Entrepreneurial Talent, Occupational Choice, and Trickle Up Policies [1]

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Abstract

We study market inefficiencies and policy remedies when agents choose their occupations, and entrepreneurial talent is subject to private information. Untalented entrepreneurs depress the returns to entrepreneurship because of adverse selection. The severity of this problem depends on the outside options of untalented entrepreneurs, i.e., working for wages. This links credit, product and labour markets. A rise in wages reduces the adverse selection problem. These multi-market interactions amplify productivity shocks and may generate multiple equilibria. If it is impossible to screen entrepreneurs then all agents unanimously support a tax on entrepreneurs that drives out the less talented ones. However, if screening is possible, e.g., if wealthy entrepreneurs can provide collateral for their loans, then wealthy entrepreneurs do not support surplus enhancing taxes.

Keywords: Occupational Choice, Adverse Selection, Entrepreneurial Talent.

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1 Introduction

When an occupation is subject to adverse selection, talented individuals receive less than the full marginal social return of their talents. This typically creates inefficiencies. For example, if consumers cannot perfectly distinguish high quality from low quality goods, and the competitive price reflects the average quality, producers of high quality goods may produce too little or leave the market (Akerlof [1]). Alternatively, if setting up a new business requires credit, and lenders cannot observe the entrepreneurial talent of potential borrowers, the presence of borrowers with little entrepreneurial talent, who repay loans less frequently on average, will worsen the terms faced by all borrowers (Stiglitz and Weiss [23]). This negative externality will reduce the incentives of talented entrepreneurs to borrow and invest. The ensuing negative effect on wages may have further negative repercussions on the average quality of the borrowers by affecting the outside option of potential entrepreneurs. To study the two-way interaction between allocation of talent and the returns to different occupations, we develop a general equilibrium model of occupational choice.

In our model agents can choose between supplying labor as a worker, or becoming an entrepreneur. Entrepreneurs borrow capital from banks and sell their output in the product market. Entrepreneurial talent is private information, so adverse selection may occur in the credit and the product market (but not in the labor market). No screening instruments are available in the basic model. The product price and the interest rate depend on the *average* talent level in the pool of active entrepreneurs. This in turn depends on the wage in the labor market, which is the outside option of entrepreneurs. The wage is endogenously determined in general equilibrium. In equilibrium, the least talented entrepreneurs will typically be indifferent between remaining entrepreneurs and switching occupations. Because they are less talented than the average of the pool, they impose a negative externality on other entrepreneurs. After a wage increase, the least talented entrepreneurs switch occupations, so the average quality of the pool goes up. This *pool quality effect* causes the price to go up and/or the interest rate to go down. Thus, a wage increase can be good not only for workers, but also for entrepreneurs, since it implies better terms for them in the product and credit markets.

The pool quality effect can potentially lead to a *positive* relationship between wages and labor demand. When the wage goes up, the improved terms in the product and credit markets may induce the remaining entrepreneurs to hire *more* labor. The more elastic is labor demand, the stronger is the pool quality effect on labor demand.

The model has significant economic policy implications. Policies that benefit workers induce the least talented entrepreneurs to switch occupations. If these marginal individuals are more socially productive as workers than as entrepreneurs, then total social surplus goes up. This can potentially make *all* agents better off. Indeed, the benefits initially given to workers *trickle up* to the remaining entrepreneurs, who obtain better terms in the product and credit markets due to the pool quality effect. We show that, if there is no screening, then there will be *unanimous* support for such trickle up policies, because all entrepreneurs suffer when the quality of the pool is low.

Policies that increase the demand for labor (for example, by improving the productivity of labor) will typically lead to higher wages, which in turn will tend to raise the average quality of the entrepreneurs. Again, this improves the returns to entrepreneurship, via improved terms in product and credit markets. Due to the interaction between multiple markets there is a *multiplier* effect of shocks (e.g., policy, productivity) that creates further incentives to expand production and employment. Also, policies that encourage firms to expand employment can finance themselves, since higher labor demand leads to higher wages, which raises overall surplus through the pool quality effect.

We extend the basic model to allow borrowers to have different (observable) levels of wealth that can be used as a screening instrument. With a "separating" contract, wealthy talented entrepreneurs are protected from the negative externalities caused by untalented entrepreneurs. Accordingly, they will not benefit from a tax on entrepreneurs, even if it raises total social surplus. Therefore, in the presence of screening instruments surplus enhancing policies no longer have unanimous support. While there is no pool quality effect of a wage increase on separating contracts, it can have a non-standard effect on labor demand even in the screening model, by a new type of *extensive margin effect.* When the wage increases, it becomes easier to separate talented entrepreneurs from untalented entrepreneurs, and so the collateral required for a separating contract decreases. More agents therefore obtain separating contracts which have low interest rates, and this increases labor demand. Thus, the basic model and the model with screening uncover two separate effects that may lead to an upward sloping labor demand curve, with important implications for policies such as a minimum wage, or a tax on entrepreneurs.

Multiple equilibria can exist in our model. If there is no screening, then the equilibria are Pareto ranked. This situation is similar to Murphy, Shleifer and Vishny [18]. Everyone prefers the wages to be high, including the entrepreneurs. As a result there is a clear incentive to coordinate on the surplus maximizing equilibrium. But when screening is possible, the multiple equilibria are typically *not* Pareto-ranked. Rich talented entrepreneurs prefer wages to be low, but those who are talented and poor prefer high wages, because this relaxes their credit constraints.

In previous models of occupational choice with credit constraints, a tax on entrepreneurs could never be optimal, because the severity of credit constraints is exogenously determined (Banerjee and Newman [3], Galor and Zeira [11], Ghatak, Morelli, Sjöström [12], Bernhardt and Lloyd-Ellis [4], Mookherjee and Ray [17], and Piketty [19]). De Meza and Webb [9] pointed out that credit constraints might be relaxed if the borrower's outside option becomes more attractive, but they also treated this outside option as exogenous. None of these articles considered the *two-way* interaction between the labor and credit markets which is the focus of our analysis.

Our model has important implications for policies aimed at stimulating entrepreneurship. In the literature on poverty traps due to credit constraints, lowering the cost of credit (e.g., through credit subsidies) encourages entrepreneurship and investment (Banerjee [2]). But this argument ignores the potentially important *selection* effect highlighted in our model. If entrepreneurial talent is private information, credit subsidies are likely to encourage less talented agents to become entrepreneurs, so the average quality of the pool falls. This exacerbates the adverse selection problem. Naturally, banks will respond by raising interest rates or imposing higher collateral requirements. As we will show, this can cancel out the intended beneficial effects of the policy.

The literature on the "cleansing" effect of recessions argues that in a recession, the quality of the pool of entrepreneurs improves due to failures of bad projects (see Caballero and Hammour [7]). Our model leads us to question this view as well. In a recession the outside options are depressed. Therefore less talented agents try to become entrepreneurs, which *worsens* the quality of the pool. In response to this, banks adopt tougher lending policies, which depresses the demand for labor. More generally, our analysis suggests that interventions in the labor market can change the outside option for entrepreneurs, and hence affect the severity of credit constraints.

Mankiw [14] discusses the possibility of multiple equilibria in a credit market with adverse selection. The intuition is that when interest rates rise, borrowing becomes less attractive, and it is the "best" (least risky) borrowers who are the first to drop out. This lowers the quality of the pool of borrowers, so banks require a higher interest rate in order to break even. However, if the banks are not price takers (i.e., if they can choose which contracts to offer), then only the equilibrium with the lowest interest rate survives.[1] In our model, multiple equilibria occur for a very different reason. We assume that when borrowing becomes less attractive, it is the *worst* entrepreneurs who are the first to drop out and become workers, which *raises* the quality of the pool of borrowers. In itself, this cannot generate multiple equilibria. Instead, multiple equilibria occur because the outside option to borrowing is endogenously determined through occupational choice, and the returns in the credit and labor markets are linked due to technological/demand complementarities. This can generate multiple equilibria even if the banks are not price takers.

The paper is organized as follows. In section 2 we present a model of adverse selection and occupational choice between complementary activities that encompasses our leading examples of product market and credit market adverse selection. Here we assume no screening instruments are available, and focus on the pool quality effect. In section 3 we extend the basic model for the case of adverse selection in the credit market, and allow banks to screen borrowers using collateral. In section 4 we make some concluding observations.

2 The Model

2.1 Environment

We consider a one-period competitive economy with a continuum of agents. The population size is normalized to 1. Each agent is endowed with 1 unit of labor which she supplies inelastically. Thus, the total labor endowment of the economy is 1. Production requires entrepreneurial labor and ordinary labor. Agents are heterogeneous in terms of their talent as entrepreneurs. Let $\theta \in \{\theta_L, \theta_H\}$ denote the quality of an agent's entrepreneurial input, where $\theta_H > \theta_L$. If $\theta = \theta_H$ then the agent is a *high type*, and if $\theta = \theta_L$ then the agent is a *low* type. The high types make up a fraction q of the population, and the rest are low types. We assume θ is subject to private information.

[1] Mas-Colell, Whinston, and Green [15] make a similar point about Akerlof's [1] model.

All agents have access to a self-employment technology that yields them an autarchy payoff normalized to zero. Each firm needs one entrepreneur, but the number of workers l is a choice variable. Production requires only working capital to pay for the wages of the workers (adding physical capital would make no substantive difference). Potential entrepreneurs do not have any liquid wealth and need to borrow to pay wages. The wage rate is denoted by w and the (gross) interest rate by r. The production function is $f(l)$, which is strictly increasing, strictly concave, and twice continuously differentiable.

The output is sold at price p. The profit function is

$$\pi(p, r, w) \equiv \max_{l \geq 0} \{pf(l) - wrl\}.$$

By the envelope theorem,

$$\pi_p(p, r, w) = f(l),\ \pi_r(p, r, w) = -wl,\ \pi_w(p, r, w) = -rl.$$

The cost of providing entrepreneurial effort for an agent of type θ is denoted $c_e(\theta)$, and the cost of providing ordinary effort (as a worker) is denoted $c_w(\theta)$. Define $b(\theta) \equiv c_w(\theta) - c_e(\theta)$. For some results, the following assumption is required.

Assumption 1:

$$b(\theta_H) > b(\theta_L).$$

Assumption 1 is a single-crossing property with regard to occupational choice. It implies that entrepreneurship is more desirable (or less costly) for high types than for low types. For example, the disutility from entrepreneurial effort may be decreasing in the type of an agent. Alternatively, extra income may be generated by higher quality entrepreneurs. However, if there is adverse selection in the credit market, then the extra income cannot be appropriated by lenders: it is a *private* benefit. (If the private benefit also depends on l, then our results will be strengthened if l and θ are complements).

2.2 Labor Demand

Since the entrepreneur's θ is his private information, the price p and the interest rate r cannot depend directly on it. Instead, p and r depend on the *average* quality of all active entrepreneurs, denoted by μ. Thus, the price of output is $p = p(\mu)$ and the interest rate is $r = r(\mu)$, where $p'(\mu) \geq 0$ and $r'(\mu) \leq 0$. To avoid trivial cases, we assume either $p' > 0$ or $r' < 0$ (or both). Notice that

$$\frac{d}{d\mu}\pi(p(\mu), r(\mu), w) = \pi_p p' + \pi_r r' = f(l)p' - wlr' > 0. \tag{1}$$

That is, all firms benefit from an increase in the *average* quality of the entrepreneurs.

There are two special cases, which we refer to as case I and case II. In case I, there is adverse selection in the product market but not in the credit market. In case II there is adverse selection in the credit market but not in the product market.

In case I, θ represents the quality of the output produced by the entrepreneur. A unit of output produced by an entrepreneur of type θ is worth θ to the buyer (another firm or the final consumer). But there is adverse selection: buyers cannot observe θ before purchasing the product, so the price equals the average quality of the output, i.e., $p(\mu) = \mu$. However, output is non-stochastic and all entrepreneurs repay the loan with certainty. Banks are competitive and face a constant (gross) opportunity cost of 1 per unit of capital, so $r(\mu) \equiv 1$ for all μ.

In case II, the quality of the output does not vary, so the output price can be normalized to $p(\mu) \equiv 1$ for all μ. But now output is stochastic and the probability that the entrepreneur succeeds in producing any output depends on his type. Specifically, output equals $f(l)$ with probability θ, and 0 with probability $1 - \theta$. Potential entrepreneurs do not have any liquid wealth and need to borrow to pay wages. Everyone is risk neutral, but due to the presence of limited liability, entrepreneurs repay only when they are successful. Since banks cannot observe the quality of the entrepreneur, and there are no screening instruments, the interest rate on a loan will depend on the *ex ante* probability that the loan is repaid, which is μ. Banks are competitive and the zero profit condition yields $r(\mu) = 1/\mu$.

The expected payoff for an entrepreneur of type θ is denoted $v(\pi(p, r, w), \theta)$. In *case I*, $p = p(\mu)$ with $p' > 0$, $r \equiv 1$, and

$$v(\pi(p(\mu), 1, w), \theta) = \pi(p(\mu), 1, w) - c_e(\theta). \tag{2}$$

In *case II*, $p \equiv 1$, $r = r(\mu)$ with $r' < 0$, and the entrepreneur succeeds with probability θ, so

$$v(\pi(1, r(\mu), w), \theta) = \theta\pi(1, r(\mu), w) - c_e(\theta). \tag{3}$$

In both cases, each entrepreneur will set l to maximize $pf(l) - wrl$. Let $l = h(wr/p)$ denote the solution to this problem. The first-order condition for an interior solution is

$$pf'(l) = wr. \tag{4}$$

Since $p = p(\mu)$ and $r = r(\mu)$ depend only on the *average* quality of active entrepreneurs, all entrepreneurs choose the same l. Thus, the firm's demand for labor can be expressed as a function of w and μ,

$$\tilde{l}(w, \mu) \equiv h\left(\frac{wr(\mu)}{p(\mu)}\right) \tag{5}$$

where $h = (f')^{-1}$ if the solution is interior. From our assumptions regarding the production function, $\tilde{l}(w, \mu)$ is differentiable. Since $f(l)$ is concave, $h(.)$ is decreasing. In other words, labor demand, $\tilde{l}$, is decreasing in the *real wage*, defined as $wr(\mu)/p(\mu)$. The real wage is clearly increasing in w. Also, by assumption, $p' > 0$ and/or $r' < 0$, and so $wr(\mu)/p(\mu)$ is strictly decreasing in μ. Therefore, labor demand is decreasing in the nominal wage rate, w and increasing in average quality of active entrepreneurs, μ.

2.3 Occupational Choice

The alternative to being an entrepreneur is being a worker. The average quality of entrepreneurs affects p and r, and hence the occupational choice decision of agents of type θ depends on μ. An agent of type θ is indifferent between being an entrepreneur and a worker if

$$v(\pi(p(\mu), r(\mu), w), \theta) = w - c_w(\theta). \tag{6}$$

We call this the occupational choice condition. In case I, (6) takes the form

$$p(\mu)f(\tilde{l}(w, \mu)) - w\tilde{l}(w, \mu) + b(\theta) = w. \tag{7}$$

In case II, (6) takes the form

$$\theta\left(f(\tilde{l}(w, \mu)) - \frac{w}{\mu}\tilde{l}(w, \mu)\right) + b(\theta) = w. \tag{8}$$

Condition (6) implicitly defines $\mu \in [\theta_L, \theta_H]$ as a function of θ and w. Given θ and w, let $\mu^\theta(w)$ denote the μ that satisfies (6). Clearly, (6) cannot be satisfied if w is too high (everyone then strictly prefers being a worker). Moreover, to avoid trivial cases we assume that even low type agents want to become entrepreneurs at zero wage:

$$v(\pi(p(\mu), r(\mu), 0), \theta_L) > -c_w(\theta_L), \quad \forall \mu \geq \theta_L. \tag{9}$$

Given this, (6) cannot be satisfied if w is too low (every agent strictly prefers being a entrepreneur). For w such that (6) cannot be satisfied for any μ, $\mu^{\theta}(w)$ is not defined.

Given our assumptions on $f(.)$, $\mu^{\theta}(w)$ is a differentiable function of w. Abusing notation slightly, let $\mu^{H}(w)$ and $\mu^{L}(w)$ denote $\mu^{\theta}(w)$ for $\theta = \theta_H$ and $\theta = \theta_L$ respectively. Notice that $\mu^{\theta}(w)$ is the average quality of the pool of entrepreneurs such that an agent of type θ is indifferent between being entrepreneur and worker when the wage is w.

For a given θ, by totally differentiating (6) with respect to w, we find that $\mu^{\theta}(w)$ is *increasing* in w :

$$\frac{d\mu^{\theta}(w)}{dw} = \frac{1 - v_{\pi}\pi_{w}}{v_{\pi}\left(\pi_{p}p' + \pi_{r}r'\right)} > 0.$$

The intuition is that the higher is w, the less attractive it is to be an entrepreneur. To restore indifference, entrepreneurship must be made more attractive. Since (1) holds, this is done by increasing the average quality of the entrepreneurs.

The following result shows how the occupational choice decision of an agent is affected when the wage rate changes.

> **Lemma 1:** *Suppose agents of type θ are indifferent between becoming entrepreneurs or workers. Following an increase in w, if agents of type θ at least weakly prefer entrepreneurship, the real wage wr/p must fall in Case II, and also in Case I if $b(\theta) > 0$.*

Proof: In case I, an agent of type θ weakly prefers being an entrepreneur to being a worker if

$$\frac{p(\mu)}{w} f(l) - l + \frac{b(\theta)}{w} \geq 1. \tag{10}$$

Starting with equality in (10), so long as $b(\theta) > 0$, an increase in w must be accompanied by a fall in the real wage for (10) to continue to hold.

In case II the analogous condition is

$$\theta\left(f(l) - \frac{w}{\mu} l\right) + b(\theta) \geq w. \tag{11}$$

Starting with equality in (11), regardless of the sign of $b(\theta)$, an increase in w must be accompanied by a fall in the real wage for (11) to continue to hold. **QED**

The above (partial equilibrium) result tells us what should be the compensating changes in $p(\mu)$ and/or $r(\mu)$ when w changes, in order for the marginal entrepreneur not to switch occupations. We next ask what will happen to labor demand if changes in the wage rate are accompanied by compensating changes in $p(\mu)$ and/or $r(\mu)$ so as to keep the marginal entrepreneur indifferent. Recall that if the average quality is $\mu = \mu^\theta(w)$ and the wage is w, then a type θ agent is indifferent between being entrepreneur and worker. The labor demand of firms, when μ adjusts to satisfy the occupational choice condition of type θ, is

$$\tilde{l}(w, \mu^\theta(w)) = h\left(\frac{wr(\mu^\theta(w))}{p(\mu^\theta(w))}\right). \tag{12}$$

Notice that this differs from the standard labor demand function (5) which considers only the direct effect of w, holding μ constant. We may refer to (12) as a *quasi labor demand function*. Since h is a decreasing function, Lemma 1 and (12) imply the following.

> **Proposition 1:** $\tilde{l}(w, \mu^\theta(w))$ *is increasing in* w *in Case II, and also in Case I if* $b(\theta) > 0$.

Thus, if μ adjusts to keep type θ indifferent between being entrepreneur and worker, then the standard (partial equilibrium) negative intensive-margin effect of an increase in w on labor demand is dominated by a positive *pool quality* effect caused by an increase in μ. The improvement in the quality of the pool raises prices and/or lowers interest rate ($p'(\mu) > 0$ in case I, and $r'(\mu) < 0$ in case II).

2.4 Market Equilibrium

From now on, Assumption 1 is made in order to simplify the analysis. The following relationships implicitly define w', $\overline{w}$ and $\underline{w}$:

$$\theta_H = \mu^L(w') \tag{13}$$

$$\theta_H = \mu^H(\overline{w}) \tag{14}$$

$$q\theta_H + (1-q)\theta_L = \mu^L(\underline{w}). \tag{15}$$

Let $\lambda \in [0, 1]$ denote the fraction of low type agents who become entrepreneurs in equilibrium. The average quality of the active entrepreneurs is

$$\mu = \frac{q\theta_H + (1-q)\lambda\theta_L}{q + (1-q)\lambda}. \tag{16}$$

If $\lambda = 0$ then there are no low type entrepreneurs so the quality of the pool is at its maximum, $\mu = \theta_H$. If $\mu = \theta_H$ and $w = w'$ then the low type agents are indifferent between being entrepreneurs and workers. If $w > w'$, then the low type agents strictly prefer to be workers. If $w = \overline{w}$ and $\mu = \theta_H$, then the high type agents are indifferent between being entrepreneurs and workers. If $w > \overline{w}$, then even high type agents prefer to be workers (since μ cannot exceed θ_H), which cannot be part of an equilibrium. Notice that Assumption 1 implies $w' < \overline{w}$.

If $w < w'$, then we must have $\lambda > 0$ (otherwise $\mu = \theta_H$, but then the low type agents would strictly prefer to be entrepreneurs, by the definition of w'). If $0 < \lambda < 1$ then the low type agents must be indifferent between being entrepreneurs and workers. Assumption 1 implies that in this case the high type agents *strictly* prefer to be entrepreneurs. If $w < \underline{w}$, then all agents strictly prefer to be entrepreneurs, even though the quality of the pool is at its minimum, $\mu = q\theta_H + (1-q)\theta_L$ (if $w = \underline{w}$ then the low types agents are indifferent). If $w > \underline{w}$ then we must have $\lambda < 1$ (otherwise $\mu = q\theta_H + (1-q)\theta_L$, but then the low type agents would strictly prefer to work for wages, by definition of $\underline{w}$).

If a wage w such that $\underline{w} \leq w < w'$ is part of an equilibrium, then the low type agents must be indifferent between the two occupations. Accordingly, the fraction λ must be such that $\mu = \mu^L(w)$. That is,

$$\frac{q\theta_H + (1-q)\lambda\theta_L}{q + (1-q)\lambda} = \mu^L(w).$$

This allows us to solve for the unique λ which corresponds to a given wage w such that $\underline{w} \leq w < w'$:

$$\lambda = \frac{q}{1-q}\frac{\theta_H - \mu^L(w)}{\mu^L(w) - \theta_L}. \tag{17}$$

The total number of active entrepreneurs is

$$q + (1-q)\lambda = q\frac{\theta_H - \theta_L}{\mu^L(w) - \theta_L}. \tag{18}$$

It will simplify the exposition to define the demand and supply of labor to include entrepreneurial labor. That is, each firm demands one unit of entrepreneurial labor, and l units of ordinary labor. Given that the population size is normalized to one, each person supplies one unit of labor inelastically, and the autarchy option of each agent is 0, aggregate labor supply is $L^s(w) = 1$ for all $w > 0$.

For $w = \overline{w}$, the high types are indifferent between the two occupations, and the aggregate labor demand consists of the segment

$$L^d(\overline{w}) = \left[0,\ q\left(h\left(\frac{\overline{w}r(\theta_H)}{p(\theta_H)}\right)+1\right)\right]. \tag{19}$$

For w such that $w' \leq w \leq \overline{w}$, all high types are entrepreneurs, but no low types, and so aggregate labor demand is

$$L^d(w) = q\left(h\left(\frac{wr(\theta_H)}{p(\theta_H)}\right)+1\right). \tag{20}$$

For w such that $\underline{w} \leq w < w'$, low types are indifferent between the two occupations, and equation (18) implies that aggregate labor demand is

$$L^d(w) = q\frac{\theta_H - \theta_L}{\mu^L(w) - \theta_L}\left(h\left(\frac{wr(\mu^L(w))}{p(\mu^L(w))}\right)+1\right). \tag{21}$$

Finally, for $w < \underline{w}$, all agents are entrepreneurs, and

$$L^d(w) = h\left(\frac{wr(\theta_H)}{p(\theta_H)}\right)+1. \tag{22}$$

We are now ready to state:

Proposition 2: *An equilibrium exists.*

Proof: The labor supply curve is a vertical line $L^s(w) = 1$ for all $w > 0$. The labor demand is continuous, because $h(.)$ and $\mu^\theta(.)$ are continuous. Since $0 \in L^d(\overline{w})$ and $L^d(\underline{w}) \geq 1$, there exists an equilibrium wage w^*, where $\underline{w} \leq w^* \leq \overline{w}$. **QED**

Considering the expressions for $L^d(w)$, there are three channels through which wages affect total labor demand. The first is the standard *intensive margin effect*: higher wages reduce labor demand per firm. The second is the standard *extensive margin effect*: higher wages reduce the total number of firms (λ falls) and so labor demand falls via this channel as well. The third effect, which we emphasize in this paper, is the *pool quality effect*: higher wages lead to an increase in the average quality of entrepreneurs, which raises prices and/or reduces the interest rate, which in turn raises labor demand.

For $w' \leq w \leq \overline{w}$, the aggregate labor demand curve is downward sloping due to the first effect. The two other effects do not operate because there are no low type entrepreneurs.

If $\underline{w} \leq w < w'$ then all three effects are in operation, and L^d may slope up or down. Totally differentiating L^d with respect to w we get

$$\frac{dL^d(w)}{dw} = q\frac{\theta_H - \theta_L}{\mu^L(w) - \theta_L}\left[\frac{dh(\phi(w))}{dw} - \frac{(\tilde{l}+1)}{\mu^L(w) - \theta_L}\frac{d\mu^L(w)}{dw}\right]. \tag{23}$$

where $\phi(w) \equiv wr(\mu^L(w))/p(\mu^L(w))$. The two terms within parenthesis have opposite signs. Proposition 1 implies that the combination of the intensive margin and the pool quality effects is positive in net terms. The first term captures this. However, the extensive margin effect is negative, and the second term captures this (recall that $d\mu^L(w)/dw > 0$).

Let ε denote (the absolute value of) the standard elasticity of labor demand. It captures the direct effect of w on labor demand, but not the indirect effect via the occupational choice condition. Using the first-order condition,

$$\varepsilon \equiv -\frac{w}{\tilde{l}}\frac{\partial \tilde{l}}{\partial w} = -\frac{f'(l)}{lf''(l)}. \tag{24}$$

Simplifying equation (23) we find the following expression whose sign is the same as $dL^d(w)/dw$ for $w < w'$:

$$\left[\frac{b(\theta_L)}{w(1+l)}\frac{\mu^L(w) - \theta_L}{\mu^L(w)}\frac{l}{(1+l)}\right]\varepsilon - 1$$

in case I and

$$\left[\frac{\tilde{l}}{\left(1+\tilde{l}\right)}\frac{\mu^L(w) - \theta_L}{\mu^L(w) + \theta_L\tilde{l}}\right]\varepsilon - 1$$

in case II.

By the occupational choice condition, $b(\theta_L) < w(1+l)$. The rest of the terms within the parentheses in both the expressions lie between 0 and 1. Thus, if $\varepsilon < 1$ then the aggregate labor demand is downward sloping even when $\underline{w} \leq w < w'$, in spite of the pool quality effect. Then there is a unique market equilibrium wage w^*. Figure 1 illustrates such a case. Intuitively, the combination of the intensive margin effect and the pool quality effect is weak if ε is small (e.g., if the production function is Leontief). In this case, the extensive margin effect dominates and labor demand has the usual negative slope. But if $\varepsilon > 1$, the combination of the intensive margin effect and the pool quality effect is strong and it is possible for labor demand to have an upward sloping part. This raises the possibility of multiple equilibria, which is discussed in section 2.6.

If the equilibrium wage is less than w', any shock (e.g., relating to technology, transactions costs) will not only have a direct effect on the labor market, but also an indirect effect via occupational choice and changes in the quality of the pool. For example, a technological shock that shifts the labor demand curve to the right will have the direct effect of raising wages in the labor market. If low quality entrepreneurs are active, the wage increase will cause some of them to switch occupations. This will improve the quality of the pool of entrepreneurs, thereby raising prices and/or lowering the interest rate, which will further boost labor demand and so on. Accordingly, such shocks will have a multiplier effect, and their short-run and long-run effects will be different.

2.5 Surplus Enhancing Economic Policies

The basic distortion in this model is the negative externality untalented entrepreneurs impose on other entrepreneurs. In case I, the existence of low type entrepreneurs reduces the price high type entrepreneurs receive for their output. In case II, the existence of low type entrepreneurs, who frequently fail, raises the interest rates for high type entrepreneurs. We therefore consider policies that reduce λ, the fraction of low type agents who become entrepreneurs, and thereby raise social surplus. In particular, we focus on *trickle-up* policies: policies that benefit workers can end up helping entrepreneurs by inducing the least talented entrepreneurs to switch occupations, thereby improving the quality of the pool of entrepreneurs which would in turn improve the terms faced by entrepreneurs in product and/or credit markets.

To focus on the interesting case, suppose that the market equilibrium is such that $0 < \lambda < 1$.[2] The total social surplus is the sum of the payoff of all agents. It can be expressed as

$$\begin{aligned} S &= qv(\pi(p(\mu), r(\mu), w), \theta_H) + (1-q)\lambda v(\pi(p(\mu), r(\mu), w), \theta_L) \\ &\quad + (1-q)(1-\lambda)\left\{w - c_w(\theta_L)\right\} \end{aligned} \tag{25}$$

where μ is given by (16). The first two terms in (25) capture the payoff to the high and low type entrepreneurs, respectively, and the third term captures the payoff

[2] If $\lambda = 0$ or $\lambda = 1$, then small changes in economic policy will not change the social surplus, as λ will not change. In any case the case $\lambda = 0$ is trivial, because there are no low type entrepreneurs and as a result, no adverse selection problem. If $\lambda = 1$ then every agent is a self-employed entrepreneur who hires no workers. This case can be ruled out by making an Inada assumption, namely, $f'(0) = \infty$.

to the workers (who are all low types).[3] The expression (25) involves w, which is simply a transfer from entrepreneurs to workers.

Alternatively, the social surplus can be expressed as the total value of output, minus the total cost of effort. The total number of firms is $q+\lambda(1-q)$. Each firm has l workers and one entrepreneur. Labor market clearing implies $(q+\lambda(1-q))(l+1) = 1$ so the number of workers in each firm is

$$l = \frac{1}{q + \lambda(1-q)} - 1. \tag{26}$$

The total social surplus can therefore be written as:

$$S = \{q\theta_H + \lambda(1-q)\theta_L\} f(l) - qc_e(\theta_H) - (1-q)\lambda c_e(\theta_L) - (q + (1-q)\lambda) l c_w(\theta_L). \tag{27}$$

This expression does not involve w. Using (26) we can write S as a function of λ:

$$\begin{aligned} S(\lambda) \quad = \quad & \{q\theta_H + \lambda(1-q)\theta_L\} f\left(\frac{1}{q+\lambda(1-q)} - 1\right) \\ & -qc_e(\theta_H) - (1-q)\{\lambda c_e(\theta_L) + (1-\lambda)c_w(\theta_L)\}. \end{aligned} \tag{28}$$

The socially optimal λ_0 maximizes $S(\lambda)$. Notice that

$$S'(\lambda) = (1-q)\left\{\theta_L f(l) - \mu(\lambda)(1+l) f'(l) + b(\theta_L)\right\} \tag{29}$$

where l is given by (26), and

$$\mu(\lambda) \equiv \frac{q\theta_H + \lambda(1-q)\theta_L}{q + \lambda(1-q)}.$$

At an interior optimum, $S'(\lambda_0) = 0$, so

$$\theta_L f(l_0) + b(\theta_L) = \mu(\lambda_0)(1 + l_0) f'(l_0) \tag{30}$$

where

$$l_0 = \frac{1}{q + \lambda_0(1-q)} - 1.$$

The left hand side of (30) is the marginal social benefit of a low type entrepreneur, who produces output worth $\theta_L f(l_0)$, and enjoys a private benefit $b(\theta_L)$. The right hand side is the social cost. Since the low type entrepreneur hires l_0 workers, if he

[3] Notice that in Case I, the price per unit of quality is constant. Therefore, when evaluating individual payoffs, from the point of view of consumers a change in μ is cancelled out by the price change. However, a change in μ does affect the payoff of entrepreneurs.

switches occupation then $1 + l_0$ agents are free to work in other firms, where they will be expected to contribute $\mu(\lambda_0)\,(1 + l_0)\,f'(l_0)$ to social surplus.

If we evaluate (29) at the competitive equilibrium, we find that

$$S'(\lambda) = (1 - q)\,\{\theta_L f(l) - lw + b(\theta_L) - w\} < 0$$

where we have used (4), and the inequality is due to the occupational choice condition ((7) in case I and (8) in case II). Therefore, reducing the number of low quality entrepreneurs will raise total social surplus. This is natural, since the low quality entrepreneurs impose a negative externality on other entrepreneurs.

Consider, therefore, imposing a tax t on all entrepreneurs (which does not depend on how much labor they hire). The tax revenue is redistributed as a lump sump subsidy to all agents to balance the budget. The occupational choice condition (7) becomes

$$p(\mu)f(\tilde{l}(w,\mu)) - w\tilde{l}(w,\mu) + b(\theta) - t = w. \tag{31}$$

(The lump-sum subsidy is given to *all* agents so it does not appear in the occupational choice condition). In case II, the entrepreneur is only able to pay the tax if he succeeds, so the occupational choice condition (8) becomes

$$\theta\left(f(\tilde{l}(w,\mu)) - \frac{w}{\mu}\tilde{l}(w,\mu) - t\right) + b(\theta) = w. \tag{32}$$

Given θ, t and w, let $\mu^{\theta}(w,t)$ denote the μ that satisfies (31) in case I, and (32) in case II. It can be verified that

$$\frac{\partial \mu^L(w,t)}{\partial w} > 0 \quad , \quad \frac{\partial \mu^L(w,t)}{\partial t} > 0. \tag{33}$$

Starting at an equilibrium where $0 < \lambda < 1$, imposing a tax $t > 0$ will make it less desirable to be an entrepreneur, so the equilibrium value of λ must fall. (Suppose λ does not fall. Then the demand for labor does not fall, so the equilibrium wage does not fall either. But then it follows from (33) that the quality of the pool, $\mu^L(w,t)$, must strictly improve to keep the low types indifferent between the two occupations. But then λ must fall, a contradiction.)

What is the effect of a tax $t > 0$ on social surplus? Consider the function:

$$\begin{aligned}\sigma(\lambda,\mu,w) \;\equiv\;& qv(\pi(p(\mu),r(\mu),w),\theta^H) + (1-q)\lambda v(\pi(p(\mu),r(\mu),w),\theta^L) \\ &+ (1-q)(1-\lambda)\,\{w - c_w(\theta_L)\}\,.\end{aligned} \tag{34}$$

If prices take their market equilibrium values $(p(\mu^*), r(\mu^*), w^*)$, computed when $t = 0$, then $\partial\sigma/\partial\lambda = 0$ from the low type's occupational choice condition (6). Thus, $\sigma(\lambda, \mu^*, w^*)$ does not depend on λ. This corresponds to an artificial exercise: if some low type entrepreneurs switch occupation and prices do not change, then there is no effect on the social surplus as expressed in (25), since the low types are indifferent between the two occupations (each individual who chooses an occupation does not think that his choice will change prices). But in fact, if λ falls due to a tax, then the equilibrium prices must change. From the balanced budget assumption, the taxes and subsidies cancel out when social surplus is computed. Moreover, wage payments are a transfer from entrepreneurs to workers, so they also cancel out. But the increase in $p(\mu)$ and/or fall in $r(\mu)$ will make the remaining entrepreneurs better off. Thus, when λ falls due to a tax $t > 0$, the true social surplus, once the price changes are accounted for, will exceed the "pseudo surplus" $\sigma(\lambda^*, \mu^*, w^*)$. Conversely, if instead we were to subsidize entrepreneurs ($t < 0$), then λ would increase and the true social surplus would be smaller than $\sigma(\lambda^*, \mu^*, w^*)$. This shows that the socially optimal λ_0 (which maximizes $S(\lambda)$) is smaller than the competitive equilibrium λ^*. That is, there are *too many* low quality entrepreneurs in the competitive equilibrium. Clearly, entrepreneurs should be taxed, not subsidized.

Proposition 3: *Suppose* $\lambda = \lambda^*$ *in market equilibrium, and let* λ_0 *denote the socially optimal* λ. *Then* $\lambda_0 \leq \lambda^*$, *with strict inequality if* $0 < \lambda^* < 1$.

Moreover, all agents *unanimously* favor a tax on entrepreneurs.

Proposition 4: *If in a market equilibrium* $0 < \lambda^* < 1$, *then all agents strictly gain from the introduction of a small tax on entrepreneurs.*

Proof: Since $0 < \lambda^* < 1$, a low type agent is indifferent between the two occupations. If the tax is small enough that this indifference is maintained, then the changes in the welfare of a low type entrepreneur is the same as the changes in the welfare of a worker. In case I, the difference between the expected payoff of a high type and a low type entrepreneur is a constant, $c_e(\theta_L) - c_e(\theta_H)$. Therefore, the effect on the welfare of a high type entrepreneur is the same as the effect on the welfare of a low type entrepreneur. In case II, the type θ entrepreneur's expected payoff is

$$v(\pi(1, r(\mu), w), \theta) = \theta\,(\pi(1, r(\mu), w) - t) - c_e(\theta).$$

Therefore,

$$\theta_L\,(v(\pi(1, r(\mu), w), \theta_H) + c_e(\theta_H)) = \theta_H\,(v(\pi(1, r(\mu), w), \theta_L) + c_e(\theta_L))\,.$$

Thus, the change in $v(\pi(1, r(\mu), w), \theta_H)$ has the same sign as the change in $v(\pi(1, r(\mu), w), \theta_L)$. So in both cases, either all agents experience an increase in welfare, or they all experience a reduction in welfare. But, since λ falls and $S'(\lambda) < 0$ at the market equilibrium, the total surplus goes up. Therefore, all agents strictly gain. **QED**

Proposition 4 shows that there will be unanimous agreement for a trickle up proposal to redistribute income from entrepreneurs to workers. The unanimity will persist until λ has been reduced to λ_0. At that point, if $\lambda_0 > 0$ then taxing entrepreneurs even further will reduce the social surplus and make all agents worse off. If $\lambda_0 = 0$, then further tax increases will simply transfer surplus from entrepreneurs to workers in a zero-sum fashion.

It follows that if an agent is randomly chosen as social planner and can tax entrepreneurs as long as nobody voices any opposition, then she would choose a tax rate such that the corresponding market equilibrium is efficient. There is unanimous support for this, because all agents are hurt by the adverse selection problem. However, there will be no unanimity on economic policy if there is wealth heterogeneity among the entrepreneurs, as shown in section 3.

2.6 Multiple equilibria

We illustrate the possibility of multiple equilibria with an example. Consider Case II, with the production function $f(l) = (1 + l)^\alpha$, where $0 < \alpha < 1$. (This is a Cobb-Douglas production function where the entrepreneur himself provides productive labor). In this case, $p \equiv 1$ and $r(\mu) = 1/\mu$. Assume $0 < b(\theta_L) \leq b(\theta_H)$. The demand for labor (not counting the entrepreneur's own labor) is

$$h\,(wr) = \left(\frac{\alpha}{wr}\right)^{\frac{1}{1-\alpha}} - 1$$

if $wr \leq \alpha$, and

$$h\,(wr) = 0$$

if $wr > \alpha$. The profit function is

$$\pi(1, r, w) = \frac{\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}}{(wr)^{\frac{\alpha}{1-\alpha}}} + wr \tag{35}$$

for $wr \leq \alpha$, and $\pi(1, r, w) = f(0) = 1$ otherwise.

We assume

$$\alpha\theta_H q < b(\theta_L) < \alpha\theta_H q^{1-\alpha}. \tag{36}$$

Also, to simplify calculations we set $\theta_L = 0$.

The inequality (36) implies that if $\mu = q\theta_H$ and $w = b(\theta_L)$, then

$$wr(\mu) = \frac{b(\theta_L)}{q\theta_H} > \alpha \tag{37}$$

so $h\left(wr(\mu)\right) = 0$. That is, no entrepreneur will hire any workers. Moreover, since the low types always fail, they are indifferent between the two occupations when the wage is $b(\theta_L)$. Low type entrepreneurs never repay their loans, and hence they do not care about the interest rate $r(\mu)$. Accordingly, $\underline{w} = w' = b(\theta_L)$.Therefore, there is an equilibrium where $w = b(\theta_L)$, and all agents become entrepreneurs so $\mu = q\theta_H$. At this low pool quality, the interest rate is so high that no entrepreneur hires any workers. (Since the demand for labor includes entrepreneurial labor by convention, $L^D(b(\theta_L)) = 1$.)

If $w > b(\theta_L)$, then no low type agent becomes entrepreneur, and $wr(\mu) = w/\mu = w/\theta_H$. As long as $w/\theta_H \leq \alpha$, a high type entrepreneur will hire

$$h\left(wr(\mu)\right) \equiv \left(\frac{\alpha}{wr(\mu)}\right)^{\frac{1}{1-\alpha}} - 1$$

workers. A high type agent prefers to be entrepreneur as long as

$$\theta_H \pi(1, r(\mu), w) + b(\theta_H) \geq w \tag{38}$$

The aggregate demand for labor (including entrepreneurial labor) would then be

$$L^D(w) = q\left(h\left(\frac{w}{\theta_H}\right) + 1\right) = q\left(\frac{\alpha\theta_H}{w}\right)^{\frac{1}{1-\alpha}}$$

Labor market clearing requires $L^D(w) = 1$, which is true if

$$w = \alpha\theta_H q^{1-\alpha} > b(\theta_L) \tag{39}$$

The inequality is due to (36). Also, $w/\theta_H = \alpha q^{1-\alpha} < \alpha$. Substituting $w = \alpha\theta_H q^{1-\alpha}$ and $r = 1/\theta_H$ into the expression (35), we can verify that (38) holds for any $b(\theta_H) > 0$. Thus, there is an equilibrium where only the high types are entrepreneurs, and the wage is given by (39). The interest rate is low enough such that the high types find it worthwhile to hire all the low types as workers.

In this example, there is both a low wage equilibrium where $w = b(\theta_L)$, and a high wage equilibrium where $w = \alpha\theta_H q^{1-\alpha} > b(\theta_L)$.[4] How can we evaluate the multiple equilibria in terms of welfare? It turns out that in general, not just in this example, the high wage equilibrium Pareto dominates the low wage equilibrium.

Consider Figure 2, which depicts a general case of multiple equilibria. For w such that $w' < w < \overline{w}$, as we move along the labor demand schedule $L^D(w)$, a wage increase is matched by a fall in λ, hence an increase in μ (so p rises in case I, r falls in case II). For $w \leq w'$ and $w \geq \overline{w}$, λ is constant (1 or 0). Thus, there must be fewer entrepreneurs at the high wage equilibrium w_1^* than at the low wage equilibrium w_0^*. But the total labor supply (including entrepreneurial labor) is constant at 1. Therefore, firm-level labor demand must be higher at the high wage equilibrium. Indeed, this increase in firm level demand is what causes the labor demand to slope up.[5] This implies the real wage wr/p must be strictly lower in the high wage equilibrium, even though the nominal wage w is higher.[6] Moreover, the price p is at least as high in the high wage equilibrium as in the low wage equilibrium. This implies that entrepreneurs are strictly better off in the high wage equilibrium. Formally, in case I the payoff of an entrepreneur is $\max_l p\left(f(l) - \frac{w}{p}l\right) + b(\theta)$, and since w/p is lower and p is higher they must be better off in the high wage equilibrium. Similarly, in case II the payoff is $\max_l \theta\left(f(l) - wrl\right) + b(\theta)$ and so because wr is lower they are better off. Workers obviously are better off in the high wage equilibrium, because they care about the nominal wage only. (Even if they consume the good the firms produce, the price per unit of quality is constant.) Therefore, the high wage equilibrium Pareto dominates the low wage equilibrium. (Some low types switch occupation as the wage increases, but by revealed preference,

[4] These two equilibria are reminiscent of the "cottage production" equilibrium and "modern industrialization" equilibrium in Murphy et al [18]. However, in their model the multiple equilibria were due to positive pecuniary externalities, whereas in our model they are due to negative information externalities.

[5] The argument is strengthened if labor supply is upward sloping since then high type entrepreneurs have to absorb a higher number of workers who are supplying more labor individually compared to the low wage equilibrium.

[6] In the example, $wr < \alpha$ in the high wage equilibrium, while $wr > \alpha$ in the low wage equilibrium.

they are even better off than if they had remained entrepreneurs.) To summarize:

Proposition 5: *If multiple equilibria exist, then they are Pareto ranked.*

It is well known that multiple Pareto-ranked equilibria can exist in the standard Akerlof model, but this relies on a very strong assumption of price taking behavior. If this assumption is dropped then only the "best" equilibrium survives (Mankiw [14] and Mas-Colell, Whinston, and Green [15]). In our framework, even if those who purchase the product in case I, and banks in case II, can offer any contract they want (so that they are not price takers), the coordination problem will not disappear since our mechanism works through multi-market interactions. An individual competitive bank, say, will correctly anticipate that lowering the interest rate will not boost aggregate labor demand enough to bring the economy out of a low wage equilibrium. It will only lead to losses for the bank. Only if all banks simultaneously lower interest rates can aggregate labor demand increase, wages go up, and the pool improve.

3 Screening

In the presence of adverse selection, a natural contractual response is to attempt to screen the individuals. Specifically, suppose publicly observed wealth can be used as collateral in the credit market adverse selection problem (as in Bester [6] and Besanko and Thakor [5]). Wealthy high type entrepreneurs will not suffer from the existence of low type entrepreneurs if they can obtain loans at low interest by providing sufficient collateral.

In the previous section the positive link between wages and aggregate labor demand was driven by the pool quality effect, for which individual labor demand $h(wr/p)$ had to be elastic. With screening, the aggregate demand for labor may slope upwards even when individual labor demand is completely inelastic. Therefore, we simplify the analysis in this section by assuming that the production technology is Leontief. In each firm it takes n workers to produce R units of output.

Workers who do not work for a firm can produce a subsistence income $\underline{w} > 0$ which sets a lower bound for the equilibrium wage rate. Each agent has some initial wealth denoted a. The cumulative distribution function for initial wealth is continuous, and is denoted by G. All wealth is observable but not liquid. Entrepreneurs need to borrow wn to pay wages. To simplify the exposition, assume

$0 < \theta_L < \theta_H = 1$, and θ_L is low enough that low types would never become entrepreneurs if types were publicly observed. There is a private non-pecuniary benefit associated with entrepreneurship, $b(\theta_H) = b(\theta_L) = M > 0$, which is not appropriable by banks (Assumption 1 is not needed when screening is possible). Banks compete by offering credit contracts of the form (c, r), where c is the collateral, and r is the gross interest rate on the loan. A borrower of type θ repays the loan with probability θ. If he does not repay, the bank seizes the collateral and liquidates it. The collateral is worth c to the borrower but, if liquidated, it is only worth ϕc to the bank, where $0 < \phi < 1$. A partial equilibrium in the credit market consists of a set of contracts such that no contract makes losses, and no additional contracts can be introduced that will earn strictly positive profits, assuming the original contracts are left unmodified.

In order to focus on the interesting cases, we assume:

Assumption 2:

$$\theta_L (R - n\underline{w}) + M > \underline{w} > \theta_L R - n\underline{w} + M.$$

This assumption implies that when the wage is the lowest possible ($w = \underline{w}$), a low type would still not want to become entrepreneur if he had to pay the whole wage cost $n\underline{w}$ (which would be the case with self-financing). However, if he pays the wages only if successful, he would want to be an entrepreneur. Since $\theta_H = 1$, the first inequality also implies that high types strictly prefer to be entrepreneurs when $w = \underline{w}$.

Since wealth is observed, agents with different wealth levels can be offered different contracts. The contract offered to an agent of wealth level a is denoted $(c(a), r(a))$. There are two possibilities: if both high and low types of wealth class a accept the credit contract and become entrepreneurs, then the contract is *pooling.* If only high types accept it, then the contract is *separating.* Agents who do not become entrepreneurs are workers, earning the wage w (there is no disutility of labor).

A low type agent who accepts the contract (c, r) gets a payoff

$$\theta_L (R - rwn) + M - (1 - \theta_L)c.$$

If instead she supplies ordinary labor she receives w. Thus the contract (c, r) is separating if and only if $c \geq c^*(r, w)$, where

$$c^*(r, w) \equiv \max \left\{ 0, \frac{\theta_L(R - rwn) + M - w}{1 - \theta_L} \right\}.$$

If $c^*(r,w) > 0$ then clearly $c^*(r,w)$ is strictly decreasing in the wage rate as well as the interest rate. If $c = c^*(r,w) > 0$ then low types are indifferent between becoming entrepreneurs and working for wages. We assume that they work for wages in this case. Competition among banks implies $r = 1$. Thus, all separating contracts will be of the form $(c^*(1,w), 1)$. They will, of course, only be offered to agents who have sufficient wealth, $a \geq c^*(1,w)$, to meet the collateral requirement. Assumption 2 implies $c^*(1,w) < wn$ for all $w \geq \underline{w}$.

The payoff of a high type who accepts the separating contract is $v^s(w) \equiv R - nw + M$. For a high type to accept the contract, her participation constraint must be satisfied, i.e., $v^s(w) \geq w$. The upper bound on the equilibrium wage rate is $\overline{w}$ such that $v^s(\overline{w}) = \overline{w}$. That is,

$$\overline{w} = \frac{R+M}{1+n}.$$

We assume $R \geq \overline{w}n$, so a high type entrepreneur with a separating contract makes non-negative monetary profits for all $w \in [\underline{w}, \overline{w}]$. Assumption 2 implies $R - n\underline{w} + M > \underline{w}$, i.e., $\overline{w} > \underline{w}$.

Next, consider a *pooling contract* $(c(a), r(a))$, with $c(a) < c^*(1,w)$. This contract attracts both high and low type borrowers with wealth a. The pooling contract yields zero expected profit to the bank if

$$[q + (1-q)\theta_L]\, r(a)nw + (1-q)(1-\theta_L)\phi c(a) = nw. \tag{40}$$

As $c^*(1,w) < wn$, and $\phi c(a) \leq c(a) < c^*(1,w)$, it directly follows from (40) that $r(a) > 1$. Thus, the payoff of high type borrowers is lower with a pooling than with a separating contract (they cross-subsidize low type borrowers). From (40), $r(a)$ varies inversely with $c(a)$, so the payoff for a high type entrepreneur with a pooling contract is increasing in $c(a)$. Therefore, competition for high type borrowers leads to $c(a) = a$. Accordingly, $r(a)$ is decreasing in a.

The payoff of a high type borrower under a pooling contract (with $c(a) = a$) is $v^p(a,w) = R - r(a)nw + M$, where $r(a)$ is given by (40). It is clear upon inspecting (40) that $r(a)$ is increasing in w, so $v^p(a,w)$ is decreasing in w (the greater the size of the loan, the greater the cross-subsidization of low types). As $r(a)$ is decreasing in a, $v^p(a,w)$ is increasing in a. Therefore, there is a wealth cutoff-level $\hat{a}(w)$ such that $v^p(a,w) \geq w$ if and only if $a \geq \hat{a}(w)$. Thus, $\hat{a}(w)$ is the lowest wealth level consistent with a pooling contract. Specifically, $\hat{a}(w) = 0$ if $v^p(0,w) \geq w$, and otherwise, $\hat{a}(w) > 0$ is determined by the equation $v^p(\hat{a}(w), w) = w$.

To summarize:

Proposition 6: *When screening is possible through collateral requirements:*
(i) If $c^*(1,w) \leq \hat{a}(w)$ then agents with wealth $a \geq c^*(1,w)$ are offered a separating contract, while agents with wealth $a < c^*(1,w)$ get no credit.
(ii) If $c^*(1,w) > \hat{a}(w)$ then agents with wealth $a \geq c^*(1,w)$ are offered a separating contract, while agents with wealth a such that $\hat{a}(w) \leq a < c^*(1,w)$ are offered a pooling contract, and agents with wealth $a < \hat{a}(w)$ get no credit.

When wealth can be used as a screening instrument, pooling contracts and separating contracts can *coexist* in equilibrium. Agents with wealth less than $c^*(1,w)$ either become workers or get a pooling contract where they put all their wealth as collateral. Within a wealth class that receives pooling contracts, a bank cannot hope to attract only high types by reducing the interest and raising the collateral requirement, because the borrowers already put *all* their wealth down as collateral ($c(a) = a$). Notice that the assumption that guarantees existence of equilibrium is that wealth is publicly observable. With unobserved wealth, there would be values of q (sufficiently high) such that pooling contracts would be inconsistent with equilibrium (as in Rothschild and Stiglitz [22]).

By our convention, the supply of labor is 1 at any $w \in [\underline{w}, \overline{w}]$. Since the technology has fixed coefficients, each firm demands $n+1$ units of labor at any $w \in [\underline{w}, \overline{w}]$, including entrepreneurial labor. The marginal agent, who is just on the threshold of being credit constrained, has wealth $a = \min\{\hat{a}(w), c^*(1,w)\}$.

We know that $c^*(1,w)$ is decreasing in w and $\hat{a}(w)$ is increasing in w. If $\hat{a}(w) > c^*(1,w)$, then the marginal agent receives a separating contract. In this case, an increase in w relaxes credit constraints, because separation becomes easier and separating contracts are given to *more* agents. If $\hat{a}(w) < c^*(1,w)$, then the marginal entrepreneur receives a pooling contract. In this case, an increase in w tightens credit constraints, because pooling contracts become less profitable and are given to *fewer* agents. Thus, the demand for labor $L^D(w)$ slopes *up* if $\hat{a}(w) > c^*(1,w)$, and *down* if $\hat{a}(w) < c^*(1,w)$. Notice that when labor demand is increasing in w it is due to an extensive margin effect *working through the equilibrium level of collateral.* This effect was naturally absent in the model without any screening instrument. As in the model without screening, it is easy to see that the upward sloping regions of

$L^d(w)$ can generate multiple equilibria. (Examples are readily constructed, but we omit the details.)

Turning now to policy implications, unlike in the previous section, it is not possible to obtain consensus on the policy to eliminate the distortions. Consider imposing a tax t on entrepreneurs, which he only pays if he succeeds (the tax revenue is redistributed via a lump-sum transfer to all agents). In effect, this reduces his revenue from R to $R - t$. The contract $(c, 1)$ is separating if and only if

$$c \geq \max\left\{0, \frac{\theta_L (R - t - wn) + M - w}{1 - \theta_L}\right\}$$

The right hand side of the inequality is decreasing in t. The tax makes it easier to screen the borrowers, so the banks respond by lowering the collateral requirements. Therefore, for any given w, *more* borrowers can obtain a separating contract if a positive tax is imposed on entrepreneurs. If there are no pooling contracts in equilibrium, then the demand for labor will increase. On the other hand, $\hat{a}(w)$ will also increase, so if pooling contracts are offered in equilibrium, fewer agents can obtain a pooling contract. Thus, the effects of a tax increase depend on whether the marginal entrepreneur gets a separating or a pooling contract. But unlike in the previous section, there can never be unanimous support for a tax increase. Wealthy high type agents, who can afford a separating contract, always strictly prefer lower taxes on entrepreneurs.

Consider finally a credit subsidy $\sigma > 0$ paid up front to any entrepreneur who invests. In effect, this reduces the necessary loan size from wn to $wn - \sigma$. Therefore, the contract $(c, 1)$ is separating if and only if

$$c \geq \max\left\{0, \frac{\theta_L (R - (wn - \sigma)) + M - w}{1 - \theta_L}\right\}$$

The right hand side of the inequality is increasing in σ. Since the subsidy makes entrepreneurship more attractive, the banks must use tougher lending policies in order to screen the borrowers. Thus, they increase the collateral requirements, so *fewer* borrowers can obtain a separating contract. If there are no pooling contracts in equilibrium, then the credit subsidy makes it harder to invest and reduces the demand for labor. On the other hand, if the credit subsidy is big enough, then pooling contracts will become profitable. In this case, the credit subsidy will increase the number of agents who get a pooling contract, hence it will increase the demand for labor. Again, the effects of the policy depend on whether the marginal entrepreneur gets a separating or a pooling contract.

In the screening model, multiple equilibria are generated by an extensive margin effect, and they cannot be Pareto-ranked. Unskilled agents are better off under a high wage equilibrium. But high types who have sufficient wealth for a screening contract strictly prefer the low wage equilibrium. For them, the interest rate is always 1, but the real cost of labor is higher in the high wage equilibrium. (In the previous section, the real cost of labor wr/p was actually lower at the high wage equilibrium, due to the pool quality effect.)

4 Conclusion

We have studied a channel through which the equilibrium consequences of adverse selection depend on the outside options of agents, which in turn depend on the endogenous inefficiencies caused by adverse selection. This channel is occupational choice. Its importance depends on the degree of interlinkage between the markets among which agents are choosing, and on the degree of complementarity between various occupations. In the presence of such complementarities, small productivity shocks can have large effects.

If it is impossible to screen the agents, there will be unanimous support for a redistribution of income from entrepreneurs to workers. Such policies improve the quality of the entrepreneurial pool, so the benefits initially enjoyed by workers trickle up to benefit entrepreneurs. With screening, however, some talented entrepreneurs may be immune to the adverse selection problem, so benefits do not "trickle up" to them. Thus, screening instruments are potentially harmful, since they partition the agents into classes with conflicting interests, and surplus enhancing policies no longer get unanimous support. If liquidity constraints prevent poor agents from lobbying for their favorite policies, as in Esteban and Ray [10], then surplus enhancing taxes on entrepreneurs may not materialize. Endogenous policy choice in this kind of environment seems like an interesting topic for future research.

The logic of our model can be applied to a variety of different contexts. The following elements need to be present: the returns to two occupations, say A and B, are positively related (e.g. a rise in the price of the good made by those in occupation A raises demand for inputs produced in B); there is occupational choice; and one occupation (e.g. A) is subject to adverse selection. If the returns to occupation B are low then the adverse selection in occupation A is severe, which depresses the returns to occupation A. This reduces demand for the output generated in occupation B, justifying the low returns in it. Consider the following example. Suppose certain "motivated" agents derive a non-pecuniary payoff from working in the public sector (A). When wages in the private sector (B) are high, only motivated agents work in the public sector, so the quality of the public sector activities will be high. If this increases the productivity of labor in the private sector, the demand for labor in the private sector will be high. This in turn will support high private sector wages.[7]

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[7] See Machiavello [13] for a model along these lines.

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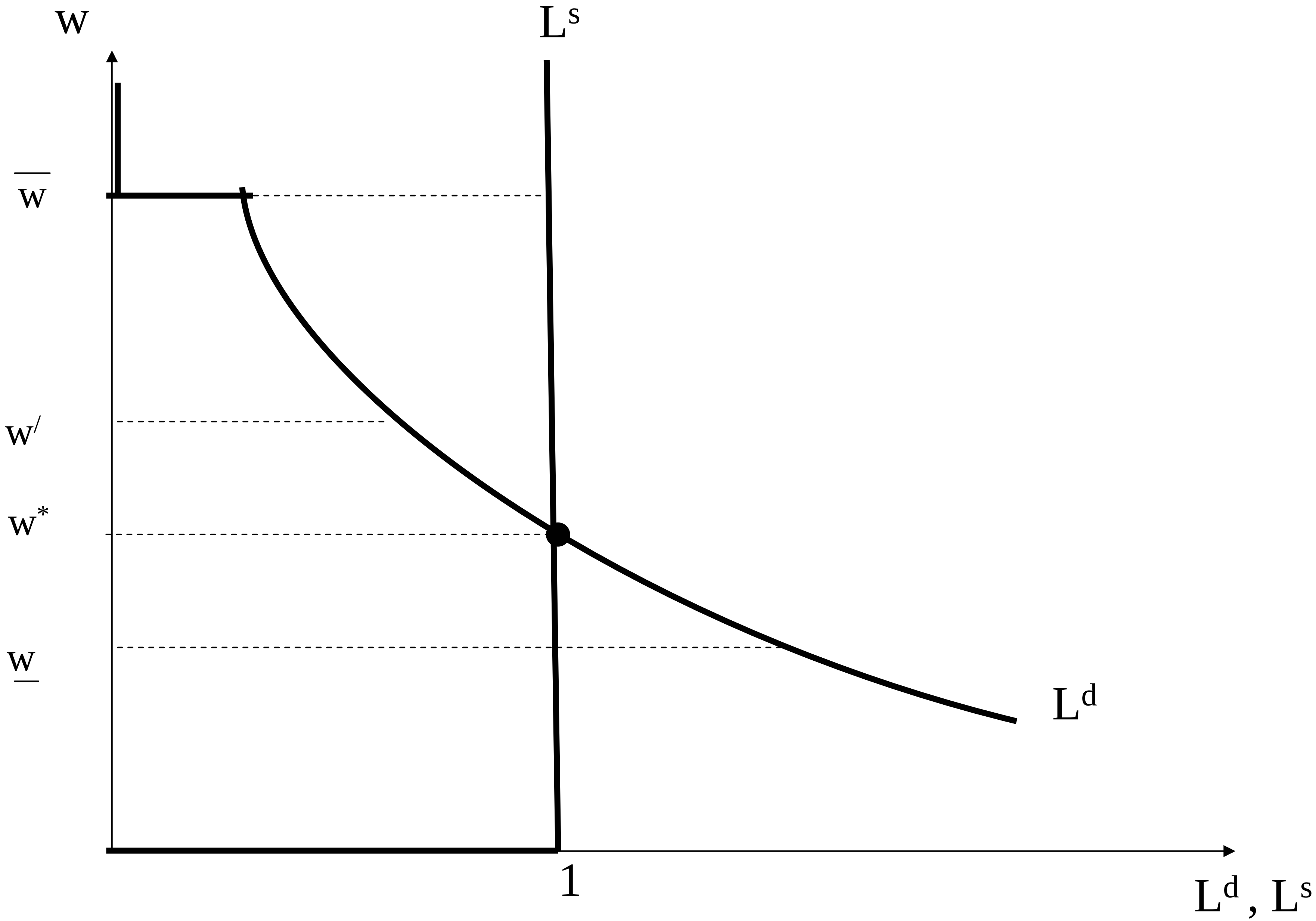

Figure 1 : Unique Equilibrium

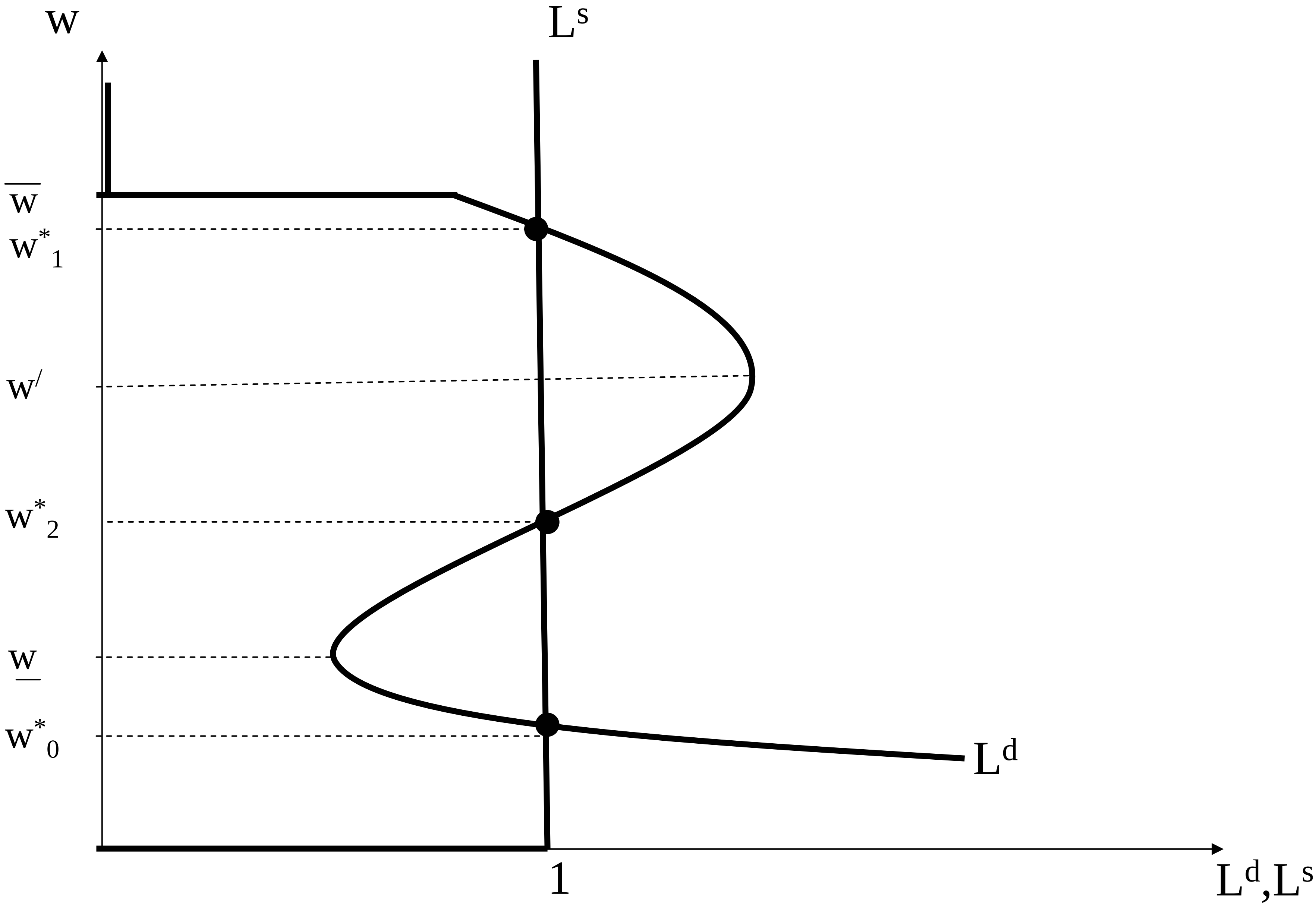

Figure 2 : Multiple Equilibria