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Credit Rationing, Wealth Inequality, and Allocation of Talent. [1]

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Abstract

We provide a simple general equilibrium model where individuals are heterogeneous in terms of wealth and entrepreneurial skills but are equally skilled as workers. Entrepreneurial talent is subject to private information and to screen borrowers banks ask for collateral. Changes in the wage rate affect the incentive constraints in the credit market in a way that could lead to multiple equilibria. The higher is the wage rate, the lower is the collateral needed to discourage less talented agents from borrowing. This allows a greater number of poor but talented agents to become entrepreneurs, thereby increasing labor demand and justifying the wage increase. In contrast to the existing literature on occupational choice, two economies can converge to different steady states starting with the same initial wealth distribution, and credit subsidies can lower aggregate surplus by making the screening problem harder for banks.

Keywords: Occupational Choice, Adverse Selection, Credit Rationing, Wealth Inequality

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1 Introduction

A well-functioning credit market allows those who have surplus savings to lend it to those who have skills, talents and ideas. In addition it allows those who are born poor to acquire skills through education and move up the economic ladder. However, there may be transactions costs due to the necessity to screen and monitor borrowers to ensure repayment. The use of collateral might reduce the transaction costs, but those who need capital most are poor and unable to pledge collateral. Thus, capital may not flow freely to those who need it most, and projects with a high potential rate of return may never be realized.[1] If the poor cannot borrow in order to enter profitable occupations, then not only are their current earnings low, but their future earnings are low as well, as will be their bequests to their descendants. In contrast to the predictions of traditional growth models, the poor may never catch up with the rich. Credit market imperfections can lock individuals (and economies) into long term poverty traps.[2] This argument suggests a role for redistributive policies and credit subsidies.

In the literature on poverty traps, entrepreneurship is typically viewed as involving monitoring other workers, a skill that can be picked up easily.[3] In contrast, the classical literature originating with Schumpeter emphasized entrepreneurial talent and ability to innovate as the key to economic development. However it did not consider the possibility that highly talented entrepreneurs may face borrowing constraints.[4] In this paper we provide a simple general equilibrium analysis of the allocation of talent in an economy with heterogeneity of wealth and skill endowments and asymmetric information regarding entrepreneurial talent

[1] See Banerjee (2000) and Mookherjee (1999) for recent reviews of the role of capital market imperfections in economic development.

[2] See Benabou (1996) and Ray (2000) for overviews of this literature.

[3] Exceptions are Evans and Jovanovic (1989) and Lloyd-Ellis and Bernhardt (2000). They allow entrepreneurs to have heterogeneous talent and combine this feature with exogenously given credit market imperfections that imply that only individuals with some minimum level of wealth can become entrepreneurs. Our model is distinguished by the fact that entrepreneuriral talent is subject to asymmetric information, and this leads to endogenous credit market imperfections.

[4] It has been argued that Frank Night, who is well known for the view that bearing risk is one of the crucial features of entrepreneurship, disagreed with the Schumpeterian view and recognized that capital markets provide too little capital to entrepreneurs because of moral hazard and adverse selection problems (LeRoy and Singell, 1987).

that leads to borrowing constraints.

Our goal is to study the relationship between the endogenously determined borrowing constraints, the (mis)allocation of entrepreneurial talent, and the level and entrepreneurship. For simplicity we assume that talent and wealth are uncorrelated, so talented agents exist in the same proportion for every wealth level. Our starting point is the standard model of financial contracting under adverse selection, where competitive lenders use collateral to screen borrowers. We embed this model in a general equilibrium of a simple competitive economy. Each individual can be either an entrepreneur or a worker, or work alone with a subsistence technology that requires no capital. Workers earn wages that are determined in labor market equilibrium. All individuals are equally skilled at providing non-entrepreneurial labor, hence all workers earn the same wage. Entrepreneurship involves a set-up cost, so individuals with insufficient wealth who want to become entrepreneurs must borrow from a bank. Some individuals have the talent necessary to succeed as an entrepreneur, others do not. A talented entrepreneur will produce a net surplus which is large enough to cover the set-up cost. An untalented entrepreneur will not produce any surplus, but will obtain a private benefit M from being entrepreneur. Suppose $\overline{w}$ is the wage that would obtain in the labor market if talent were observable such that at this wage talented entrepreneurs make zero profit (after the opportunity cost $\overline{w}$ of not becoming a worker has been subtracted). If $M > \overline{w}$, then untalented agents would like to become entrepreneurs if they could, and there will be an adverse selection problem if the agent's talent is his private information.

In the presence of adverse selection the only way for the bank to screen the borrowers is to ask for collateral. Untalented individuals are unwilling to give up collateral since they know they will not be able to repay the loan. The amount of collateral sufficient to discourage untalented individuals from becoming entrepreneurs is $c^*(\overline{w}) = (M - \overline{w})/\rho$, where ρ equals one plus the interests rate. If the number of talented individuals who have initial wealth greater than $c^*(\overline{w})$ is sufficient to guarantee full employment, then even in the presence of adverse selection there exists an equilibrium where the wage is $\overline{w}$ and social surplus is at the first best level. Adverse selection introduces the possibility of other equilibria, however. Suppose all individuals expect a wage $w < \overline{w}$ on the labor market. The bank's screening problem will be more difficult with a low wage, since untalented individuals will be more interested in becoming entrepreneurs if the wage they can earn as workers is low. To screen the borrowers, the banks increase the collateral requirement to $c^*(w) = (M - w)/\rho$. However, this reduces the number of talented individuals who can afford to become entrepreneurs, and so reduces the demand for labor. The reduced demand for labor may justify a lower wage, so multiple equilibria can easily occur. In particular, there may be an equilibrium where the wage is the lowest possible, equal to the "subsistence wage" $\underline{w}$. At such a low wage, all workers are indifferent between working for an entrepreneur or engaging in the subsistence activity. With outside opportunities thus depressed, untalented individuals will crowd the credit market, and the collateral requirement $c^*(\underline{w}) = (M - \underline{w})/\rho$ will be very large. If the number of talented individuals that have wealth greater than $c^*(\underline{w})$ is smaller than the number of entrepreneurs required for full employment, then $\underline{w}$ is an equilibrium wage. At this equilibrium, wealthy entrepreneurs make large profits and everybody else earns the subsistence income. Many talented individuals are unable to come up with the required collateral are prevented from becoming entrepreneurs. In fact it turns out that no other wages except $\underline{w}$ and $\overline{w}$ are consistent with a stable equilibrium.

The key insight from endogenizing the credit market constraints is that markets are linked, and price changes in one market may change the incentive constraints in the other market, which in turn feeds back to the market where the initial price change occurred. In our model, the feedback through the credit market causes the demand for labor to be increasing in the wage. With a high wage, untalented agents will not crowd the credit market, the banks will ask for limited collateral, entrepreneurial activity and labor demand will be high. Hence, multiple equilibria can easily exist. As would be expected from a model with set-up costs and imperfect credit markets, the wealth distribution matters. Reallocating wealth can increase the number of talented individuals who can afford the collateral requirement, making it possible to support a high wage equilibrium and getting rid of a low wage equilibrium. Even if the low wage equilibrium cannot be eliminated, total output is increasing in the number of talented agents who have wealth at least $c^*(\underline{w})$, since they are the ones who will become entrepreneurs. While this policy conclusion is consistent with the finding of the literature on poverty traps (e.g., Banerjee and Newman, 1993), those involving credit subsidies or minimum wage laws are not. We show that credit subsidies can lower total output and net surplus by making the screening problem harder for banks, thereby raising the collateral requirement which leads to poor high type agents to be credit rationed. Also, as in coordination failure models, a one-shot policy such as a minimum wage law can coordinate the economy to an equilibrium with higher output and net surplus.

For a given initial distribution of wealth and a given wage, the endogenous borrowing constraints determine the level of entrepreneurial activity and hence the demand for labor, which in turn determines the equilibrium wage. This way we find a general equilibrium for a given distribution of wealth. However, at the end of the period the distribution of wealth will in general be different from the initial distribution. Assuming each individual passes on a constant fraction of his wealth as bequests to the next generation, we can study the dynamics of the wealth distribution. In section 4 we study the long run equilibrium of the economy where the wealth distribution evolves endogenously. We restrict attention to stationary equilibria, where the wage rate is the same over time, and examine the how the wealth distribution evolves over time. In particular, we are interested in finding out conditions under which an economy could have two stationary equilibria, one with the low wage prevailing in the labor market in each period, and the other with the high wage.

Developed countries such as the United States seems to have both higher wages and easier access to credit than many other countries, and our model shows how this could be explained by a simple multiple equilibrium argument, without invoking differences in technology and preferences. Our model may also explain why recessions tend to persist. Caballero and Hammour (1994) argue that recessions have a cleansing effect by weeding out inefficient firms. Our argument is, to the contrary, that recessions worsen the adverse selection problems in the credit market, which reinforces the recession.

Our paper is also closely related to the recent literature on occupational choice. Like Banerjee and Newman (1993) we consider the endogenous determination of returns to different occupations in the presence of imperfect credit markets and set-up costs.[5] These papers show that there can be multiple steady states, and which one is reached can depend on the initial distribution of wealth. However, once the initial distribution of wealth is known, the long term outcome of the economy is perfectly known.[6] In our model, for a given initial

[5] For related contributions see Galor and Zeira (1993), Mookherjee and Ray (2000) and Piketty (1997).

[6] See Ray (2000) for a discussion of this point.

distribution of wealth there can be multiplicity of equilibria due to the interaction of multiple markets. In this sense our model is closely related to models of coordination failure such as Murphy, Shleifer and Vishny (1989).

In a previous paper (Ghatak, Morelli and Sjöström, 2000) we studied occupational mobility when individuals are endowed with identical wealth and identical talent, and hence there is equality of opportunity. In that model, imperfections in the credit market gave rise to entrepreneurial rents which stimulate social mobility through hard work. In the current model, the problem is not to get individuals to work hard, but rather to make sure that the most talented individuals have the opportunity to implement their good ideas by starting their own firms. That is, the focus is on social mobility through the realization of good ideas, not through high effort.

2 The Static Model

2.1 Endowments and Preferences

We consider a one-period competitive economy with a continuum of risk neutral agents identified with the interval $[0, 1]$. Each agent i is born with initial wealth a_i. The initial distribution of wealth is $G(\cdot)$ which we take as given in the static model. All agents are born with an endowment of one unit of labor which they supply inelastically, either as entrepreneurial labor or as ordinary labor. An agent is talented with probability α and not talented with probability $1-\alpha$. We will refer to talented and not talented agents as h and l types, respectively. Talent refers to entrepreneurial ability only: all agents are equally qualified to supply ordinary labor. An agent's type (talent) is private information. Wealth and ability are independently distributed. Consumption can take place at the beginning or at the end of the period. End of period consumption is discounted by the factor $1/\rho$, $\rho \geq 1$.

2.2 Technology

The economy produces one homogenous good, a numeraire commodity referred to simply as output. Output can be consumed or used as capital. There is a subsistence technology that requires no capital and one unit of labor to produce $\underline{w} > 0$ units of output. There is an entrepreneurial technology called a **project**. Each project requires $k > 0$ units of capital, one unit of entrepreneurial labor, and $n \geq 1$ units of ordinary labor. The technology is fixed-coefficients type, and n and k are given exogenously. The capital depreciates completely at the end of the period, and can be interpreted as human capital. If the entrepreneur is talented, the project will produce R units of output as well as a **private benefit** to the entrepreneur worth $M > 0$ units of the numeraire. If instead the entrepreneur is not talented, the project will generate only a private benefit M and no other output. The private benefit cannot be appropriated by a lender, which captures the idea that an entrepreneur cannot be prevented from diverting some part of the investment into his own benefit.[7] In order to focus on the interesting cases, we make the following assumptions on the exogenous parameters.

Assumption 1. $R - n\underline{w} - \rho k > 0$.

Assumption 2. $M - \rho k < \underline{w} < M$.

Assumption 3. $M + \alpha(R - n\underline{w}) < \underline{w} + \rho k$.

To interpret these assumptions, suppose the wage takes the lowest possible value, $\underline{w}$. Assumption 1 says that R is sufficiently big that a project operated by a talented entrepreneur yields a net surplus after paying the wage bill $n\underline{w}$ and the set-up cost ρk. Assumption 2 says that the private benefit of being entrepreneur, M, exceeds the income from the subsistence technology, $\underline{w}$. Therefore, l type agents could potentially gain from becoming bank-financed entrepreneurs. However, when the set-up cost ρk is subtracted from the private benefit, the subsistence technology dominates, so l type agents never want to become **self financed** entrepreneurs. To interpret Assumption 3, suppose an agent is picked at random from the population and made an entrepreneur. The random agent is type h with probability α, in which case she produces R and pays wages $n\underline{w}$.[8] Regardless of her type, she receives the

[7] The private benefit could be different for l types and h types without changing any of our results. For example, l types might get a higher benefit than h types if they, knowing that they would not produce a surplus anyway, simply embezzle part of the capital.

[8] If the entrepreneur is type l, she does not produce any output. We may assume that she does not hire any workers, or we can assume that she hires n workers and defaults on their wages. What we assume is irrelevant for our results because type l agents will not become entrepreneurs in equilibrium.

private benefit M and she foregoes the $\underline{w}$ units of output she could have produced using the subsistence technology. The set up cost of a project is ρk. Thus, Assumption 3 guarantees that the expected social cost of a project exceeds the expected social gain if the entrepreneur is randomly chosen. Notice that Assumption 3 is satisfied if α is low enough, since $M < \underline{w} + \rho k$ from Assumption 2. As is standard in competitive screening models, an equilibrium will not exist if the fraction of "good types" is too large, because separating equilibria will be destroyed by deviations where banks offer "pooling" contracts that attract both types of borrowers. To ensure the existence of an equilibrium, we need to make sure α (the fraction of type h agents) is not too large. Assumption 3 guarantees it.

2.3 Markets

All markets are perfectly competitive. Every individual has the same skill as a worker, and there is no moral hazard with respect to effort. Wages adjust without any frictions to clear the labor market. As a result there is no involuntary unemployment, and each entrepreneur is able to hire n workers at the going market wage. The supply and demand for labor are determined by the occupational choices of agents (entrepreneurship versus wage labor). Notice that since any agent can use the subsistence technology, wages can never fall below $\underline{w}$.

Since entrepreneurial talent is private information and type l entrepreneurs will never repay their loans, there is an adverse selection problem on the credit market which will be discussed in the next section. Banks have access to an international credit market where the supply of funds is infinitely elastic at the gross interest rate $\rho \geq 1$. Agents who have wealth can deposit any portion of it and earn gross interest ρ. Since the discount factor for end of period consumption is $1/\rho$, agents are indifferent between consuming immediately, or saving and consuming later.

3 Equilibrium in the Static Model

3.1 Credit Market

Banks compete by offering credit contracts. Borrowers accept the contract they prefer, if any. All take the labor market wage as given. Since borrowers' types are private information, the market suffers from an adverse selection problem. As in Besanko and Thakor (1987), collateral can be used as a screening device. Following Rothschild and Stiglitz (1976), an equilibrium consists of a set of contracts such that no contract makes losses, and no additional contracts can be introduced that earns profits if the original contracts are left unmodified. A standard argument shows that each contract that is offered in equilibrium will yield zero expected profit, and there can be no pooling of types. Moreover, an equilibrium may not exist if α is close to one.[9]

We assume that no transaction costs are involved in pledging or liquidating the collateral. Introducing such costs would not add anything to the analysis. In effect, the collateral consists of the numeraire commodity, not an illiquid asset like a house, so to pledge collateral is in fact equivalent to self-financing part of the investment. We choose the collateral formulation for convenience.

Output is verifiable so if a project has produced a surplus, the borrower can be forced to repay her loan out of her project's earnings. However, there is limited liability in the sense that an entrepreneur who did not produce a sufficient surplus can at most lose the assets she had pledged as collateral. Moreover, the private benefit M cannot be appropriated by the bank. Without loss of generality we consider credit contracts of the following form. The bank makes a loan of size k to finance a project, but asks for collateral c. The interest rate on the loan is r. Thus, a contract can be written as (c, r). An agent can accept the contract (c, r) only if her initial wealth is at least c. The bank holds on to the collateral c until the end of the period, earning interest $(\rho - 1)c$, and hands c back to the agent if and only if the loan is repaid in full (the required repayment is rk). As we already remarked, the bank could just as well require borrowers to contribute c to the project while the bank contributes $k - c$.

While type h entrepreneurs care about the interest on the loan as well as the collateral, type l entrepreneurs care only about the collateral requirement since they will never repay their loans. Thus, collateral can be used to screen the borrowers, which by a standard argument guarantees that an equilibrium (if one exists) must be "separating". But if type l agents are separated out they must in fact be completely shut out from the credit market,

[9] For a lucid derivation of these and other results for the standard competitive screening model, see chapter 13D of Mas-Colell, Whinston and Green (1995).

for they will always default on their loans. Thus, the minimum collateral requirement must be high enough to deter type l agents from becoming bank-financed entrepreneurs.[10]

A contract (c, r) which attracts only type h borrowers will yield zero profit if

$$rk + (\rho - 1)c = \rho k \tag{1}$$

This zero profit condition can be written as

$$rk - c = \rho\,(k - c) \tag{2}$$

or $r = \bar{r}(c)$, where

$$\bar{r}(c) \equiv \rho - (\rho - 1)\frac{c}{k} \tag{3}$$

In effect, the bank needs to obtain $k - c$ on the international credit market to finance the project at a cost of $\rho\,(k - c)$. At the end of the period, the agent makes a net transfer of $rk - c$ to the bank, which explains (2).

The type h entrepreneur who has accepted the contract (c, r) will pay wages nw to her n workers and she will pay rk to the bank at the end of the period. Moreover, she will have to postpone the consumption of her collateral until the end of the period, which is worth $(\rho - 1)c$. Her net payoff[11] is, therefore,

$$R + M - nw - rk - (\rho - 1)c$$

Since banks break even on each contract, we can use equation (2) to obtain the following expression for the expected payoff of a bank-financed type h entrepreneur:

$$\pi(w) = R + M - nw - \rho k. \tag{4}$$

Notice that the only endogenous variable that appears in (4) is w. Neither c nor r appear separately. Indeed, (4) gives the payoff for a self-financed type h entrepreneur as well. Assumptions 1 and 2 imply that $\pi(\underline{w}) > \underline{w}$.

[10] If type l agents borrow at all, then only banks with the lowest collateral requirement in the market, say (c', r'), will attract them. If the contract (c', r') attracts both h and l types and breaks even, there exists a nearby contract (with slightly higher c and lower r) which attracts only h types and yields a strictly positive profit for the bank that offers it, but this is inconsistent with equilibrium. Thus, there cannot be any pooling in equilibrium.

[11] We will measure payoffs in end of period units of utility for convenience. The discounted value of being an entrepreneur would be π^{h}/ρ.

A type h entrepreneur with wealth a will be indifferent between all loans that have collateral requirement $c \leq a$, since all such loans will give him payoff (4). As long as the bank's zero profit constraint is satisfied, the entrepreneur will be precisely compensated for "renting" excess collateral to the bank for one period. That compensation is done by lowering his interest rate if he puts in more collateral, but it serves no useful screening purpose and is completely neutral.[12] Therefore, without loss of generality we can assume that type h borrowers always take the contract with the lowest collateral requirement. So we can just as well assume that only one credit contract $(c, \bar{r}(c))$ is offered in equilibrium. The level of collateral c must be the minimum level that prevents type l agents from wanting a loan.[13] The net payoff to a type l entrepreneur who accepts contract $(c, \bar{r}(c))$ will be $M - \rho c$, where ρc is the cost to her of losing her collateral. If instead she supplies ordinary labor she earns the wage w. If $w \geq M$ then she will not want a loan even if $c = 0$. If $M > w$, then to prevent type l agents from borrowing we need $M - \rho c \leq w$. Thus, the equilibrium level of collateral must be

$$c^*(w) \equiv \max \left(\frac{M - w}{\rho}, 0 \right). \tag{5}$$

Any lower level of collateral would attract type l agents. By Assumption 2, $c^*(\underline{w}) > 0$ and $c^*(w) \leq k$ for any $w \geq \underline{w}$ as we would expect. Also, (5) implies that the level of collateral required to discourage l types from borrowing is decreasing in the wage rate $(dc^*/dw \leq 0)$, since the alternative to starting a project is to work for wages.

We have shown that, given a labor market wage w, the only[14] candidate for an equilibrium on the credit market is the contract $(c, \bar{r}(c))$ with $c = c^*(w)$, where the functions c^* and $\bar{r}$

[12] If some transactions cost was involved in transferring the collateral back and forth between the bank and the borrower, then only the smallest level of collateral necessary to screen the borrowers would be used.

[13] If the required level of c were strictly higher than necessary to deter type l agents from borrowing, then some collateral level $c^* < c$ would also be high enough to deter type l agents. A bank which deviates and offers a contract with a collateral level c^* would be able to make positive profits from those type h agents that have initital wealth between c^* and c, since these would not be served by any other bank. This would be incompatible with equilibrium.

[14] More precisely, if any equilibrium exists, then there also exists an equilibrium where the only contract on the market is $(c, \overline{r}(c))$ with $c = \overline{c}(w)$. Other equilibria could exist because contracts $(c, \overline{r}(c))$ with $c > \overline{c}(w)$ could be offered and accepted by some type h agents in equilibrium. However, the existence of these other contracts would not change anybody's welfare, so this non-uniqueness is trivial.

are defined by (3) and (5). To show the existence of equilibrium, we need to show that if $(c, \bar{r}(c))$ with $c = c^*(w)$ is offered, no bank has any incentive to deviate to a pooling contract with a lower collateral level. This deviation could potentially be profitable since it would attract h types whose wealth is below $c^*(w)$, and the gain from lending to them could exceed the cost of lending to l types who would also be attracted by the loan. Suppose a deviating bank offers a contract (c', r') with $0 \leq c' < c^*(w)$. This contract will attract all type l agents with wealth at least c'. They are of measure $(1-\alpha)(1-G(c'))$. In particular it includes all l agents with wealth above $c^*(w)$. On each loan to a type l agent the bank loses $\rho\,(k-c')$. To be profitable, it must be the case that $r' > \bar{r}(c)$. Therefore, type h agents with wealth $a \geq c^*(w)$ will not be attracted by the new contract (they prefer $(c^*(w), \bar{r}(c^*(w)))$ to (c', r')). Type h agents with initial wealth between c' and $c^*(w)$ might be attracted, however, since they cannot get any other loan. The measure of high types with wealth between c' and $c^*(w)$ is $\alpha\{G(c^*(w)) - G(c')\}$. Since attracting these h types is necessary for the new contract to be profitable, the highest interest rate r' the bank can charge is the one that extracts all the surplus from the type h borrowers:

$$R + M - nw - r'k - (\rho - 1)c' = w$$

Here the left hand side is the type h entrepreneurs payoff when he gets the loan, and the right hand side the opportunity cost of not working for wages. Using this, the deviating bank's profit is at most

$$\Pi^B = \alpha \left(G(c^*(w)) - G(c')\right)(R + M - (n+1)w - \rho k) - (1-\alpha)\left(1 - G(c')\right)\rho\left(k - c'\right)$$

Since $G(c^*(w)) \leq 1$ and

$$c' < c^*(w) = \frac{M - w}{\rho}$$

we have

$$\begin{aligned}
\Pi^B &< \left(G(c^*(w)) - G(c')\right)\left[\alpha\,(R + M - (n+1)w - \rho k) - (1-\alpha)\rho\left(k - \frac{M-w}{\rho}\right)\right] \\
&= \left(G(c^*(w)) - G(c')\right)\left[M - \rho k - w + \alpha\,(R - nw)\right] \leq 0
\end{aligned}$$

for any $w \geq \underline{w}$, by Assumption 3. Thus, no deviation to a contract that attracts both l and h types will be profitable.[15] So we have established the following.

[15] If the deviating bank could observe borrowers' wealth levels directly, it would know that any client with

Proposition 1. For a given labor market wage $w \geq \underline{w}$, there exists a unique[16] equilibrium on the credit market. The equilibrium credit contract is $(c^*(w), \bar{r}(c^*(w)),$ where $\bar{r}$ and c^* are as defined by (3) and (5).

In Figure 1 we depict the credit market equilibrium in the (r, c) plane. Some indifference curves of a h type agent are depicted by π_a and π_b. For a given value of w, the point B_1 denotes the contract that will be offered to h types in a screening equilibrium and B_2 denotes the pooling contract that involves no collateral and for which the bank breaks even when both types of agents borrow.

3.2 Labor Market

As a benchmark, let us begin with the allocation that will result if there was no private information. All h type agents whose wealth is less than k will get a loan and no l type agent will be able to borrow. All h type agents will become entrepreneurs and all l type agents will become workers or engage in subsistence. The total demand for labor would be αn and the high will be the equilbrium wage rate if $\alpha n \geq 1 - \alpha$ or $\alpha \geq \frac{1}{1+n}$ and the low wage will be the equilbrium wage rate if $\alpha n < 1 - \alpha$ or $\alpha < \frac{1}{1+n}$. Technological parameters will be the only determinant of aggregate surplus and the wealth distrbution will not have any role to play.

Now let us consider the second best environement where type of an agent is private information. Given a labor market wage w, anybody who has initial wealth higher than $c^*(w)$ is able to get a loan on the credit market. No l type agent wants to borrow on such terms, hence entrepreneurs consist of h type agents with wealth $a \geq c^*(w)$. Agents with entrepreneurial talent who have wealth $a \geq c^*(w)$ are indifferent between becoming entrepreneurs and working for wages if $\pi(w) = w$, i.e., if $w = \overline{w}$ where

$$\overline{w} \equiv \frac{R + M - \rho k}{1 + n} \tag{6}$$

wealth above $\overline{c}(w)$ would be type l, since no type h agents with wealth above $\overline{c}(w)$ would be attracted by the pooling contract. However, even if the deviating bank could refuse to lend to individuals with wealth above $\overline{c}(w)$, the pooling deviation would still be unprofitable under Assumption 3.

[16] As explained, there is uniqueness in the sense that any set of contracts offered in any equilibrium would yield the same level of welfare for everybody as the equilibrium described in Proposition 1.

This is in effect the wage that yields a zero profit to entrepreneurs, net of the opportunity cost of not working for wages. This is the wage that will prevail in the labor market if the type of an agent was not subject to asymmetric information since in that case collateral is not needed and any h type agent can become an entrepreneur. Assumption 1 implies $\overline{w} > \underline{w}$. Clearly, $\underline{w}$ is a lower bound on the wage since any agent can earn $\underline{w}$ by using the subsistence technology on his own, and $\overline{w}$ is an upper bound (no agent would want to be an entrepreneur if the wage rate is $w > \overline{w}$, but all agents would want to be hired by one). We will show that $\underline{w}$ and $\overline{w}$ are in fact the only two wages that are consistent with a stable equilibrium in the labor market.

If $w < \overline{w}$ then $\pi(w) > w$ so all type h agents with wealth $a \geq c^*(w)$ will want to become entrepreneurs. Thus, the amount of labor demanded by entrepreneurs will be as follows. At $w = \overline{w}$ the demand schedule has a horizontal segment from 0 to $\alpha n(1 - G(c^*(\overline{w})))$. For $\underline{w} \leq w < \overline{w}$, the demand for labor is exactly $L^D(w) = \alpha n(1 - G(c^*(w)))$, with $dL^D/dw = -\alpha n G'(c^*(w))\,(d\bar{c}/dw) \geq 0$. If the wage falls, the collateral requirement $c^*(w)$ increases, so fewer agents have enough wealth to become entrepreneurs. Hence, the demand for labor is backward-bending, with the quantity demanded reaching a maximum of $\alpha n(1 - G(c^*(\overline{w})))$ at $w = \overline{w}$ and a minimum of $\alpha n(1 - G(c^*(\underline{w})))$ at $\underline{w}$.

No labor is forthcoming at wages below $\underline{w}$. At $w = \underline{w}$, those who are not entrepreneurs are indifferent between using the subsistence technology and working for wages. Hence, the labor supply schedule has a horizontal segment from 0 to $1 - \alpha(1 - G(c^*(\underline{w})))$ at $w = \underline{w}$. For $\underline{w} < w < \overline{w}$, the labor supply consists of all those agents who do not become entrepreneurs. That is, the supply is $L^S(w) = 1 - \alpha(1 - G(c^*(w)))$, with $dL^S/dw = \alpha G'(c^*(w))\,(d\bar{c}/dw) \leq 0$. If the wage increases, the collateral requirement $c^*(w)$ falls, so more agents have enough wealth to become entrepreneurs. Therefore, the supply curve for labor is backward-bending, too. Finally, at $w = \overline{w}$ the supply is horizontal from $\alpha(1 - G(c^*(\overline{w})))$ to 1.

The equilibrium wage is found by equating the demand for labor with the supply. Notice that, since each entrepreneur can hire n workers and the total mass of individuals is normalized to one, the number of entrepreneurs that will ensure full employment in the non-subsistence sector is $\frac{1}{1+n}$. This observation leads to the following simple characterization of equilibria:

Proposition 2. (i) If

$$\alpha\left[1-G\left(c^{*}(\underline{w})\right)\right]>\frac{1}{1+n} \tag{7}$$

then the unique equilibrium wage is $\overline{w}$ as defined by (6). The number of entrepreneurs is $1/(1+n)$. (ii) If

$$\alpha\left[1-G(c^{*}(\overline{w}))\right]<\frac{1}{1+n} \tag{8}$$

then the unique equilibrium wage is $\underline{w}$. The number of entrepreneurs is $\alpha\left(1-G(c^{*}(\underline{w}))\right)$. (iii) If

$$\alpha\left[1-G\left(c^{*}(\underline{w})\right)\right]\leq\frac{1}{1+n}\leq\alpha\left[1-G(c^{*}(\overline{w}))\right] \tag{9}$$

then both $\underline{w}$ and $\overline{w}$ are equilibrium wages. In addition, if both inequalities in (9) are strict and if G is continuous, then there is a third equilibrium wage $w^{*}\in(\underline{w},\overline{w})$ which satisfies

$$\alpha\left[1-G(c^{*}(w^{*}))\right]=\frac{1}{1+n}. \tag{10}$$

For $w\in(\underline{w},\overline{w})$, $L^{D}(w)=L^{S}(w)$ implies

$$\alpha\left[1-G(c^{*}(w))\right]=\frac{1}{1+n}$$

Now if $G(c)$ is continuous and $\alpha\geq 1/(1+n)$ then there always exists $c^{*}\geq 0$ such that

$$\alpha\left[1-G(c^{*})\right]=\frac{1}{1+n}$$

From (5) we can find out the corresponding wage rate, $w^{*}=M-\rho c^{*}$. If $\underline{w}<w^{*}<\overline{w}$ then w^{*} could be an equilibrium wage in the labor market that is consistent with rational expectations equilibrium in occupational choice and equilibrium in the credit market. However, this equilibrium would not be stable. If the expected wage $w>w^{*}$ satisfies

$$\alpha\left[1-G(c^{*}(w))\right]>\frac{1}{1+n}$$

then $L^{D}(w)>L^{S}(w)$. Because $L^{D}(w)$ and $L^{S}(w)$ slope "the wrong way", the actual wage will be pushed up all the way to $\overline{w}$. Conversely, if the expected wage $w<w^{*}$ satisfies

$$\alpha\left[1-G(c^{*}(w))\right]<\frac{1}{1+n}$$

then the wage is pushed all the way down to $\underline{w}$. For this reason, in a stable equilibrium the wage is either $\underline{w}$ or $\overline{w}$.

It is convenient to separately consider three possible configurations of the exogenous parameters.

Case 1: $\alpha(1+n) < 1$. This case is depicted in Figure 2 (in the figure we assume $\overline{w} > M$ so that $c^*(\overline{w}) = 0$). We plot c on the horizontal axis and $f(c) \equiv \alpha\left[1 - G(c^*(w))\right]$ on the vertical axis. Since $1 > \alpha(1+n)$ there is always excess supply of labor. In this case, part (ii) of Proposition 2 implies that a unique equilibrium exists independently of the wealth distribution G. The wage is the lowest possible, $\underline{w}$. This is clear because even if all talented individuals become entrepreneurs, they will only be able to hire αn workers, but there are $1 - \alpha > \alpha n$ untalented individuals to be hired. In this case, the wage must equal the lowest possible, $\underline{w}$. The wealth distribution still matters for aggregate welfare, however, since the number of entrepreneurs when the wage is $\underline{w}$ is

$$\alpha\left(1 - G(c^*(\underline{w}))\right) = \alpha\left(1 - G\left(\frac{M - \underline{w}}{\rho}\right)\right)$$

using the fact that $c^*(\underline{w}) = (M - \underline{w})/\rho$. If $G\left((M - \underline{w})/\rho\right) > 0$, that is, if some individuals have initial wealth below $(M - \underline{w})/\rho$, then not all talented individuals will become entrepreneurs.

Case 2: $\alpha(1+n) > 1$ and $R > \rho k + nM$. Notice that from (6), $R > \rho k + nM$ implies $\overline{w} > M$, so $c^*(\overline{w}) = 0$ and $1 - G(c^*(\overline{w})) = 1$. In this case, (8) can never be satisfied, so a high wage equilibrium with $w = \overline{w}$ always exists. Other equilibria may exist as well, depending on the value of $G(c^*(\underline{w}))$.

Case 2a:

$$\alpha\left(1 - G(c^*(\underline{w}))\right) \leq \frac{1}{1+n} \tag{11}$$

Then equation (9) holds so both the high wage ($w = \overline{w}$) and low wage ($w = \underline{w}$) equilibria exist. In addition, if the inequality in (11) is strict, then there is a third equilibrium wage $w = w^*$ such that (10) holds. This case is depicted in Figure 3. In this case both $L^D(w)$ and $L^S(w)$ have vertical segments for $M \leq w \leq \overline{w}$, because the collateral level is $c^*(w) = 0$ for all such w, hence a slight reduction or increase in the wage will not affect the demand or supply of labor. More precisely, $L^D(w) = 1 - \alpha$ and $L^S(w) = \alpha n > 1 - \alpha$ whenever $M \leq w \leq \overline{w}$.

Notice that $c^*(w^*) > 0$ since $\alpha(1+n) > 1$. However, if $G' > 0$ in the relevant area, then the third equilibrium is unstable in the following sense. If the expected wage w' were slightly above w^*, then the collateral requirement would be $c^*(w') < c^*(w^*)$, the number of entrepreneurs would be

$$\alpha(1 - G(c^*(w'))) > \alpha(1 - G(c^*(w^*)))$$

and the number of workers would be

$$1 - \alpha(1 - G(c^*(w'))) < 1 - \alpha(1 - G(c^*(w^*))).$$

But (10) implies the demand for labor equals the supply at wage w^*, so there is excess demand for labor at w' and the wage will increase to $\overline{w}$. The instability is due to the fact that the demand and supply curves on the labor market slope the wrong way: an increase in the wage leads to a lower collateral requirement for entrepreneurs which indices an excess demand for labor. Symmetrically, a slight decrease in the wage below w^* leads to an excess supply of labor and the wage is pushed down to $\underline{w}$. The equilibrium with $w = w^*$ is a knife-edge equilibrium in the sense that if individuals make an epsilon mistake in their expectations, the wage goes to one of the two extreme values $\underline{w}$ or $\overline{w}$. On the other hand, if people make epsilon mistakes around one of the two extreme equilibria $\underline{w}$ or $\overline{w}$, the economy returns back to them. Consequently, we shall focus on the stable equilibria where the wage is either $\underline{w}$ or $\overline{w}$. Note that the w^* equilibrium has the same occupational choice features as $\underline{w}$ for the high types (namely, they earn strictly positive profits) and the low types stay out because of the corresponding collateral requirement $c(w^*)$.

Case 2b.

$$\alpha\left(1 - G\left(c^*(\underline{w})\right)\right) > \frac{1}{1+n}$$

From Proposition 2, the unique equilibrium is $w = \overline{w}$. This case is depicted in Figure 4.

Case 3: $\alpha(1+n) > 1$ and $R < \rho k + nM$. Notice that from (6), $R < \rho k + nM$ implies $\overline{w} < M$, so $c^*(\overline{w}) > 0$ and $1 - G(c^*(\overline{w})) < 1$. In this case, either (7), (8), or (9) could be satisfied, depending on the shape of G.

Since the entrepreneurial technology yields a higher level of surplus than the subsistence technology, and there are more entrepreneurial firms when the wage is $\overline{w}$ than when it is $\underline{w}$, national income is higher under the high wage equilibrium. The wealth distribution clearly matters for overall (output) efficiency. In particular, the set of equilibria depends on the number of individuals who have wealth in excess of $c^*(\underline{w})$ and $c^*(\overline{w})$. For the same total wealth, an economy which has a greater number of individuals whose wealth is less than the required collateral level (which means greater inequality, other things being constant) will have lower output, as in poverty trap models.

What is unique about this model is that for the same wealth distribution, two economies can have different equilibria. When multiple equilibria exist, total output is higher under the high wage equilibrium. This feature of our model implies that a minimum-wage policy will guarantee coordination on the high-wage equilibrium. Generically the equilibria cannot be Pareto ranked, since talented individuals whose wealth exceeds $c^*(\underline{w})$ prefer the low wage equilibrium. However, it is possible for the high wage equilibrium to Pareto dominate the low wage equilibrium. Suppose parameters are such that case 2a is relevant, and in addition $G(c^*(\underline{w})) = 1$. Then if the economy starts off with a low wage equilibrium, there are no entrepreneurs and everyone is engaged in the subsistence activity. If the economy starts off with a high wage equilibrium, however, every talented agent will be able to become an entrepreneur (since by assumption $c^*(\overline{w}) = 0$ in this case) and everyone will be better off.

Finally, in the standard model of poverty traps due to borrowing constraints, credit subsidies always (weakly) improve efficiency.[17] But in this model, cheap credit will make the screening problem harder and can lead to a tightening of borrowing constraints. If the borrowing rate falls to $\rho' < \rho$ due to a credit subsidy from the government, then type l agents become more inclined to borrow and the required collateral will go up (for any given wage rate). This will increase the number of talented agents who face borrowing constraints.

4 Extension: The Dynamic Model

So far we have taken the wealth distribution as given exogenously. In this section we consider the long run equilibrium of the economy where the wealth distribution evolves endogenously. We will restrict attention to stationary equilibria, where the wage rate is the same over time, and examine the how the wealth distribution evolves over time. In particular, we are interested in finding out if for the same initial conditions, an economy could have two

[17] An exception is Ghatak, Morelli and Sjostrom (2000) where credit subsidies reduce the incentive of young people to work hard and save.

stationary equilibria, one with the low wage prevailing in the labor market in each period, and the other with the high wage. Following the occupational choice literature (e.g., Banerjee and Newman, 1993, Galor and Zeira, 1993, and Piketty, 1997) we assume the following simple dynamic framework. Each person lives for one period, and is replaced by another person at the end of the period who is identical in all respect, except possibly for talent. A person has a probability α of being talented irrespective of the parent's talent. The case where talent is perfectly inherited is straightforward to analyze.

When an individual is born, he inherits some wealth $a \geq 0$, makes his or her occupational choice, and at the end of the period saves a constant fraction s of total income that is passed on as bequest to the next generation. We now derive the equations of motion that determine the initial wealth of a period $t+1$ individual belonging to dynasty i whose parent had wealth a_i^t. If the parent supplied ordinary labor (either to an entrepreneur, or using the subsistence technology) she earned some labor income w^t, where w^t is the period t wage rate. The inherited wealth a_i^t grows to ρa_i^t (principal plus interest) and the labor income is $w^t \geq \underline{w}$. Hence her descendant starts with a wealth endowment of

$$a_i^{t+1} = s\left(w^t + \rho a_i^t\right).$$

Suppose instead the parent was an entrepreneur. If $a_i^t \geq k$ then the parent was self-financed and bequeaths

$$a_i^{t+1} = s\left(R + M - nw^t + \rho\left(a_i^t - k\right)\right).$$

If $c^*(w^t) \leq a_i^t < k$ then the parent was bank-financed and bequeaths

$$a_i^{t+1} = s\left(R + M - nw^t - rk + c^*(w^t) + \rho\left(a_i^t - c^*(w^t)\right)\right) = s\left(R + M - nw^t + \rho\left(a_i^t - k\right)\right)$$

using the bank's zero profit constraint. Thus, the transition equation is the same for bank-financed and self-financed entrepreneurs. Notice that, for convenience, we assume the child inherits a fraction of the parents private entrepreneurial benefit M.

We want to characterize equilibria in the dynamic model that involves a stationary profile of wages (i.e., $w^t = \underline{w}$ for all t). Given a stationary profile of wages, we find out the corresponding sequence of wealth distributions, and the limiting wealth distribution. In turn we make sure that the demand and supply of labor generated by the sequence of wealth distributions and the limiting wealth distribution all generate the stationary wage profile we started out with as an equilibrium in the labor market. Of particular interest is the question if starting with same initial conditions, it is possible to have two types of stationary equilibria, one involving high wages and one involving low wages. In general, it is possible to have non stationary equilibria where the wage rate changes over time but we will restrict attention to stationary equilibria only.

Consider a dynasty that starts with zero wealth in period 0. The period 1 wealth will be at least $s\underline{w}$, period 2 wealth will be at least $s(\underline{w}+\rho s\underline{w})$ and period t wealth is at least

$$s\underline{w}\left(1+\rho s+(\rho s)^2+...+(\rho s)^{t-1}\right) \tag{12}$$

This will become infinitely large unless we assume $\rho s<1$. So, from now on assume $\rho s<1$. Then from (12), the long run minimum wealth level of a dynasty is

$$\frac{s\underline{w}}{1-\rho s}.$$

If this wealth level is at least as large as $c^*(\underline{w})$ then no dynasty will be capital constrained in the long run. If instead $\frac{s\underline{w}}{1-\rho s}<c^*(\underline{w})$ (see Figure 5) we have the following result.

Lemma 1 : Suppose that

$$\frac{s\underline{w}}{1-\rho s}<c^*(\underline{w})=\frac{M-\underline{w}}{\rho} \tag{13}$$

or, $\frac{\underline{w}}{1-\rho s}<M$. If there is a period T such that the wage in each period $t\geq T$ is $w^t=\underline{w}$, then the economy will converge to a state where there are no entrepreneurs at all.

Proof : Take $T=0$ without loss of generality, i.e., suppose $w^t=\underline{w}$ for all t. Consider a dynasty that starts with wealth $a_i^0<c^*(\underline{w})$ in period 0. The period 1 wealth will be $s\left(\underline{w}+\rho a_i^0\right)$. As long as everybody in this dynasty remains a worker, the period t wealth is

$$s\underline{w}\left(1+\rho s+(\rho s)^2+...+(\rho s)^{t-1}\right)+(\rho s)^t a_i^0=\left(1-(\rho s)^t\right)\frac{s\underline{w}}{1-\rho s}+(\rho s)^t a_i^0$$

Assuming (13) holds this expression is always strictly smaller than $c^*(\underline{w})$. Thus, a dynasty that starts with wealth below $c^*(\underline{w})$ will never give rise to any entrepreneurs. By the same argument, if at any period t a dynasty's wealth falls below $c^*(\underline{w})$, their wealth will be below $c^*(\underline{w})$ forever. To avoid this, the dynasty must maintain wealth level above $c^*(\underline{w})$ forever. The steady state wealth of a dynasty where each generation happens to be type h, has enough wealth to finance their own project or use as collateral to borrow, and the wage happens to be $\underline{w}$ in every period is $\frac{s}{1-s\rho}\left(R+M-n\underline{w}-\rho k\right)$. This is the upper bound to the long run wealth level of any dynasty in a low wage steady state. Since this is a finite number, there exists a finite integer t' such that if there is a series of $t \geq t'$ talent shocks to successive generations (who all will be workers), the dynasty will have an initial wealth level lower than $c^*(\underline{w})$ in period $t'+1$. That is, if such a dynasty starts with wealth $a_i^0 \leq \frac{s}{1-s\rho}\left(R+M-n\underline{w}-\rho k\right)$, after t' untalented generations the dynasty will have wealth

$$\left(1-(\rho s)^{t'}\right)\frac{s\underline{w}}{1-\rho s}+(\rho s)^{t'}a_i^0.$$

Since this is an infinite horizon game any dynasty will receive t' successive negative talent shocks at least once with probability 1. From that point on, all members of the dynasty must remain workers forever. Thus, in the long run, all dynasties will have wealth levels converging to $\frac{s\underline{w}}{1-\rho s}$, and there will be no entrepreneurship in equilibrium. QED.

Now suppose $w^t = \overline{w}$ for all t. By definition, $\overline{w}$ satisfies

$$\overline{w} = R+M-n\overline{w}-\rho k$$

so that bequests at the end of period t are independent of the occupation of the generation t individual:

$$a_i^{t+1} = s\left(\overline{w}+\rho a_i^t\right)$$

Notice that for each dynasty,

$$a_i^t \rightarrow \frac{s\overline{w}}{1-\rho s}$$

if $w^t = \overline{w}$ for all t. Since entrepreneurs and workers will receive the same income in a high-wage equilibrium, each dynasty will converge to the steady state wealth level $\frac{s}{1-\rho s}\overline{w}$ if $w^t = \overline{w}$ for all t. This immediately leads to the following result:

> Lemma 2 : If $\frac{s\overline{w}}{1-\rho s} < c^*(\overline{w})$ then a high wage equilibrium cannot be sustained in the long run.

Consider the opposite case where $\frac{s\overline{w}}{1-\rho s} \geq c^*(\overline{w})$. Figure 6 depicts this case. Let G_t denote the wealth distribution in period t. We show that two conditions must hold for a high-wage stationary path to be feasible. First, the initial wealth distribution G_0 must be such that a high wage equilibrium exists in the first period, that is,

$$\alpha\left[1 - G_0\left(c^*(\overline{w})\right)\right] \geq \frac{1}{1+n}$$

Second, since entrepreneurs and workers will receive the same income in the high-wage equilibrium, and since a dynasty of workers will converge to the steady state wealth level $\frac{s}{1-\rho s}\overline{w}$, this steady state wealth level must be bigger than the required collateral:

$$\frac{s\overline{w}}{1-\rho s} \geq c^*(\overline{w}).$$

The following result formally proves this:

Lemma 3 : There exists an equilibrium with $w^t = \overline{w}$ for all $t \geq 0$ if and only if

$$\frac{s\overline{w}}{1-\rho s} \geq c^*(\overline{w}) \tag{14}$$

and

$$\alpha\left[1 - G_0\left(c^*(\overline{w})\right)\right] \geq \frac{1}{1+n} \tag{15}$$

both hold.

Proof. First notice that

$$c^*(\overline{w}) = \max\left\{0, \frac{M-\overline{w}}{\rho}\right\} = \max\left\{0, \frac{\rho k + nM - R}{\rho(1+n)}\right\}$$

using the definition of $\overline{w}$. If $R > \rho k + nM$ then $c^*(\overline{w}) = 0$ and so (14) holds. Hence if (15) holds in this case (i.e., $\alpha \geq \frac{1}{1+n}$ since $G_0\left(c^*(\overline{w})\right) = 0$) then by Proposition 2 there is an equilibrium where $w^t = \overline{w}$ for each t, regardless of the income distribution in period t.

Thus, we only need to consider the case $R < \rho k + nM$, where

$$c^*(\overline{w}) = \frac{M-\overline{w}}{\rho} = \frac{\rho k + nM - R}{\rho(1+n)} > 0 \tag{16}$$

By Proposition 2, $w^t = \overline{w}$ can be part of an equilibrium if and only if

$$1 - G_t(c^*(\overline{w})) \geq \frac{1}{\alpha(1+n)}$$

and this condition needs to be satisfied for each t to guarantee that $w^t = \overline{w}$ is part of an equilibrium. For any a, $w^t = \overline{w}$ implies

$$\begin{aligned} G_{t+1}(a) &= \Pr\{a_i^{t+1} \leq a\} = \Pr\left\{ s\overline{w} + \rho s a_i^t \leq a \right\} \\ &= \Pr\left\{ a_i^t \leq \frac{a}{\rho s} - \frac{\overline{w}}{\rho} \right\} = G_t\left(\frac{a}{\rho s} - \frac{\overline{w}}{\rho} \right) \end{aligned}$$

Iterating on this expression, we find that

$$G_t(a) = G_0\left(\frac{1}{(\rho s)^t}\left[a - s\overline{w}\frac{1-(s\rho)^t}{1-s\rho} \right] \right)$$

Therefore,

$$\begin{aligned} G_t\left(c^*(\overline{w})\right) &= G_0\left(\frac{1}{(\rho s)^t}\left[c^*(\overline{w}) - s\overline{w}\frac{1-(s\rho)^t}{1-s\rho} \right] \right) \\ &= G_0\left(\frac{1}{(\rho s)^t}\left(c^*(\overline{w}) - \frac{s\overline{w}}{1-s\rho} \right) + \frac{s}{1-s\rho}\overline{w} \right) \end{aligned}$$

The necessary and sufficient condition for $w^t = \overline{w}$ to be possible for each t is, therefore,

$$1 - G_0\left(\frac{1}{(\rho s)^t}\left(c^*(\overline{w}) - \frac{s\overline{w}}{1-s\rho} \right) + \frac{s}{1-s\rho}\overline{w} \right) \geq \frac{1}{\alpha(1+n)} \tag{17}$$

for all t. For $t = 0$, it reduces to

$$1 - G_0\left(c^*(\overline{w})\right) \geq \frac{1}{\alpha(1+n)} \tag{18}$$

The expression

$$\frac{1}{(\rho s)^t}\left(c^*(\overline{w}) - \frac{s\overline{w}}{1-s\rho} \right) + \frac{s}{1-s\rho}\overline{w}$$

decreases monotonically as $t \to \infty$ if (14) holds, otherwise it goes to $+\infty$ as $t \to \infty$. If it does go to $+\infty$ as $t \to \infty$ then the left hand side of (17) would be close to zero for large t, hence the inequality (17) must eventually be violated for large t. Conversely, if it decreases monotonically to in t then the left hand side of (17) would be monotonically increasing in t, hence (17) would hold for all t provided that (18) is satisfied. QED

Now we are ready to characterize stationary equilibria in the dynamic version of our model. Notice that if $M > w$, $c^*(w) \equiv \frac{M-w}{\rho} > 0$. As a result, the condition $\frac{sw}{1-\rho s} \gtrless c^*(w)$ is equivalent to $\frac{w}{1-\rho s} \gtrless M$. If $M \leq w$ (which is ruled out for $w = \underline{w}$ by Assumption 2, but not for $w = \overline{w}$), then $c^*(w) \equiv 0$ and so $\frac{sw}{1-\rho s} > c^*(w)$ trivially holds. As $\frac{w}{1-\rho s} > w$, in this case

$\frac{\underline{w}}{1-\rho s} > M$ hold as well. Using this fact (and that $\underline{w} < \overline{w}$) we can conveniently partition the parameter space into the following cases:

Case 1. $\frac{s\overline{w}}{1-\rho s} < M$. From Lemma 2 we immediately see that for this case the long run equilibrium of the economy must involve subsistence irrespective of the initial wealth distribution. The required collateral level is greater than the steady wealth level of any dynasty in the high wage equilibrium (where aggregate income is the highest). As a result, even if the economy starts off with $w^0 = \overline{w}$, there exists $T > 0$ such that $w^t = \underline{w}$ for $t \geq T$. Since $\frac{s\underline{w}}{1-\rho s} < M$ in this case as well, using Lemma 1 we see that the only stationary wage profile that can exist is $w^t = \underline{w}$ for all t but eventually all agents will be engaged in subsistence.

Case 2. $\frac{\overline{w}}{1-\rho s} \geq M > \frac{\underline{w}}{1-\rho s}$. From Lemma 3 we know that if $\alpha\left[1 - G_0\left(c^*(\overline{w})\right)\right] \geq \frac{1}{1+n}$ then an equilibrium with $w^t = \overline{w}$ for all $t \geq 0$ exists. However, if $\frac{1}{1+n} > \alpha\left[1 - G_0\left(c^*(\underline{w})\right)\right]$ then $w^t = \underline{w}$ for $t = 0$ is also an equilibrium in the labor market. Since $\frac{s\underline{w}}{1-\rho s} < c^*(\underline{w})$ in this case, from Lemma 1 we know if $w^t = \underline{w}$ for all t then the economy will converge to a long run equilibrium where there is no entrepreneurial activity. From Proposition 3 in the static model we know that for the special case $\alpha\left[1 - G_0\left(c^*(\overline{w})\right)\right] \geq \frac{1}{1+n} > \alpha\left[1 - G_0\left(c^*(\underline{w})\right)\right]$ both $w^t = \underline{w}$ and $w^t = \overline{w}$ are possible equilibrium wages in the labor market for $t = 0$. Since $\frac{s\overline{w}}{1-\rho s} \geq c^*(\overline{w})$ and $\frac{s\underline{w}}{1-\rho s} < c^*(\underline{w})$, by Lemma 1 and Lemma 3 two stationary profile of wages can be sustained in equilibrium. If $w^t = \underline{w}$ for all t the economy will converge to a long run equilibrium where everyone is engaged in the subsistence activity and will have the same wealth level (namely, $\frac{s\underline{w}}{1-\rho s}$). If instead $w^t = \overline{w}$ for all t the economy will converge to a long run equilibrium where everyone is engaged in the entrepreneurial activity and will have the same wealth level (namely, $\frac{s\overline{w}}{1-\rho s}$). Therefore for Case 2 the wealth distribution matters. In addition, for the same initial wealth distribution two different stationary equilibrium wage profiles can be supported even when we allow the wealth distribution to be endogenous.

Case 3. $M \leq \frac{\underline{w}}{1-\rho s}$. In this case the lowest possible steady state wealth level of a dynasty (i.e., $\frac{s\underline{w}}{1-\rho s}$) exceeds the highest possible level of collateral that banks can ask for (i.e., $c^*(\underline{w})$) and so no dynasty can be capital constrained in the long run. Irrespective of the prevailing wage rate, $G_t(c^*(\underline{w}))$ will approach 0 as $t \to \infty$, and since $c^*(\underline{w}) > c^*(\overline{w})$, $G_t(c^*(\overline{w}))$ will approach 0 as $t \to \infty$ as well. If $\alpha \geq \frac{1}{1+n}$ then from Lemma 3 we know that a high wage stationary equilibrium will exist. Also, this will be the unique stationary wage profile, since even if the economy starts off with $\alpha\{1 - G_0(c^*(\underline{w}))\} < \frac{1}{1+n}$ and so $w^0 = \underline{w}$, there exists a finite time after which the wage will switch to $\overline{w}$. If $\alpha < \frac{1}{1+n}$ a low wage stationary equilibrium will result. Also, this will be the unique stationary wage profile since it is not possible to have $\alpha\{1 - G_t(c^*(\overline{w}))\} \geq \frac{1}{1+n}$ for any $t \geq 0$. While $w_t = \underline{w}$ for all t in this case, unlike in Cases 1 and 2, there is entrepreneurial activity in long run equilibrium - all talented agents get to be entrepreneurs, but there is not enough of them to absorb the entire labor force. In Case 3 there is no room for policy - the economy achieves the same allocation as the first-best (i.e., with no private information).

We summarize the characterization of stationary wage profiles in Proposition 3. Figure 7 provides a convenient graphical classification of the cases.

Proposition 3. (i) Suppose $M > \frac{\overline{w}}{1-\rho s}$. The unique stationary equilibrium wage profile is $w^t = \underline{w}$ for all t. There is no entrepreneurial activity in the long run. (ii) Suppose $\frac{\overline{w}}{1-\rho s} \geq M > \frac{\underline{w}}{1-\rho s}$. If $\alpha\left[1 - G_0\left(c^*(\underline{w})\right)\right] \geq \frac{1}{1+n}$ then the unique stationary equilibrium wage profile is $w^t = \overline{w}$ for all t. If $\alpha\left[1 - G_0\left(c^*(\overline{w})\right)\right] < \frac{1}{1+n}$ then the unique stationary equilibrium wage profile is $w^t = \underline{w}$ for all t and there is no entrepreneurial activity in the long run. If $\alpha\left[1 - G_0\left(c^*(\overline{w})\right)\right] \geq \frac{1}{1+n} \geq \alpha\left[1 - G_0\left(c^*(\underline{w})\right)\right]$ then it is possible to support both $w^t = \overline{w}$ for all t and $w^t = \underline{w}$ for all t as stationary wage profiles, there being no entrepreneurial activity in the long run in the latter case. (iii) Suppose $M \leq \frac{\underline{w}}{1-\rho s}$. If $\alpha < \frac{1}{1+n}$ the unique stationary equilibrium wage profile is $w^t = \underline{w}$ for all t but there is some entrepreneurial activity in the long run. If $\alpha \geq \frac{1}{1+n}$ then the unique stationary equilibrium wage profile is $w^t = \overline{w}$ for all t. The economy achieves the first-best allocation.

5 Concluding Remarks

In this paper we have proposed a simple general equilibrium model of financial contracting in the presence of adverse selection. We show that labor markets and credit markets may be linked in a way that can lead to multiple equilibria which can be ranked in terms of output (and net surplus). Unlike the usual models of multiple equilibria (as in Murphy, Shleifer and Vishny, 1989) here there are no direct strategic complementarities in the actions of agents such as regarding the decision to invest or adopt a new technology. Rather, price changes in one market affects the incentive constraints in another market in a way that affects demand in the first market, thereby justifying the initial price change. Also, in contrast to the literature on dynamic models of poverty traps in the presence of credit market imperfections (e.g. Banerjee and Newman, 1993), we show that for the same initial wealth distribution two economies can converge to different steady states.

The main insight of the paper is that if there are frictions in the credit market then unlike the standard textbook model where higher wages lead to lower demand for labor, higher wages can lead to a greater demand for labor via relaxation of credit constraints which induces more investment. It seems worthwhile to examine in future research to what extent this effect depends on the particular version of credit market imperfection based on adverse selection that we have chosen. An alternative model that appears to have similar properties is one where there is entrepreneurial moral hazard vis-a-vis lenders, and limited liability.[18] Higher wages in the labor market may allow current workers to become future entrepreneurs by saving and offering it as collateral in the credit market. The resulting increase in investment and demand for labor (assuming labor and capital are complementary inputs) will then lead to higher wages for the new cohort of workers, and so on.

A major limitation of the current model is that capital depreciates after one period. As a result we cannot examine topics such as capital accumulation, and the resulting dynamic relationship between development and inequality (as in the theoretical literature on the Kuznets-curve, such as Bernhardt and Lloyd-Ellis, 2000). Moreover, since firms live for one period only, we cannot address interesting questions such as the bank's choice between financing a new firm (a "start-up") whose quality is uncertain (and possibly subject to asymmetric information) or an old firm whose quality may be much better known but whose capital is likely to be subject to depreciation, diminishing returns or obsolescence. The next step of our research agenda is to examine some of these issues.

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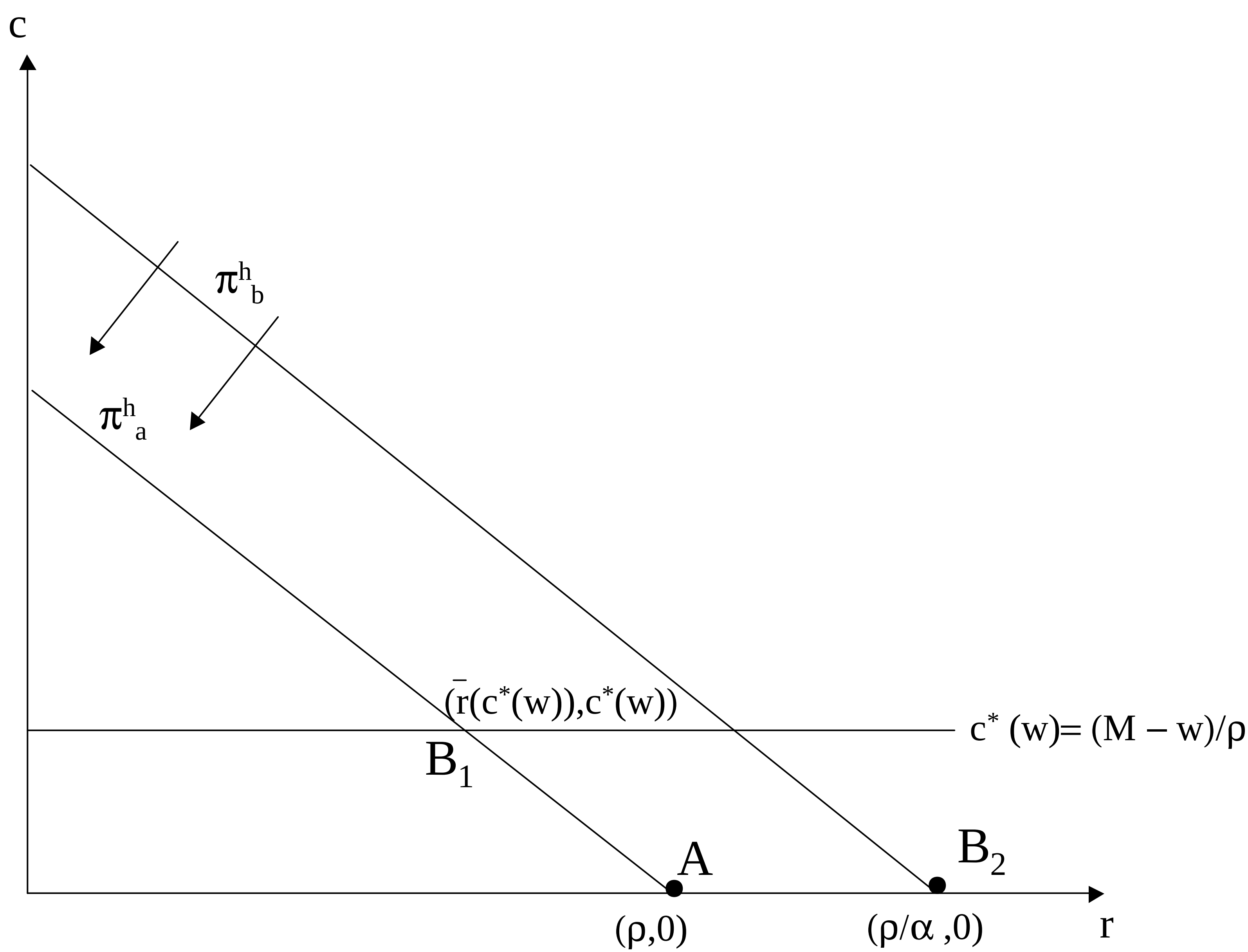

Figure 1 : Credit Market Equilibrium

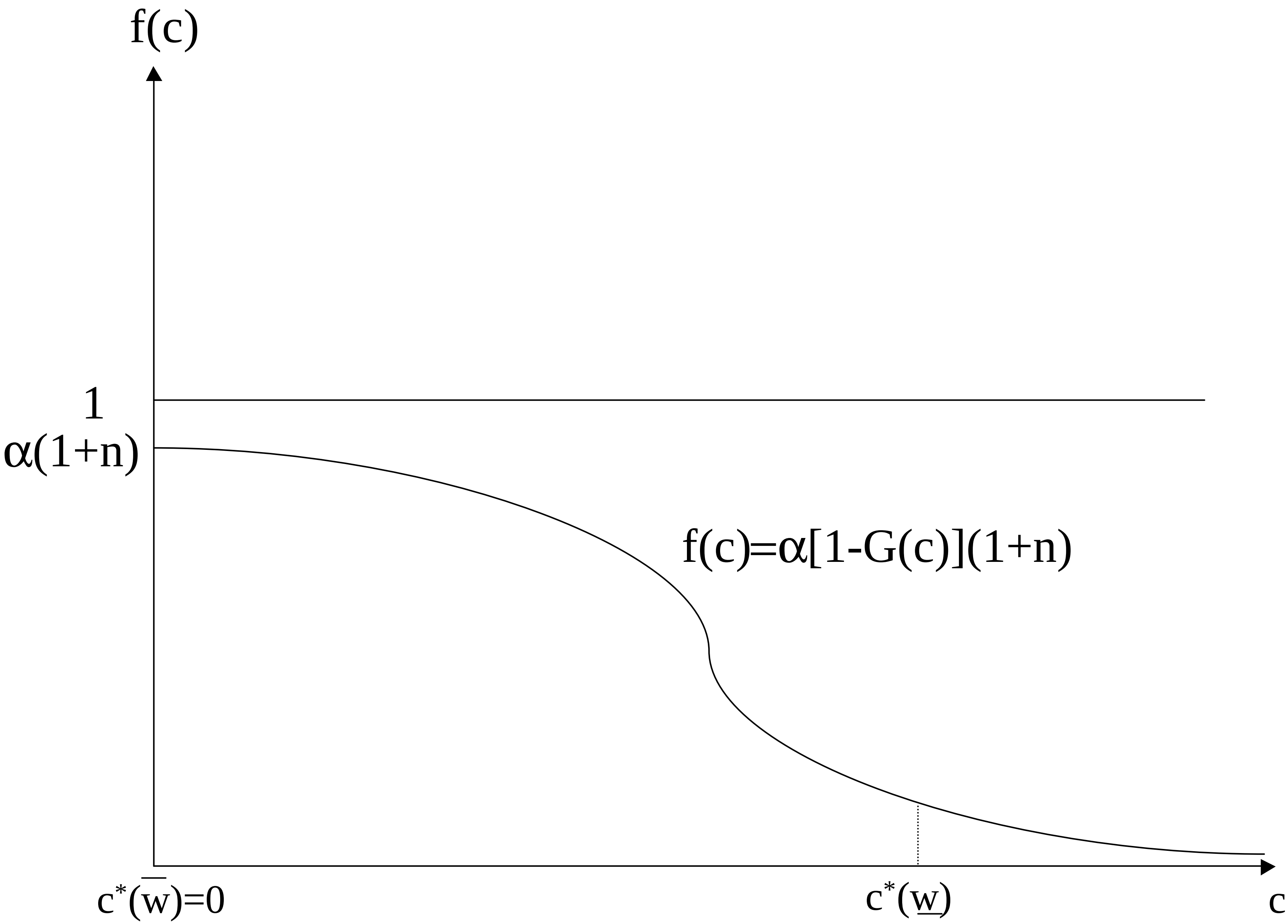

Figure 2 : Low wage equilibrium

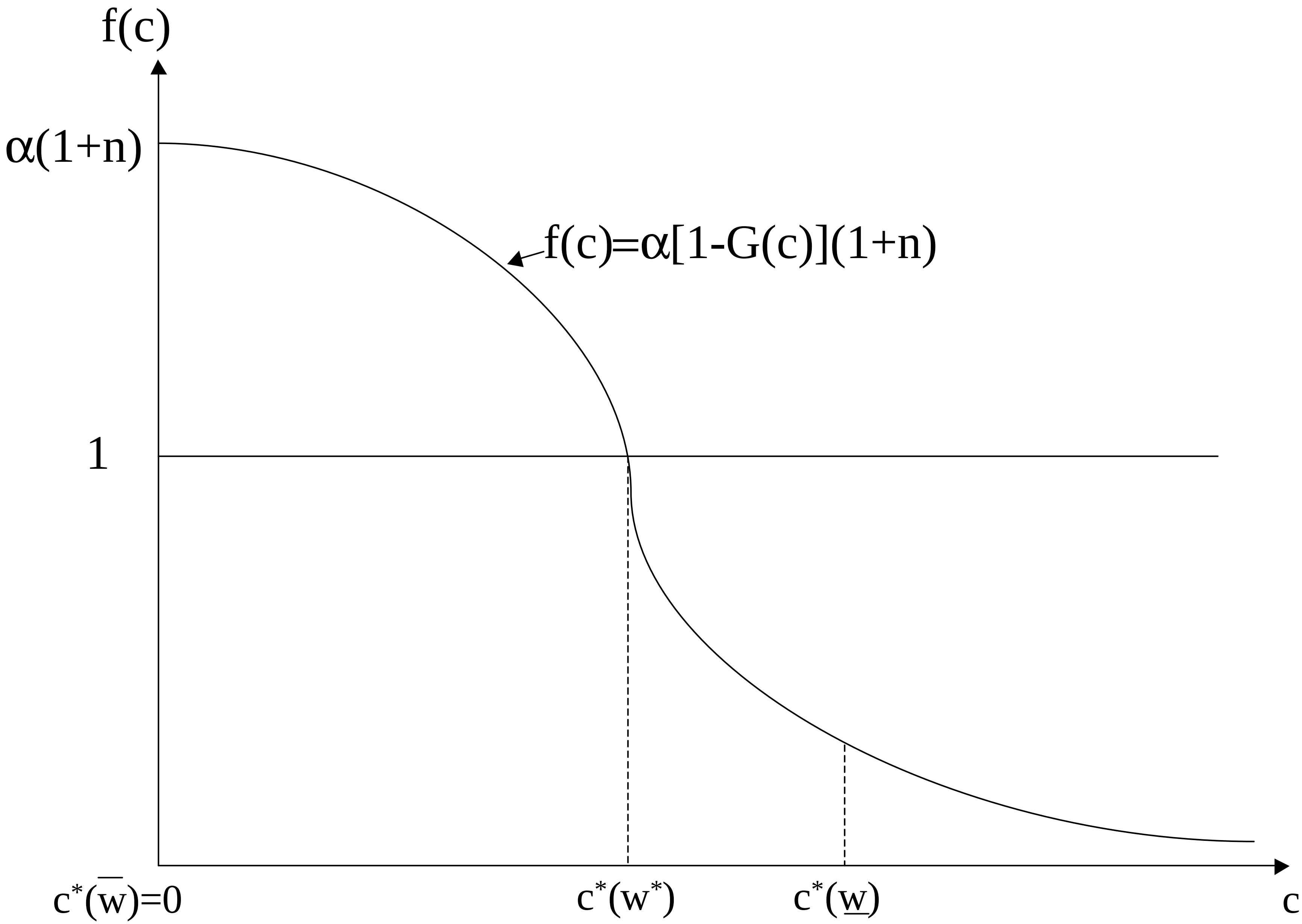

Figure 3 : Multiple Equilibria

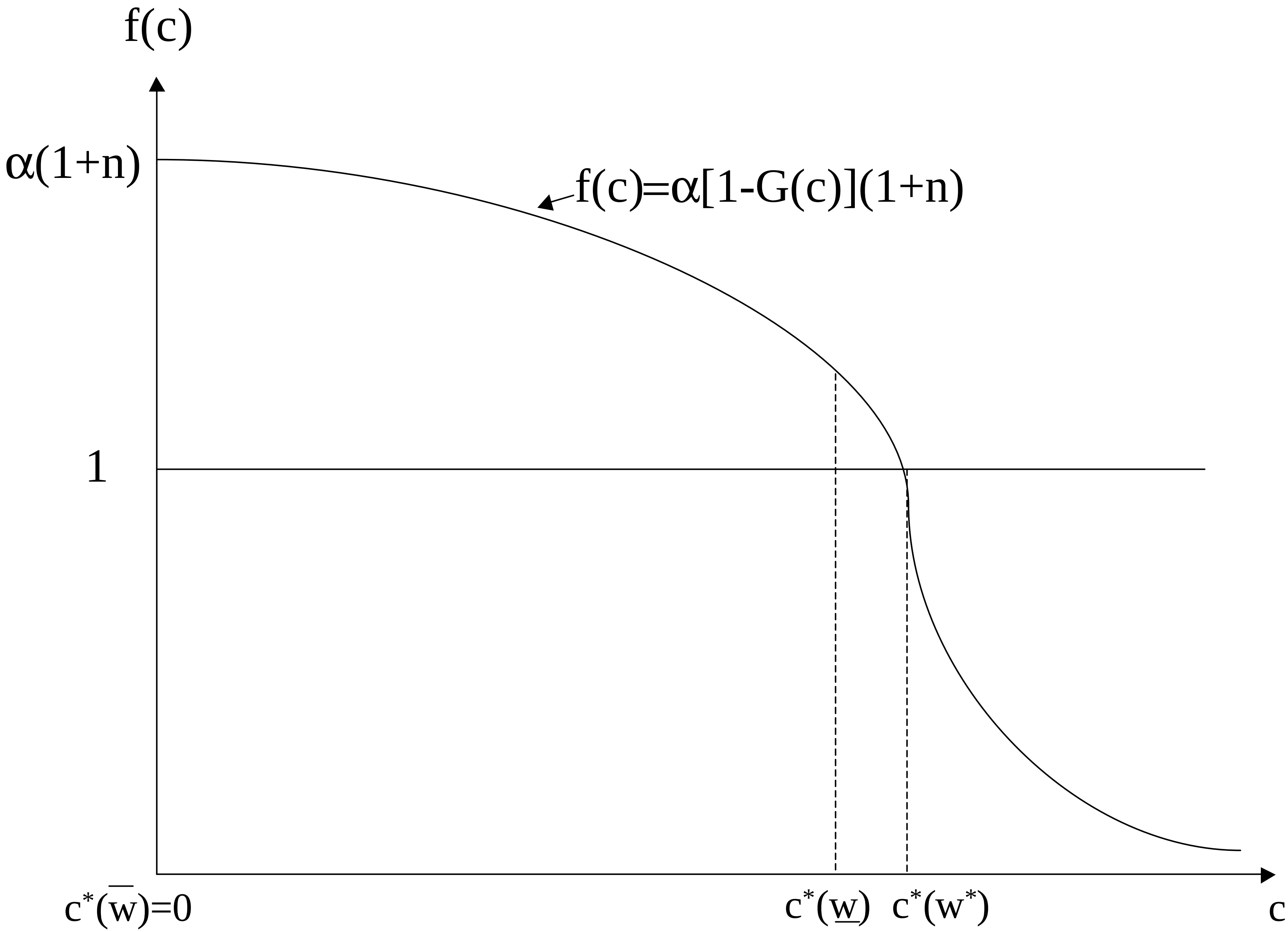

Figure 4 : High wage equilibrium

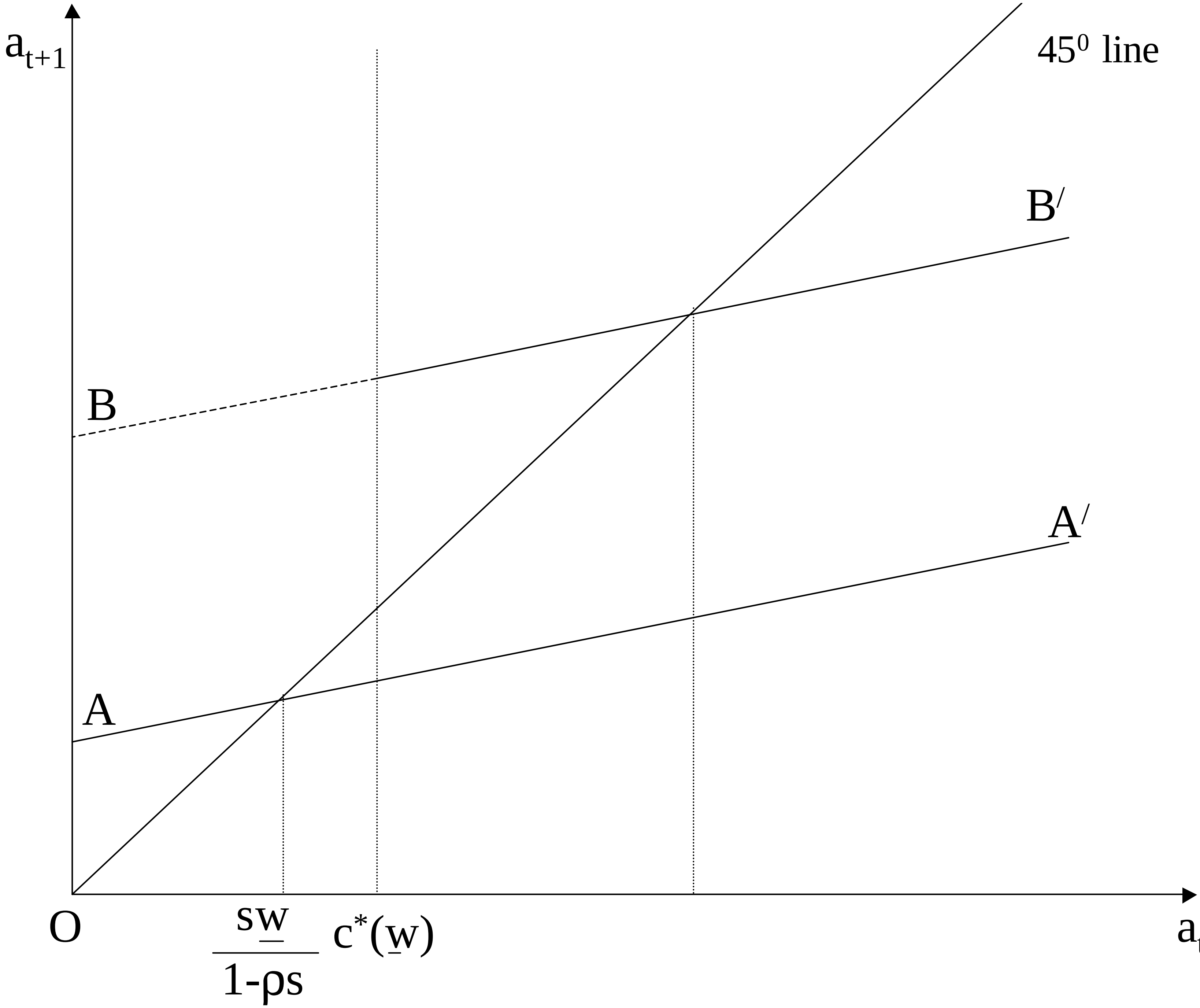

Figure 5: Low wage (subsistence) steady state

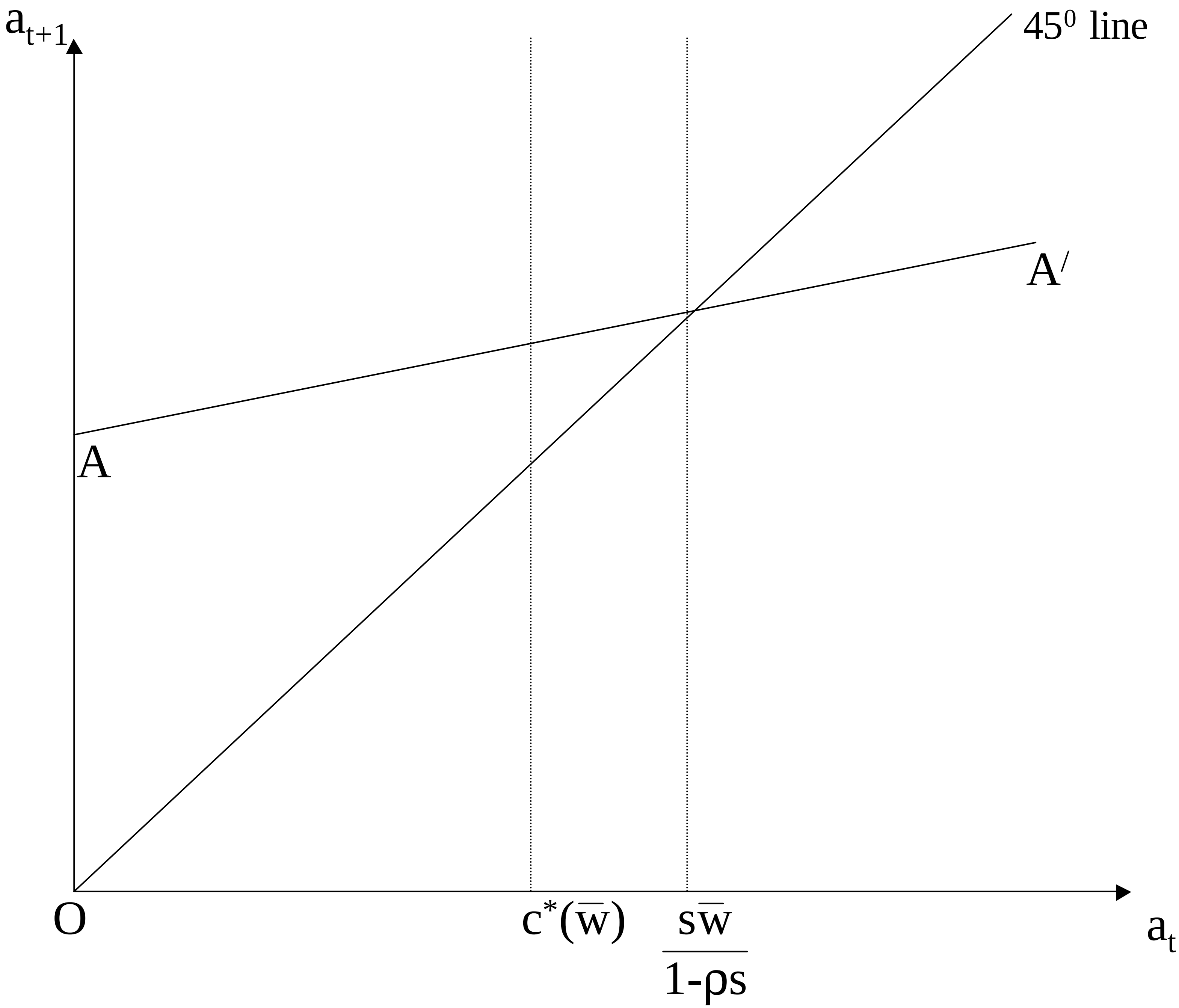

Figure 6: High wage steady state

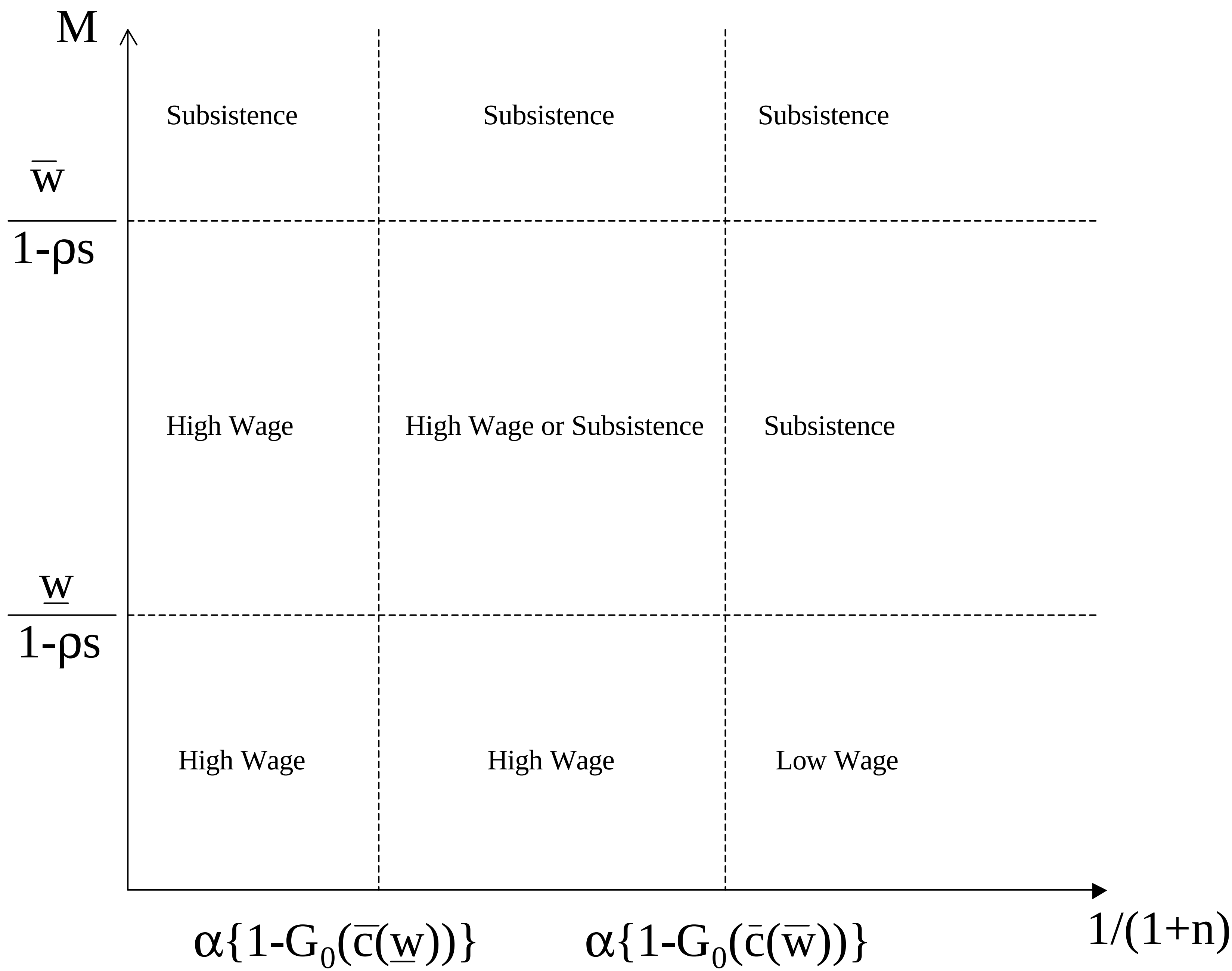

Figure 7. Characterization of Steady State Equilibria