Entrepreneurial abilities and liabilities in a model of self-selection

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The role of the liability form as a signalling device is analyzed in a model of occupational choice (entrepreneurs, employees), with asymmetric information in loan markets about the abilities of entrepreneurs. The properties of the equilibrium are described. When factor prices are exogenous, the feasibility of limited liability is a Pareto improvement over a regime where there is only unlimited liability. This result does not hold when factor prices are endogenous.

1. Introduction

According to Schumpeter (1941, ch. 12, p. 132), the function of the entrepreneur is "to reform or revolutionize the pattern of production by exploiting an untried technological possibility." For such a task a superior ability in organizing production processes with predictable outcomes is not sufficient. The main quality of the entrepreneur is to deal with unforeseen events. Because of this uncertainty, the entrepreneurial function has often been associated with risk taking. Frank Knight in his classical study has emphasized that entrepreneurs and employees can be characterized by different degrees of risk aversion (to use a modern term). This idea has been recently formalized by Kihlstrom and Laffont (1979) in a general equilibrium model of occupational choice. The more risk-averse individuals choose to be employees and to receive a fixed wage; the less risk-averse become entrepreneurs and receive all the (uncertain) profits. The equilibrium is inefficient (in a first-best sense).

However, mere differences in risk aversion cannot explain the special role of entrepreneurs if independent risks can be insured by capital markets. Risk can fail to be insurable on account of moral hazard, or adverse selection in a situation of asymmetric information. These causes are related to the two entrepreneurial qualities emphasized by Schumpeter. Entrepreneurs have to produce an effort in "getting things done," which may not be monitored by others. Also, the skill required in dealing with unforeseen events or the "vision," may not be observable to others.

In this article, we address only the issue of adverse selection in a simple model of occupational choice. The choice of the form of liability can serve as a self-selection

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1 This term is not restricted to deterministic outcomes; no entrepreneurial talent is necessary to choose between projects described by well-determined probability distributions of outcomes.

2 The best short summary of the economists' view on the entrepreneurial function may be found in Schumpeter (1954) under the references to "entrepreneur."

3 Kanbur (1979) analyzes the problem of income distribution in a model of occupational choice with uncertainty.
mechanism that solves (albeit imperfectly) this problem. However, some entrepreneurial risk may be desirable to prevent low skill individuals from competing with more able entrepreneurs for capital funds. Indeed, the welfare value of the limited liability institution is a priori ambiguous.

The model is presented in the next section. The equilibrium with no limited liability is analyzed in Section 3. Equilibria with both liability forms and conditions of existence are considered in Section 4. The institution of limited liability is evaluated from a welfare point of view in Section 5. The results are summarized in the last section.

2. The model

We consider a one-good economy with three types of agents: employees, entrepreneurs, and financial institutions. The economy is divided in two production sectors; in the first sector production is risk free and is a function of the capital and labor inputs. In the second sector we find a large number of small firms; each firm is headed by one entrepreneur. The output of this firm is uncertain, and depends on the input of capital and on the skill of its entrepreneur. The size of the first (risk-free) sector is assumed to be sufficiently large that the wage rate and the risk-free rate of return on capital are fixed. This assumption is relaxed in the second part of Section 5.

For simplicity, we make the following assumptions: all individuals have the same level of wealth, w; each individual is characterized by the level of his entrepreneurial ability, s. Individuals are distributed according to the distribution function, F(s). To simplify the exposition we shall make the following assumption about F:

Assumption 1. F has a density function, g(s), which is strictly positive for 0 ≤ s ≤ 1.

Each individual lives for one period. In the beginning of the period he chooses to be an entrepreneur or an employee.

An entrepreneur invests an amount k in a production process. Two outcomes are possible: if the production process is successful, the output is a function of the capital invested, f(k), where f' > 0, f'' < 0, f(k) → ∞ if k → 0. If the process is unsuccessful, it is a total loss, and output is equal to zero. The probability of success is equal to the entrepreneur's skill level, s.

An entrepreneur can invest his own wealth in his own firm or lend it to financial intermediaries which will pay him the risk-free total rate of return, R (principal and interest). He can also borrow from financial institutions at the rate r (which also refers to principal and interest). Loans are made only for investment purposes, and there is no rationing. Lenders do not know the skill level of an entrepreneur and can only observe his liability form. The interest rates on loans to firms with limited liability (type L) and unlimited liability (type N) will be called rL and rN, respectively. The utility level of an entrepreneur is represented by the von Neumann-Morgenstern utility function:

\[ U = su(y_1) + (1 - s)u(y_0), \]  

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4 Since the seminal article by Akerlof (1970), markets with asymmetric information and the role of signals have been analyzed in various contexts by numerous authors. See, for example, Spence (1974), Rothschild and Stiglitz (1976), Ross (1977), Jaynes (1978), Wilson (1978, 1979) and Shavell (1980).

5 This could be generalized to the case where inputs of capital and labor are required (assuming that entrepreneurs do not default on the wage bill); inputs depend on factor prices. The only factor price which will vary across entrepreneurs is the price of capital, and the utility of an entrepreneur can be written as a function of this price.

6 We could also have considered discrete distribution.

7 Financial institutions can monitor if a loan is used for the purchase of machinery. Entrepreneurs cannot borrow large cash amounts under fictitious corporate names for consumption purposes. For an analysis of the rationing problem, see Stiglitz and Weiss (1981).

8 The case of a variable liability is examined below.
where \( u^* \leq 0 \), \( (U \) is defined for \( x \geq 0 \)), and \( y_t \) and \( y_0 \) represent levels of wealth when the production outcome is successful or unsuccessful. These levels depend on the capital invested in the firm, the amounts lent to and borrowed from financial institutions, and on the type of liability chosen by the entrepreneur prior to the investment decision.

For a successful production outcome, \( y_t = f(b + t) - rb + R(a - i) \), where \( i \) represents the amount of personal wealth invested by an entrepreneur in his own firm and \( b \) is the amount borrowed from financial markets.

When the production outcome is unsuccessful, the income depends on the choice of liability by the entrepreneur. With unlimited liability, the entrepreneur is liable up to his total income: \( y_0 = \text{Max}(0, -rb + R(a - i)) \). If he chooses limited liability, he is liable only up to the income generated by the firm. Should his venture fail, he keeps the interest and principal of his other financial investments: \( y_0 = R(a - i) \).

The second type of agent, the employee, has a risk-free activity. This fixed income is equal to \( w + Ra \), and he has the same utility function, \( u \), as the entrepreneur.

In our model individuals choose the type of activity (entrepreneur or employee), which provides the highest level of utility.

Finally, the third type of agent, the financial institution, is risk neutral (independent risks are fully diversified), and does not make a profit. It pays its depositors the risk-free rate, \( R \), and lends these funds to entrepreneurs of types \( L \) and \( N \) (if they exist) at the rates \( r_L \) and \( r_N \), respectively, with the information structure described above. The rates \( r_L \) and \( r_N \) are computed so that the expected return on a loan (principal and interest, or a fraction of it) is equal to the risk-free rate \( R \).

To ensure that entrepreneurs and financial institutions trade, it is assumed that an individual’s wealth is not excessive and that entrepreneurs need to borrow if the production process is worthwhile. More specifically, the level of personal wealth, \( a \), satisfies Assumption 2.

**Assumption 2. \( f(a) < w + Ra \).**

Under this condition the income of an entrepreneur who does not borrow is always smaller than the income of an employee; such an individual cannot exist.

Finally, the function \( f \) is assumed to satisfy the following condition:

**Assumption 3. \( M = f(k) - Rk + Ra > w + Ra \) with \( f'(k) = R \).**

This condition will be sufficient for the existence of entrepreneurs, and it has a very simple interpretation: assume that an individual with the highest skill \( s = 1 \) is identified by lenders. Since he does not face any risk, he can borrow at the risk-free rate, \( R \). When his investment is optimal, his net income is sufficient to induce him to choose to be an entrepreneur. This assumption is minimal: if it is not satisfied, no enterprise exists in the equilibrium under any informational structure (and is obviously not socially desirable). The value \( M \) will be an upper bound for all incomes in the equilibrium.

### 3. Equilibrium without limited liability

To analyze the effect of limited liability on the allocation of resources, it is best to consider first how individuals choose their activity when they are all liable up to their total wealth for production losses.

If an entrepreneur borrows from financial intermediates, he does not at the same time lend to them because such an investment provides a rate of return \( R \) only after all borrowings are repaid (with an interest rate \( r \) greater than \( R \)). By Assumption 2 all entrepreneurs borrow a positive amount, \( b \). Therefore their income is equal to zero in the case of unsuccessful production. Since no income can be claimed by lenders in this situation, the loan is a total loss. From the assumptions made in the previous section
about the behavior of financial institutions, we can deduce that the equilibrium interest rate on loans to firms is equal to:

$$r_N = \frac{R}{\bar{s}_N},$$

where $\bar{s}_N$ is the mean level of skills of active entrepreneurs (who are all of type $N$). The utility of an entrepreneur of ability $s$ is then equal to:

$$U = su(f(b + a) - r_N b) + (1 - s)u(0).$$

The optimal amount of borrowing, $b_N$, is defined by the relation $f(b + a) = r_N$. All entrepreneurs borrow the same amount and have the same income if successful. The utility of entrepreneurs is an increasing linear function of the skill, $s$. It is immediate that an equilibrium, if it exists, is characterized by the values of the lowest skill level of active entrepreneurs, $s_N$, the interest rate, $r_N$, and the level of borrowing, $b_N$, which are determined by the following equations:

$$u(w + Ra) = s_N u(f(b_N + a) - r_N b_N) + (1 - s_N)u(0);$$

$$r_N = \frac{R}{\bar{s}_N},$$

where $\bar{s}_N = \int_{s_N}^1 s dF(s) \int_{s_N}^1 dF(s)$; and

$$f(b_N + a) = r_N.$$

The first of these equations determines for given $b_N$ and $r_N$, the skill level of the marginal entrepreneur, $s_N$. Of course, $b_N$ and $r_N$ themselves depend on $s_N$ by (5) and (6). Substituting $b_N$ and $r_N$ with these functions in (4), the right-hand side can be considered as a function of $s_N$, $\phi(s_N)$. It is a trivial exercise to show that this function is monotonically strictly increasing. Also $\phi(0) = u(0) < u(w + Ra)$, and $\phi(1)$ is equal to $u(f(b + a) - R(a + b) + Ra)$, with $f(b + a) = R$. By Assumption (2), $\phi(1) > u(w + Ra)$. We have proved the following proposition.

**Proposition 1.** When limited liability is not allowed, under Assumptions 1–3 there exists a unique equilibrium level of skill, $s_N (0 < s_N < 1)$, which separates the entrepreneurs (with $s > s_N$) from the employees (with $s < s_N$). The equilibrium is characterized by the values of $s_N, r_N$, and $b_N$ which are determined by equations (4), (5), and (6).

The equilibrium is Pareto inefficient in a first-best sense because of the externalities between individuals of different skills. If marginal entrepreneurs of the lowest skill could be identified, they could be displaced to the pool of employees. Assuming their number is small with respect to the labor force, they would not affect the welfare of employees. The mean ability of entrepreneurs would increase, and because of a lower borrowing rate, the utility level of entrepreneurs would be higher.

This shift of low skill individuals could be induced by a penalty imposed on unsuccessful entrepreneurs. Since their wealth is nil, the penalty would have to be nonfinancial. In fact, the level of wealth under unlimited liability is often a social convention, and may not be optimal (before Solon, bankrupt citizens of Athens could lose their citizenship and be sold as slaves).

4. **Equilibrium with limited liability**

Assume now that entrepreneurs can choose between the two types of liability form. We first analyze the behavior of individuals, then the properties of the equilibrium, if it exists, and finally the conditions for the existence of an equilibrium.
The income generated by a firm of an unsuccessful entrepreneur is equal to zero, and the loan is a total loss for the lender. Therefore, as for firms of type \( N \), the equilibrium rate of interest (including principal) on loans to entrepreneurs of type \( L \) is equal to
\[
    r_L = \frac{R}{s_L},
\]
where \( s_L \) is the mean level of skill of \( L \)-entrepreneurs. The expected utility of an \( L \)-entrepreneur of skill \( s \) is equal to
\[
    U = su \{ f(b + i) - r_L(b + R(a - i)) + (1 - s)u(R(a - i)) \}.
\]
He maximizes this utility with respect to \( b \) and \( i \) \((0 \leq i \leq a)\). The optimal level of total investment \((b + i)\) is separable from the decision concerning \( i \), and under Assumption 2 is given by
\[
    f(b + i) = r_L.
\]
Then the choice of \( i \) is to be made to maximize
\[
    U = su \{ h(r_L) + Ra + (r_L - R)i \} + (1 - s)u[R(a - i)]
\]
where
\[
    h(r) = \text{Max}_k \{ f(k) - rk \}.
\]
It is immediate that the choice of \( i \) satisfies the following properties:
\[
\begin{align*}
    i(s) &= 0 \quad \text{if} \quad s \leq s_B = \frac{Ru'(Ra)}{Ru'(Ra) + (r_L - R)u'(h(r_L) + Ra)}; \\
    i(s) &= a \quad \text{if} \quad s \geq s_C = \frac{Ru'(0)}{Ru'(0) + (r_L - R)u'(h(r_L) + r_L a)}; \\
    0 < i(s) < a &\quad \text{if} \quad s_B < s < s_C, \quad \text{and} \quad i(s) \text{ increases with } s.
\end{align*}
\]

The indirect utility function \( v_L(s, r_L) \), of an \( L \)-entrepreneur is determined by substitution of \( i(s) \) in (10). Assume that the value of \( r_L \) is given. The indirect utility is then a function of \( s \), and its graph is represented by the curve \( AD \) in Figure 1. By definition of the indirect utility, this graph is the envelope of the segments between the points of coordinates \((0, u(y_0(s)))\) and \((1, u(y_1(s)))\) (the values of \( y_0(s) \) and \( y_1(s) \) are determined by \( i(s) \); they are decreasing and increasing functions of \( s \), respectively). This implies that \( CD \) is on the segment \( OD \), and that the curve \( AD \) is above the segment \( OD \).

In the same way, the graph of the indirect utility function of \( N \)-entrepreneurs \( v_N(s, r_N) \), for a given value of \( r_N \), is represented by a linear segment, \( OE \). (We have seen in the last section that all \( N \)-entrepreneurs have the same incomes \( y_0 = 0 \), and \( y_1 = h(r_N + R a) \).

If both types \( L \) and \( N \) exist in the equilibrium, the segment \( OE \) intersects the curve \( AD \). Since the curve \( AD \) is above the segment \( OD \), the point \( D \) must be below the point \( E \); in the equilibrium \( r_N \) is smaller than \( r_L \). From the geometry of the figure, one deduces immediately that there exists a threshold level of skill \( s_N \) such that entrepreneurs with skill \( s \) greater than \( s_N \) choose to be of type \( N \), and individuals of skill \( s \) smaller than \( s_N \) choose to be of type \( L \) or to be employees.

In the same way, there is a level \( s_L \) such that individuals with skill smaller (greater) than \( s_L \) choose to become employees (entrepreneurs).

**Proposition 2.** If firms with limited and unlimited liabilities exist in the equilibrium, there exist two numbers, \( s_L \) and \( s_N \), such that individuals of ability greater than \( s_N \) choose to be entrepreneurs of type \( N \), individuals of ability between \( s_L \) and \( s_N \) choose type \( L \), and the others are employees.
FIGURE 1
THE EQUILIBRIUM WITH TWO TYPES OF LIABILITY FORMS

One should notice that it cannot be said a priori which of $s_N$ and $s_B$ is the larger. If $s_N$ is smaller, as shown in the figure, then in the equilibrium, none of the $L$-entrepreneurs invests any of his own assets in his own firm ($i = 0$). If $s_N$ is larger than $s_B$, the $L$-entrepreneurs with comparatively higher skill have a positive $i$, corresponding to some stake in their own firms. Of course, this stake is always smaller than their personal wealth; otherwise they would choose the type $N$ and obtain a lower borrowing rate $r_N$ ($s_C$ is greater than $s_A$).

Ceteris paribus, all entrepreneurs would prefer to choose limited liability to shift at least a fraction of the risk of production to the financial institutions which are risk neutral. In the situation of asymmetric information, however, the entrepreneurs of higher skill prefer to use the unlimited liability form as a signal of their greater ability. In this way, they gain better terms for their borrowings. The “price” of this signal is the penalty in case of business failure (it is, of course, lower for the highly skilled individuals). This insurance aspect of limited liability is only valued by risk-averse individuals. If they are risk neutral, no entrepreneur chooses limited liability because it would only reveal a lower level of skill. By continuity we expect that types $L$ and $N$ arise only if the degree of risk aversion is sufficient. This intuitive argument and the existence of an equilibrium are stated more explicitly in the following proposition.

Proposition 3. For a distribution of skills and a technology which satisfy Assumptions 1–3, there exists at least one occupational equilibrium with employees and entrepreneurs.

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9 The proofs of Propositions 3 and 4 are rather lengthy and are available in the fuller version of this article (Chamley, 1981).
There is a positive number \( \epsilon \), such that if \( |u'| < \epsilon \) on \([0, M]\), the equilibrium is unique and all entrepreneurs have unlimited liability.

Assume that the utility function \( u(x) \) is fixed for \( x \geq Ra \). Then there is a number \( \eta \) such that if \( u(0) < \eta \), both types of liability are found in the equilibrium.

A risk-averse entrepreneur is willing to pay the "price" of unlimited liability only if this allows him to borrow at a significantly lower rate. When the difference between the highest and the lowest level of skill is small, there is no such incentive, and no \( N \)-entrepreneur exists. To see this, we relax Assumption 1 and assume that all skills are contained in the interval \([\alpha, \beta]\), \((\alpha \geq 0, \beta \leq 1)\). We then have the following proposition.

**Proposition 4.** Assume that an occupational equilibrium exists for a given utility function and a technology which satisfies Assumptions 2 and 3. There exists a positive number \( \gamma \) such that if \( \beta - \alpha < \gamma \), all entrepreneurs have a limited liability.

To some extent, the previous discussion about the types of liability found in the equilibrium can be summarized by Table 1 (where the dispersion of skills is defined by the difference between the highest and the lowest levels of skills).\(^{10}\)

The occupational equilibrium with either or both types is not efficient in a first-best sense, as in the previous section.

The equilibrium may not be unique because of the externalities between individuals of different skills. Assume that the values \((s_{L1}, s_{N})\) and \((s_{L2}, s_{N})\) define two equilibria with \( s_{L1} < s_{L2} \). In this case the interest rate on loans to \( L \)-entrepreneurs in the first equilibrium \( r_{L1} \) is smaller than \( r_{L2} \) (to attract more employees to the \( L \)-occupation). This implies that the mean skill of \( L \)-entrepreneurs is higher and that \( s_{N} < s_{N} \).

Multiple equilibria can be ranked by the Pareto criterion.

**Proposition 5.** If there exist two equilibria with levels of lowest skill for \( L \)-entrepreneurs, \( s_{L1} \) and \( s_{L2} \), respectively, and \( s_{L1} < s_{L2} \), the first equilibrium Pareto dominates the second.\(^{11}\)

This result can be compared to those obtained by Stiglitz (1975) in a different context. Entrepreneurs purchase the type-\( N \) signal to reveal higher skills by foregoing the insurance of limited liability. As in Stiglitz, we may have multiple equilibria.

![Image](image1.png)

**Table 1** Types of Liability in Equilibrium

<table>
<thead>
<tr>
<th>Risk Aversion</th>
<th>Low</th>
<th>High*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dispersion of Abilities</td>
<td>Low</td>
<td>?</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>Type N</td>
</tr>
</tbody>
</table>

* The precise meaning of "High" or "Low" risk aversion is relative to the skill dispersion (and vice versa); it is made more precise in the sufficiency conditions of Propositions 3 and 4. For example, types \( L \) and \( N \) exist if the range of skills includes 0 and 1, and if \( |u''(x)| \) is sufficiently large for some \( x \), \( 0 < x \leq Ra \).

\(^{10}\) An equilibrium without \( N \)-entrepreneurs exists only if all skill levels are contained in an interval sufficiently small. For the existence of an \( N \)-entrepreneur, it is sufficient to assume the existence of only one individual with skill \( s = 1 \).

\(^{11}\) The result is proved easily by using the inequalities \( r_{L1} < r_{L2} \) and \( r_{L1} < r_{L2} \).
here that if they exist, an equilibrium with type \( L \) only (no screening) always Pareto dominates an equilibrium with both types \( L \) and \( N \) (and screening).

We have allowed only complete or limited (zero) liability. Within the structure of the model as presented, there is no reason to limit oneself to these two polar arrangements. There could be a continuum of contracts with a borrowing rate depending on the amount of liability taken.\(^{12}\)

When individuals are sufficiently risk averse, the variable amount of liability allows the market to discriminate among all skill levels, and in the equilibrium, information about entrepreneurial skills is perfectly revealed to the lenders.\(^{13}\)

However, contracts with variable amounts of liability may be difficult to implement. Lenders should evaluate the wealth of unsuccessful entrepreneurs. This requires the observability of the individual's entire portfolio, not just his personal investment in his firm. Monitoring costs may prevent the acquisition of this information \textit{ex ante}. If the probability of business failure is relatively small, this information may be easier to obtain \textit{ex post} on the small number of bankrupt firms. This argument is reinforced by the fact that entrepreneurs with unlimited liability do not invest outside of their own firm. Financial intermediaries need only to verify \textit{ex post} that this investment is nil.\(^{14}\)

In what follows we shall continue to assume that lenders can observe only the type of an entrepreneur's liability.

5. Private and social value of limited liability

- The institution of limited liability is relatively recent from a historical point of view,\(^{15}\) and it is worthwhile to analyze the welfare implications of this institution in the context of the model.

Under Assumptions 1–3, when no entrepreneur is allowed to take limited liability the occupational equilibrium exists and is unique (Section 3). Assume now that limited liability "charters" are given without charge to applicants. The initial equilibrium may be replaced by a new equilibrium with entrepreneurs of types \( L \) and \( N \).\(^{16}\) The charters have a private value for some entrepreneurs because of their insurance property. However, their introduction induces occupational changes, which, because of the externalities mentioned above, may affect adversely some individuals. The social value of the limited liability institution (in a sense which remains to be defined) is not \textit{a priori} unambiguous.

We first consider the case where the factor prices (wage rate and risk-free rate of return) are exogenous and independent of the occupational choices.

- Exogenous factor prices. Consider the following proposition.

\textit{Proposition 6}. When the factor prices are exogenously fixed, the introduction of limited liability is a Pareto improvement over a regime where there is only unlimited liability.\(^{17}\)

\(^{12}\) The existence of such an equilibrium is proved, and its properties are analyzed in the fuller version of this article (Chamley, 1981).

\(^{13}\) An analogous situation has been presented by Ross (1977). In his study the penalty in case of bankruptcy is \textit{ad hoc}, and managers choose competitively the debt/equity ratio (and therefore the probability of bankruptcy) to reveal inside information. Here, the probability of failure is given (it is identical to the inside information), and the bankruptcy penalty is competitively determined.

\(^{14}\) Different degrees of risk aversion across entrepreneurs may also make the evaluation of the bankruptcy penalty more difficult.

\(^{15}\) See Section 3 and King (1977).

\(^{16}\) A sufficient condition is given in Proposition 3.

\(^{17}\) No particular assumption (like 1, 2, or 3) is necessary for Proposition 5 except for the existence of equilibrium.
Proof. Denote by a star variables in the equilibrium when limited liability is not allowed \( (s^*_N = s^*_N) \) and assume that there is a new equilibrium when the restriction is lifted (with variables without a star). We must have \( s_N > s_N^* \); otherwise \( r_N \geq r_N^* \), and the following chain of inequalities is infeasible:

\[
 u(w + Ra) = v_L(s_L, r_L) < v_L(s_N, r_L) \\
= v_N(s_N, r_N) \leq v_N(s_N^*, r_N) < v_N(s_N^*, r_N^*) = u(w + Ra).
\] (12)

When \( s_N > s_N^* \), \( r_N < r_N^* \), and the utility of \( N \)-entrepreneurs is strictly greater in the new equilibrium. (Under Assumption (2) their borrowing is strictly positive.) The utility of individuals with skill between \( s_N^* \) and \( s_N \) is higher than if they had chosen to be employees or \( N \)-entrepreneurs in the second equilibrium, and a fortiori, higher than in their first equilibrium occupation. Also, one can show with an a contrario argument in Figure 1 that \( s_L < s_N^* \). Then, for \( s_L < s < s_N^* \), \( u_L(s, r_L) > u(w + Ra) \); the utility level of new entrants in the entrepreneurial occupation is strictly increased. Q.E.D.

In the signalling terminology, one can say that according to Proposition 6, it is Pareto inefficient to compel entrepreneurs to “purchase” (through higher risk) the signal of unlimited liability when factor prices are exogenous.

The last assumption is not valid when the occupational shifts involve a relatively large amount of capital and labor and affect the factor prices.

□ Endogenous factor prices. Consider an initial competitive equilibrium where limited liability is allowed and entrepreneurs of type \( L \) (and also of type \( N \), if they exist) use capital and labor for production.\(^{18}\) Aggregate capital is given, and the labor force is equal to the difference between the population and the number of entrepreneurs.

Assume now that limited liability is abolished by law and that all entrepreneurs are required to take unlimited liability. The less skilled individuals will join the labor force, thereby liberating some capital. Two effects arise: first, capital and labor are employed more efficiently by high skill entrepreneurs. However, as the quantities of capital and labor per entrepreneur increase, diseconomies of scale may have a negative effect. In general, the overall effect is ambiguous. If diseconomies of scale per entrepreneur are not excessive, the abolishing of limited liability increases the wage rate and the risk-free rate of return for a given level of capital. In a dynamic context with an infinitely elastic supply of savings in the long run, the level of capital and the wage rate increase.

The abolition of limited liability can be achieved by a tax on the incomes of limited liability firms at a 100% rate. This discussion implies that the socially optimal level of such tax may well be positive.\(^{19}\)

6. Conclusion

This article has analyzed the institution of limited liability in a simple model of occupational choice with asymmetric information between entrepreneurs and capitalists. Entrepreneurs are required to take some risk to signal their ability.

The institution of limited liability has two effects. First, it improves the information about entrepreneurial skills and reduces the externalities between individuals. Second, it reduces the risk borne by some (or all) entrepreneurs, i.e., the cost of signalling entrepreneurial talent. When factor prices are exogenous, this institution is a Pareto improve-

\(^{18}\) This discussion is illustrated by a numerical example which is given in the fuller version of this article (Chamley, 1981).

\(^{19}\) In the case of multiple equilibria, a tax on \( L \)-firms may eliminate some Pareto-inferior equilibria (one should note that in this case the tax increases the number of \( L \)-firms).
ment (in this context multiple equilibria may exist and can be ranked according to the Pareto criterion). When the substitutions between occupations affect a large sector of the economy, the factor prices cannot be exogenous. In this case, although the abolition of limited liability may not be a Pareto improvement, it could be regarded as desirable by many individuals. Such a policy could put the capital and labor in the hands of the more skilled individuals and raise the rewards of the factors of production if the diseconomies of scale per firm are not excessive.

Of course, this article provides only a partial view on the limited liability institution; for example, one could consider the twin problem of moral hazard mentioned in the introduction, or more general types of probability distributions for the production outcomes, different degrees of risk aversion, etc. The complexity of these problems arises from the variety of situations.

The approach followed here may also have some application to the study of the corporate tax. One of the important attributes of a corporate charter is the property of limited liability. Traditionally, studies of the corporate tax have assumed the existence of a corporate sector, with a corporate production function (Shoven, 1976). The corporate tax affects the relative inputs of the corporate and the noncorporate sector. This approach is valid for some important sectors with large firms, where production has to be organized under the corporate form.

However, in some sectors where an individual's entrepreneurial talent becomes important in deciding success or failure, two production processes, identical from a technical point of view, can be undertaken under different legal structures. This article analyzes one of the aspects of the substitution between two legal forms of production (we have seen that in this framework a corporate tax could be justified). Despite the gloomy predictions of Schumpeter, the entrepreneurial sector is still very active and seems to require further theoretical and empirical investigations.

References


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20 Stiglitz and Weiss (1980) have shown that financial intermediaries may use credit rationing to discriminate against risky projects.

21 For a brief discussion of the properties of the corporate form, see King (1977).

22 For an introduction to some aspects of the taxation on small firms, see Clark (1977).

23 "The romance of earlier commercial adventure is rapidly wearing away, because so many more things can be strictly calculated that had of old to be visualized in a flash of genius" (Schumpeter, 1941, p 132).