdot (I - \bar{w}))$. We know that it is impossible to attract only the high-ability type with a single contract (see again Figure 2). Moreover, it is impossible for a bank to make positive profits with a screening contract that attracts both types. To see this consider again Figure 2 where point P characterizes the pooling equilibrium (D_0^*, D_Y^*). A screening contract that attracts the high-ability agents must lie on or below the isoprofit line of type h that passes through P, e.g. point H. The contract for low-ability agents must lie in the area below the isoprofit line of the low-ability type that passes through point H, e.g. point L. All low ability agents strictly prefer contract L to P. Moreover, profits of the bank that offers the menu (H, L) are smaller than in point P. This is so because the isoprofit lines of agents and banks have the same slope.

Step 2 Next we show that for $\overline{w} < w^+(\hat{s})$ there is no equilibrium where all high-ability agents open firms and provide effort. This it is an immediate consequence of Lemma 5. Consider a potential equilibrium with a perceived probability of success $\hat{s}$. From Figure 3 one sees that high-ability agents participate and provide effort only at rate of returns where all low ability agents participate. Hence, participation of high ability agents implies that there is excess demand on the capital market.

STEP 3 It remains to be shown that there is a unique wealth level $\tilde{w}$ such that $\overline{w} \geq w^{+}(\hat{s})$ if and only if $\overline{w} \geq \tilde{w}$ (remember that $\hat{s}$ is not independent of $\overline{w}$). To see this one has to plug $\widehat{s}$ from (16) into

$$\overline{w} \geq w^{+}(\widehat{s}) = \frac{B}{\widehat{s}\,(p-q)\,Y - (\widehat{s}-q)\,B} \cdot qI \tag{17}$$

and solve for $\overline{w}$ to get:

$$\overline{w} \geq \tilde{w} := \left[\frac{B}{(p-q)\,Y} - \alpha\frac{p-q}{q}\left(1 - \frac{B}{(p-q)\,Y}\right)\right] \cdot I. \tag{18}$$

STEP 4 It remains to be shown that the surplus-maximizing equilibrium is unique if the economy is sufficiently rich. Three other constellations might constitute an equilibrium. Firstly, it may be that both types of agents are indifferent between investment and entrepreneurship. The probability of success s must then satisfy by $\overline{w} = w^{+}(s)$. Such an equilibrium exists iff $\overline{w} \in [w^{+}(\hat{s}), w^{+}(q)]$ (the proof for this is completely analogue to Step1). It can also easily be seen that this equilibrium is Pareto-dominated by the surplus-maximizing equilibrium. Secondly, there may be an equilibrium where no entrepreneur provides effort. A necessary condition for the existence of this equilibrium is that $\overline{w}$ is sufficiently small to ensure that no one wants to provide effort at $R = qY/I$. This holds if $\overline{w} < \omega(qY/I, q) = w^{+}(q)$. Moreover there may not exist profitable deviation for banks. One can show that no profitable deviation exists if $\overline{w}$ (or α) are sufficiently small.

The third case that the high-ability individuals have binding participation constraints and the low-ability agents strictly prefer to participate can easily be excluded if one considers Figure 3. With a binding participation constraint of high-ability agents either the participation constraint of the low-ability agents or the incentive constraint of the high-ability agents is violated.

The uniqueness of the surplus-maximizing equilibrium is guaranteed for $\overline{w} > w^+(q)$. This completes the Proof. Q.E.D.

9.3 Proof of Proposition 2

Figure 4 shows how the functions $\omega(R,s)$, $v(R,s)$, and $\phi(R,s)$ and their intersection (R^+, w^+) vary with s.

- Figure 4 here -

- Figure 5 here -

Consider now a situation where the lower class agents own less than $w^+(p)$ and where the lower class on its own would exhaust the capital stock: $\mu_l \cdot I > \bar{w}$. For all $s \in [q,p]$ the incentive compatibility constraint of the high ability agents in the lower class only holds at an rate of return below $\tilde{R}$ where $w_l = \omega(\tilde{R}, s)$. For these rate of returns the participation constraints of both high-ability and low-ability agents hold with a strict inequality. This follows directly from Lemma 5 and from the fact that $w_l < w^+(p) < w^+(s)$ for all $s \leq p$ (see Figure 5). Hence, if high-ability agents provide effort, all agents in the lower class open firms. Given that $\mu_l \cdot I > \bar{w}$ this leads to excess demand on the capital market. Q.E.D.

9.4 Proof of Proposition 3

Consider a situation where all high-ability rich and some low-ability rich agents open firms. The probability of success is then $\check{s} := \mu_u \alpha p + \left(\frac{\overline{w}}{I} - \mu_u \alpha\right) q < p$. The corresponding rate of return is $\check{R} = \phi^{-1}(w_u, \check{s})$. At this rate of return rich low-ability agents are indifferent between opening a firm and investing. This situation constitutes an equilibrium if (i) it does not pay for a bank to offer another contract to upper class members and (ii) it does not pay for a bank to offer a contract to lower class members. (i) follows from an argument which is completely analogue to the one in the proof of Proposition 1, Step 1. For the proof of (ii) I proceed in three steps. First, I show that $\check{R} > \underline{R}$. Secondly, I show that if high ability lower class agents are not willing to provide effort when $D_Y = \underline{R}/p(I - w_l)$, then they do not provide effort at $D_Y = \check{R}/s \cdot (I - w_l)$ either, provided that $s \leq p$ and $\check{R} > \underline{R}$. Thirdly, I consider the case where $D_Y = \underline{R}/p(I - w_l)$ and derive a wealth level below which talented agents do not provide effort. It turns out that this wealth level is positive if B is sufficiently large.

STEP1*:* $\check{R} > \underline{R}$. This follows from the fact that (i) $\phi_R(R, s) < 0$ [Lemma 5 (i)], (ii) $I > w_u$ and (iii) $I = \phi(\underline{R}, s)\ \forall s$.

STEP 2*:* The amount of capital needed to provide effort increases with R and decreases with s: $\omega_R(R, s) > 0$ and $\omega_s(R, s) < 0$. Hence, if high-ability lower class agents are not willing to provide effort when $D_Y = \underline{R}/p(I - w_l)$, then they do not provide effort at $D_Y = \check{R}/s \cdot (I - w_l)$ either.

STEP 3*:* The incentive constraint (12) for a lower class individual does not hold at $\underline{R}$ and $s = p$ if

$$w_l < I - p\frac{y - \frac{B}{p-q}}{\underline{R}}, \tag{19}$$

or

$$w < w^{++} := \left(1 - p/q\left(1 - \frac{B}{(p-q)Y}\right)\right) \cdot I. \tag{20}$$

It is easily verified that $w^{++} > 0$ if $B > (p - q)/p \cdot (p - q)Y < (p - q)Y$. If B is sufficiently close to the output gain $(p-q)Y$ then there are positive wealth levels at which the poor high-ability agents do not have an incentive to provide effort. For such low wealth levels, there are no contracts such that at $\tilde{R} > \underline{R}$ a bank can make the high-ability poor agents provide effort and earn positive profits. Hence, positive profits with the lower class agents are excluded if the lower class is sufficiently poor. Q.E.D.

9.5 Proof of Proposition 4

From Proposition 1 it follows that the surplus of the economy is given by qY if there is complete equality. It remains to be shown that there are equilibria with inequality that yield a higher surplus. Consider the case where a fraction $\overline{w}/I$ of the population is endowed with all the capital. In equilibrium, a fraction α of them provides effort. The surplus is then

$$\alpha \cdot \overline{w}/I \cdot (pY - B) + (1-\alpha) \cdot \overline{w}/I \cdot qY \quad (21)$$

$$= \overline{w}/I \cdot qY + \alpha \cdot \overline{w}/I \cdot [(p-q)Y - B] \quad (22)$$

The proposition follows from $(p-q)Y > B$. Q.E.D.

9.6 Proof of Proposition 5

It suffices to provide an example, i.e. to find two wealth distributions with corresponding market equilibria that can be ranked according to the Pareto-criterion. We consider the case where there is enough wealth such that exactly $2 \cdot \alpha$ firms can be opened: $2\alpha I = \bar{w}$. The Proposition follows from three Lemmata.

Lemma 6 *Consider an economy with two wealth classes of equal size. The upper class has wealth*

$$w_1 = w^+\left(\frac{p+q}{2}\right) + \varepsilon, \tag{23}$$

and the lower class

$$w_2 = w^+(p) - \varepsilon. \tag{24}$$

For $\varepsilon > 0$ *sufficiently small, there is a capital market equilibrium where* $R = \phi^{-1}(w_1, s)$ *with* $s = (p+q)/2$. *Only upper class agents open firms. There are* $\alpha/2$ *high-ability and* $\alpha/2$ *low-ability upper class entrepreneurs. In this equilibrium rich low-ability agents are just indifferent between opening a firm and investing.*

Lemma 7 *For* $\varepsilon = 0$ *there is a unique equilibrium where only high-ability agents open firms. The rate of return is* $R = \bar{R}$.

Lemma 8 *All agents are better off in the equilibrium from Lemma 2.*

Proof of Lemma 6At $R = \phi^{-1}(w_1, s)$ low-ability upper class agents are indifferent between entrepreneurship and investment. Moreover, high-ability upper class agents want to open a firm and provide effort. It remains to be shown that no profitable alternative contract can be offered to upper- or lower class agents. The proof for the case of upper-class agents is analogue to the one in Proposition 3. It remains to consider the case of the lower-class. We first want to show that, with $w_2 < w^+(p)$ and $R = \phi^{-1}(w_1, s)$ it is impossible to make zero profits with a pooling contract. Suppose that such a zero-profit contract leads to an average probability of success s in the participating enterprises. From Figure 7 it is obvious that - for ε small enough - at the rate of return $R = \phi^{-1}(w_1, s)$, s must exceed $(p+q)/2$ in order to induce effort of the high-ability agents. However, for these values of s all the low-ability agents are attracted. Hence, s is not sustainable and a bank cannot make zero profits with a pooling contract.

Next, we have to show that there is no screening contract for the lower class that yields positive profits. To see this consider Figure 8 which depicts the set of feasible contracts in the D_0, D_Y-diagram. The incentive compatibility constraint of a high-ability entrepreneur is given by $D_Y \leq Y - B/(p-q) + D_0$. Point A its the pooling contract offered to the upper class in our equilibrium. Point B describes a pooling contract for the lower class that yields zero profits to the bank for a probability of success of $(p+q)/2$. In this point the bank makes positive profits with the high-ability agents and negative profits with the low-ability agents. This contract is, as we have shown above, not incentive compatible for the rich. Hence, B is not in the IC set. Now consider a screening contract (C, D) that offers the lower class high-ability agent a contract in the IC set. The low-ability agents must prefer their contract (D) to C. We know that low-ability agents strictly prefer this contract to investing. This follows from the fact that $\phi'_R < 0$. Hence all low-ability agents would strictly prefer point D to investing. Given that in B the bank makes zero profits (and negative profits with low-ability agents), this implies that the combination of C and D must yield negative profits to the bank.

Proof of Lemma 7 Figure 9 shows that, at $R = \bar{R}$ and $s = p$ the agents in both wealth classes react to the contract $\left(D_0 = 0, D_Y = \bar{R}/s(I-w)\right)$ in a way that capital supply and demand are equalized. Point A describes the situation of the poor agents. Both participation constraints and the incentive constraint are just binding. Hence, it is possible that all good entrepreneurs participate and the bad do not participate.

Point B describes the situation of the rich agents. High-ability agents are indifferent between entrepreneurship and investment and provide effort as entrepreneurs. Low-ability agents strictly prefer not to open a firm. It remains to be shown that there is no profitable deviation for a bank. This is obvious: Any such contract can only attract additional low-ability entrepreneurs who generate losses at $R = \bar{R}$. At the same time high-ability agents cannot generate gains at $R = \bar{R}$.

PROOF OF LEMMA 8 Finally we have to show that redistribution leads a Pareto improvement. We begin with the expected income before redistribution. Given that ε can be chosen arbitrarily small, the rate of return can be made arbitrarily close to $R^+(s)$ as defined in (). The payoffs of the four sorts of agents are therefore arbitrarily close to:

$$y_1^h = \quad p \cdot \left(Y - \tfrac{R^+(s)}{s}\left(I - w^+(s)\right)\right) - B \tag{25}$$

$$y_1^l = \quad R^+(s) \cdot w^+(s) \tag{26}$$

$$y_2^h = \quad R^+(s) \cdot w^+(p) \tag{27}$$

$$y_2^l = \quad R^+(s) \cdot w^+(p) \tag{28}$$

Next, consider that, after giving ε units of wealth to each lower class agent, the payoffs are exactly given by:

$$y_1^h = \quad p \cdot \left(Y - \tfrac{\bar{R}}{p}\left(I - w^+(s)\right)\right) - B \tag{29}$$

$$y_1^l = \bar{R} \cdot w^+(s) \tag{30}$$

$$y_2^h = p \cdot \left(Y - \tfrac{\bar{R}}{p}\left(I - w^+(p)\right)\right) - B \tag{31}$$

$$y_2^l = \bar{R} \cdot w^+(p). \tag{32}$$

Lower class members always gain because the rate of return rises. Low-ability upper class agents gain for the same reason (note that they were indifferent between investing and entrepreneurship before redistribution). Hence, it remains to consider the high-ability upper-class agents. They now pay a rate of return $\frac{\bar{R}}{p}$ instead of $\frac{R^+(s)}{s}$ on their loan. They strictly gain from redistribution if

$$\begin{aligned} \frac{R^+(s)}{s} &> \frac{\bar{R}}{p} \Leftrightarrow && (33) \\ \frac{\frac{p+q}{2}Y - \frac{B}{2}}{\frac{p+q}{2}I} &> \frac{pY - B}{pI} \Leftrightarrow && (34) \\ Y - \frac{B}{p+q} &> Y - \frac{B}{p}, && (35) \end{aligned}$$

i.e. if $q > 0$. For $\varepsilon > 0$ all payoffs are continuous functions of ε. Hence, there is a continuum of equilibria that are Pareto-inferior to the one after redistribution. Q.E.D.

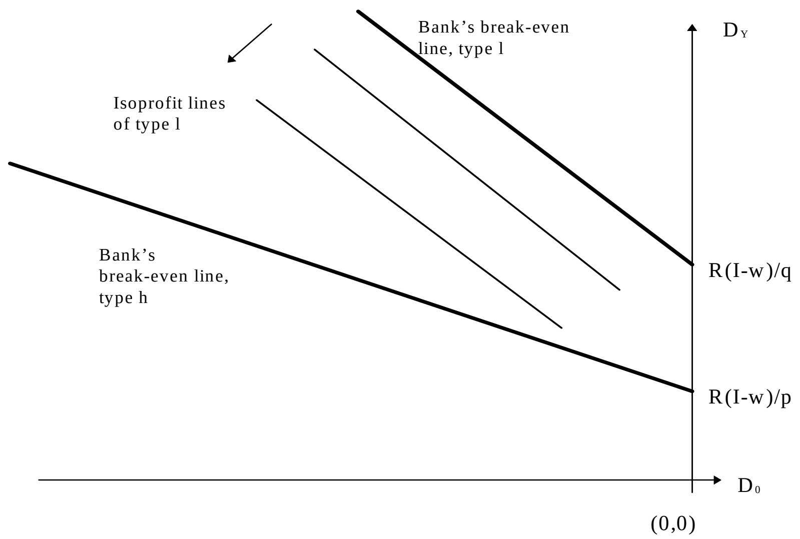

Figure 1: Non-existence of separating equilibria. The isoprofit lines of low-ability agents have the same slope as the break-even line for type l. This is why low-ability agents always prefer a contract on the break even line for type h. Note that entrepreneurs are protected by limited liability. Hence, an entrepreneur cannot pay money to the bank if his project fails: $D_0 < 0$.

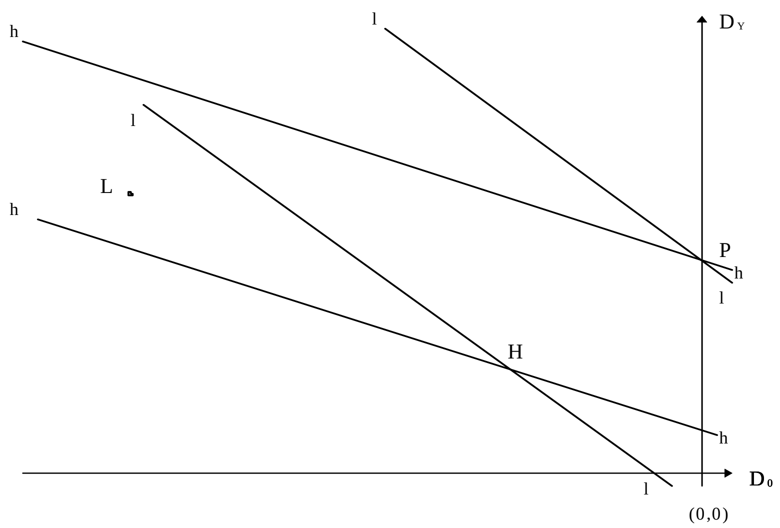

Figure 2: Pooling contracts.

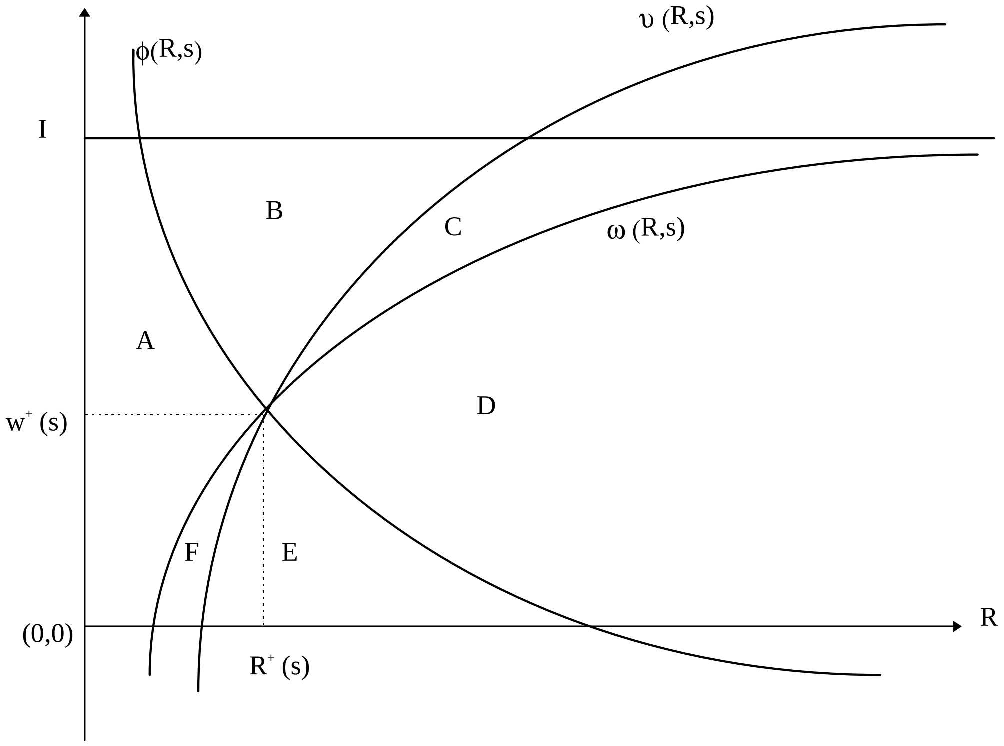

Figure 3: The incentive- and participation constraints for a given value of s. The incentive constraint of high ability entrepreneurs is $w \geq \omega(R,s)$. The participation constraints of high- and low-ability entrepreneurs are $w \leq \upsilon(R,s)$ and $w \geq \phi(R,s)$.

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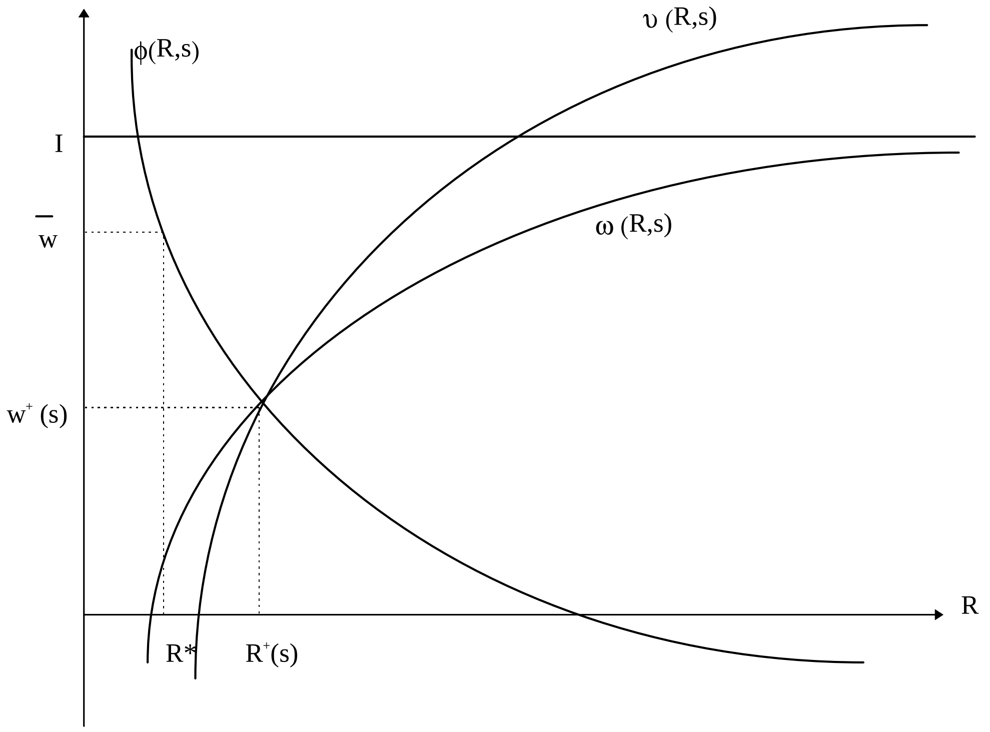

Figure 4: Equilibrium with a single wealth class.

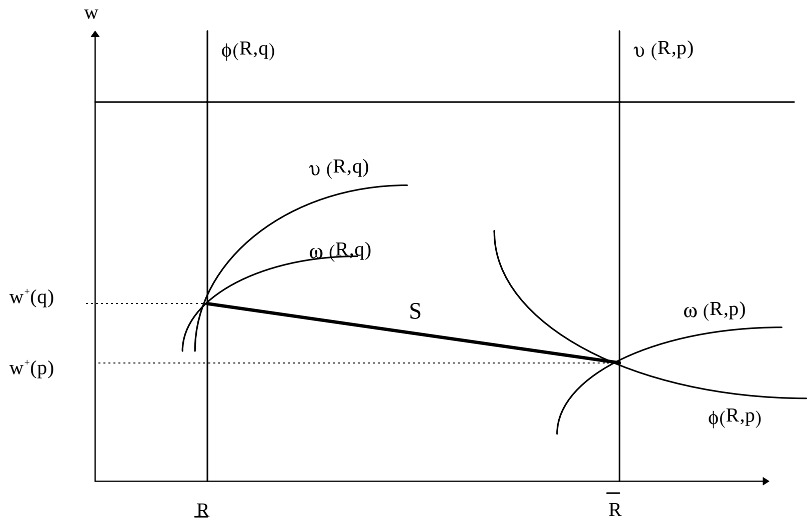

Figure 5: For varying perceived success probabilities, the two functions $R^{+}(s)$ and $w^{+}(s)$ define a set of intersection points $S = \{(R^{+}(s), w^{+}(s)), s \in [q, p]\}$.

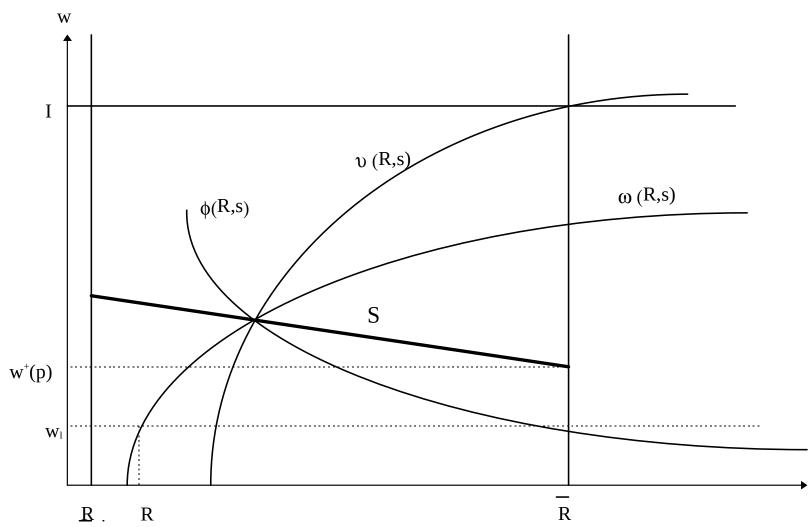

Figure 6: Proof of Proposition 2.

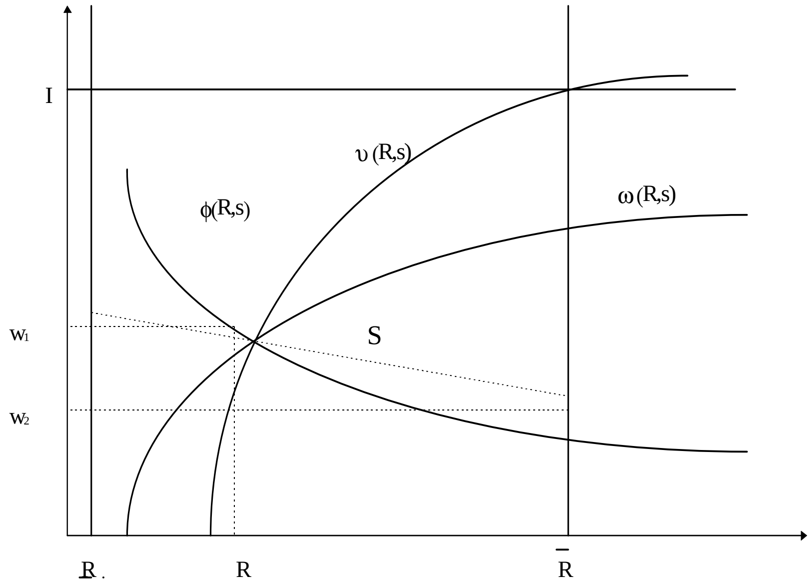

Figure 7.

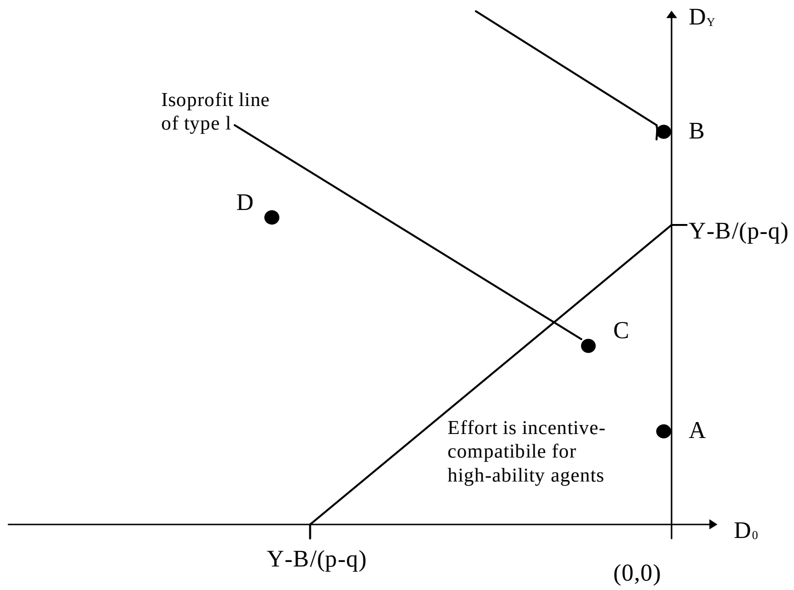

Figure 8

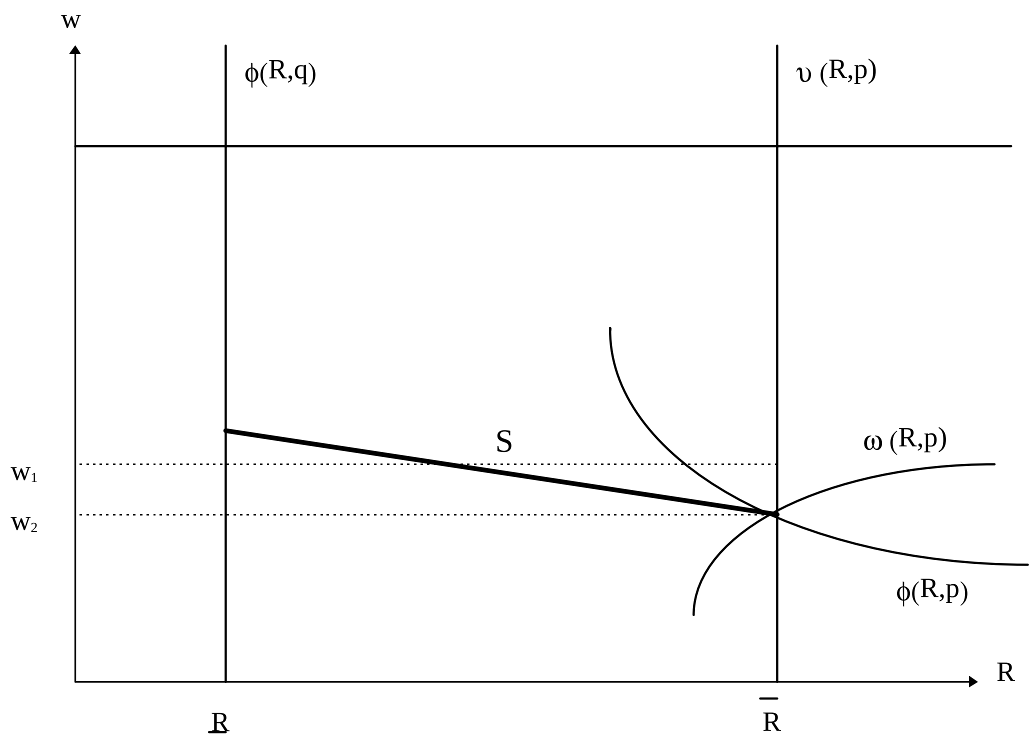

Figure 9

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