

# Credit Market Imperfections and the Separation of Ownership from Control\*

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This paper offers a model of credit markets with adverse selection and moral hazard. The equilibrium is highly inefficient, and the underlying reason is the zero-profit condition imposed by competing financial intermediaries which gives very high powered incentives to entrepreneurs. The paper demonstrates that when entrepreneurs can hire a manager to run their projects, the inefficiencies are prevented. This is because the manager is not the residual claimant of the returns, and hence has low powered incentives. Therefore, the divergence of interests between owners and managers may have beneficial effects as well as the often emphasized costs. *Journal of Economic Literature* Classification Numbers: D82, G32.

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## 1. INTRODUCTION

This paper presents a model of credit markets with adverse selection and moral hazard. In the model economy, the zero profit condition imposed by competition among financial intermediaries plays a crucial role and leads to an inefficient outcome with low level of social surplus. With the zero profit condition relaxed, social surplus can be increased. Intuitively, the zero-profit condition is harmful because it allows entrepreneurs to receive very high returns in the states in which they are successful. As a result, all types (of entrepreneurs) have *high-powered* incentives and are easily enticed to go ahead with their projects, even if these are not sufficiently profitable.

The paper's main result is that the introduction of a third party—a manager—enables a change in the organizational form, leading to an

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improved allocation. Specifically, if the key decisions can be delegated to a manager, an efficient allocation can be restored. The introduction of the third-party breaks the zero-profit condition because the decision-maker is no longer the residual claimant and can be given low-powered incentives; as a result, the adverse effects of high-powered incentives are avoided.

The literature most closely related to this paper is the one pioneered by Rothschild and Stiglitz [22], Wilson [25], Jaynes [11], and Riley [21], which analyzes economies with privately informed agents and competing principals. An important result in this literature is that efficiency may require cross-subsidization across types, in the sense that high types receive less, and low types receive more than their respective marginal productivities. The equilibrium concept used by Rothschild–Stiglitz and later extended by [21] and [8] imposes an individual level zero-profit condition, and does not allow such cross-subsidization making it impossible to reach the efficient allocation. Wilson proposed a different equilibrium concept in which such cross-subsidization can be sustained in equilibrium and efficiency can be achieved more easily [6, 17, 25]. However, it is an unsatisfactory aspect of this literature that the key efficiency conclusions depend on the choice between nonstandard equilibrium concepts. In this paper, I use a standard equilibrium concept (Subgame Perfect Nash/Perfect Bayesian), but in contrast to the above mentioned papers, I consider an economy in which, due to the interaction of moral hazard and adverse selection, preferences do not satisfy single-crossing. I show that in equilibrium there will inevitably be some degree of cross-subsidization, but social surplus will never be maximized. Moreover, using Wilson's (or Riley's) equilibrium concept would not change this result. Therefore, the inefficiency of the decentralized equilibrium that I propose here appears much more robust than the ones analyzed in the previous literature. The analysis of the inefficiency of equilibrium also shows that cross-subsidization is only part of the story. I suggest that a key ingredient is how much rent an agent can expect from the relation which is crucially related to the relative supplies of entrepreneurs and financiers.

As in the above mentioned literature, I model competition by having principals in excess supply and agents in short supply. Thus, as it seems more relevant to the real world, financial intermediaries are in excess supply, and entrepreneurs receive all the rents. The presence of these rents implies that it is very difficult to discourage unprofitable types from undertaking their projects. It is therefore not the absence of cross-subsidization per se, but the high powered incentives of entrepreneurs induced by the zero profit condition which are the source of the inefficiency. The key contribution of the paper is to demonstrate that this inefficiency is not unavoidable. I prove that there is a simple way to achieve first-best in this

economy: to introduce a third party—a manager. Although this third-party has identical preferences to the entrepreneur and no funds, in contrast to the entrepreneur, she is not in short supply. As a consequence, she does not receive rents, and her equilibrium incentives are low powered, ensuring that the adverse consequences of competition among financial intermediaries are avoided. More precisely, when control is delegated to the manager, she abandons unprofitable projects, and hence only good projects find it beneficial to hire a manager. Therefore, separation of ownership and control acts as a good signal and reduces the cost of capital to profitable projects.

The results I present, as well as being of theoretical interest, have a number of potential applications. The first application relates to the separation of ownership and control exemplified by the management of large companies passing to the hands of professional managers. The process of such change is lucidly explained by Alfred Chandler [2, 3]. Chandler emphasizes how the change in organizational form enabled better production systems to develop and better risk-diversification opportunities to be exploited. These factors or others indeed appear to have reduced the cost of capital to many corporations. For example, Hannah illustrates this with a case study of Barclays and Co. in the U.K. which experienced an increase in price-earnings ratios from five to twenty after separating management from ownership and floating in the stock market (thus, at the margin, a comparable reduction in the cost of capital [9]). Similar evidence for the U.S. is summarized in [19]. However, it is not entirely clear in these historical accounts why the introduction of professional managers has been so beneficial. This may be a non-trivial concern, especially since other scholars, including [1, 10, 12, 13], have emphasized the costs of separation of ownership and control due to the fact that the manager is not the residual claimant of the returns she generates. Moreover, professional managers have very low powered incentives in practice, thus appear far from internalizing the interests of the owners (e.g., [14]). Therefore, the standard agency models predict that all else equal, the emergence of managerial firms should often lead to a deterioration of economic performance. In contrast, the mechanism developed in this paper introduces a new benefit from the separation of ownership from control and suggests that the low powered incentives of the professional manager, often blamed as a source of distorted business decisions, can also lead to better incentives and lower agency costs.

Another application of the ideas developed here is the role played by the employees of financial intermediaries in the board of directors of large firms. This proved to be a very successful strategy for J. P. Morgan at the turn of the century and is argued to have reduced the cost of capital by preventing the opportunistic behavior of entrepreneurs [5]. Finally, the

importance of venture capital in the recent past also fits the mechanism outlined here.

The plan of the paper is as follows; the next section analyzes the basic model, characterizes the equilibrium and shows how the Social Planner can improve upon this allocation. Section 3 introduces the possibility of hiring a manager, and demonstrates how this enables the separation of rents from incentives. It shows that in the unique equilibrium of this economy only good projects hire a manager and obtain finance. Section 4 concludes while an appendix contains all the proofs.

## 2. THE BASIC MODEL

### 2.1. *Agents and Technology*

There are three types of agents: (i) potential entrepreneurs; (ii) financial intermediaries; and (iii) managers. All agents are risk-neutral. Potential entrepreneurs may have a project but have no funds, thus need to borrow money to run their project. There is a large number of financial intermediaries, each with an unlimited supply of funds, at opportunity cost normalized to 1. I denote financial intermediaries by  $i \in [1, +\infty)$ . In this section, managers do not play a role.

There is a continuum of potential entrepreneurs with measure normalized to  $(1 + \theta)$ . I use  $x$  to denote the type of an entrepreneur (or equivalently the type of the project), which is not observed by financial intermediaries. A proportion  $\theta/(1 + \theta)$  of the entrepreneurs discover no project. I denote these by  $x = 0$ . The remaining  $1/(1 + \theta)$  proportion of entrepreneurs discover one project each with type  $x \in [\underline{x}, \bar{x}]$  where  $\underline{x} > 0$ . Conditional on  $x > 0$ , the distribution function of  $x$  is  $F(x)$ . Therefore, the overall distribution function of  $x$  is given as  $G(x) = (\theta + F(x))/(1 + \theta)$  for  $x > 0$  and has an atom at 0 equal to  $\theta/(1 + \theta)$ .

All projects cost the same amount,  $k$ . Their returns are determined by the type of the project and an action,  $q$ , chosen by the entrepreneur. More specifically, entrepreneurs with a project (i.e.  $x > 0$ ) can choose between action 1 ( $q = 1$ ) and action 2 ( $q = 2$ ). This choice of action is never observed by outsiders, thus there is hidden action as well as hidden information in this economy. I denote the stochastic output of a project as a function of its type and the action chosen by  $\tilde{y}(x, q)$ . We have  $\tilde{y}(0, \cdot) = 0$ , thus an entrepreneur without a project always produces 0.  $\tilde{y}(x, 1) = x$  for  $x \in [\underline{x}, \bar{x}]$ , so an entrepreneur who chooses action 1 produces a non-random amount equal to his type. Further, for all  $x \in [\underline{x}, \bar{x}]$ :

$$\tilde{y}(x, 2) = \begin{cases} 0, & \text{with probability } \varepsilon; \\ X, & \text{with probability } 1 - \varepsilon. \end{cases}$$

Therefore, an entrepreneur with  $x > 0$  choosing action  $q = 2$  faces a stochastic output independent of his type. I denote the value that the random variable  $\tilde{y}$  takes by  $y$ . Every entrepreneur can also decide not to run his project and return the money he has borrowed as it is. I denote this by  $p = 0$ . Then  $p = 1$  implies that the entrepreneur has gone ahead and undertaken the project. I also assume that if  $p = 1$ , an entrepreneur incurs the disutility of effort equal to  $\alpha$ , which can also be interpreted as internal funds that he invests and loses if the project is unsuccessful. Finally, entrepreneurs can destroy some of the returns of the project. This assumption will ensure that equilibrium contracts are monotonic. The observed return of a project is the actual return minus what has been destroyed, and I denote this observed return by  $\hat{y}$  ( $\leq y$ ). Note that  $y - \hat{y}$  is destroyed, it is not pocketed by the entrepreneur.

I also make the following assumptions to focus on the interesting cases:

*Assumption 1.*

$$X \geq \bar{x} > k + \alpha \quad \text{and} \quad k > \underline{x} > \varepsilon X.$$

*Assumption 2.*

$$\theta \geq \frac{\int_{\underline{x}}^k (k - x) dF(x)}{\varepsilon n}.$$

The first assumption ensures; (i) that there are both profitable ( $x > k + \alpha$ ) and unprofitable ( $x < k$ ) projects, and (ii) that action 1 always produces more output in expected terms than action 2. The only way action 2 can be profitable for an entrepreneur is if the losses are being borne by an intermediary. I will therefore refer to action 2 as the *risk-shifting* action. Assumption 2 ensures that there is a large number of potential entrepreneurs without project. The role of these entrepreneurs without a project and of Assumption 2 is to rule out unintuitive contracts that pay a positive amount to entrepreneurs who abandon their projects.

## 2.2. Timing of Events

$t = -1$ : entrepreneurs discover their projects.

$t = 1$ : intermediaries offer financial contracts,  $R$ ; entrepreneurs decide which contract, if any, to accept.

$t = 2$ : each entrepreneur decides whether to proceed with the project,  $p$ , and if so which action to choose,  $q$ .

$t = 3$ : returns of the project are realized. Each entrepreneur decides whether to destroy part of the returns. Whatever is not destroyed gets

revealed and is divided between entrepreneurs and financial intermediaries according to the contract  $R$ .

There is no discounting between periods.

### 2.3. Contracts and Allocations

Let  $R_i$  denote the contract offer of intermediary  $i$ . This contract maps observables into a payment for the entrepreneur:

$$R_i: \{0, 1\} \times [0, X] \rightarrow \mathbb{R}_+.$$

The first argument is  $p$ , whether the project has been undertaken or not. The second argument,  $\hat{y}$ , is the realized return of the project in case it is undertaken. This function maps into  $\mathbb{R}_+$  because entrepreneurs have no funds thus have to be paid a non-negative amount.

Let me also use  $E$  to denote the set of entrepreneurs,  $I$  for the set of intermediaries, and  $r(x)$  for the contract accepted by  $x$  where  $r(x) = \emptyset$  (that is no contract) is allowed. Also,  $I$  denote the decision of  $x$  of whether to go ahead by  $p(x)$  and the action choice of  $x$  by  $q(x)$ .

A strategy configuration in this game is a contract  $R_i$  for each  $i \in I$  and  $(r(x), p(x|r(x)), q(x|r(x)), \hat{y}(y|x, r(x)))$  for every  $x \in E$ . The restrictions on the actions are that  $r(x) \in \mathfrak{R}$  where  $\mathfrak{R}$  is the set of all  $R_i$ 's,  $p(x) \in \{0, 1\}$ ,  $q(x) \in \{1, 2\}$ , and  $\hat{y}(y|x) \leq y$ . Since optimal actions will depend on the contract that the entrepreneur accepts, strategies are conditioned on  $r(x)$ , their contract choice from the set of available contracts. This dependence on  $r(x)$  is useful in the appendix, but will be suppressed in the text when it will cause no confusion. The equilibrium concept is Subgame Perfect (or Perfect Bayesian): a strategy configuration will be an equilibrium if each financial intermediary is maximizing expected profits and each entrepreneur is maximizing expected utility given the strategies of all other players.

Before defining an equilibrium more formally, we can make a number of useful observations. First,

$$\hat{y}(y|x) = \arg \max_{0 \leq v \leq y} R_i(1, v),$$

where  $r(x) = R_i$  is the contract accepted by  $x$ , and recall that  $y$  is the actual return of entrepreneur  $x$ , and  $\hat{y}$  is the observed return after the entrepreneur destroys part of the returns. Let  $Y$  be the set of admissible functions  $\hat{y}(y|x)$ . Then the expected utility of an entrepreneur of type  $x$  when he accepts contract  $R_i$  can be written as,

$$u: \{0, 1\} \times \{1, 2\} \times \mathfrak{R} \times Y \rightarrow [-\alpha, +\infty),$$

where the first argument denotes whether the project has been undertaken or not; the second is the choice of action; the third is the choice of contract; and the final one denotes the decision of the entrepreneur of how much of the return to keep (not to destroy),  $\hat{y}(y|x)$ . As we will see in equilibrium,  $R_i$ 's will be non-decreasing in their second argument, and thus we will have  $\hat{y} = y$ . It is convenient in the verbal discussion to impose  $\hat{y} = y$ . In particular, imposing  $\hat{y} = y$ , we can ignore the last argument of  $u$ , and write:

$$\begin{aligned} u(p=0, \cdot, R|x) &= R(0, \cdot) \\ u(p=1, q=1, R|x) &= R(1, x) - \alpha \\ u(p=1, q=2, R|x) &= \varepsilon R(1, X) + (1 - \varepsilon) R(1, 0) - \alpha. \end{aligned} \quad (1)$$

Note that an entrepreneur of type  $x$  generates output  $x$  when he chooses action 1, and a stochastic return when he chooses action 2. In both cases, as he goes ahead with the project, he incurs the cost  $\alpha$ . We can also define the expected profit of intermediary  $i$ ,

$$\pi_i: \{0, 1\} \times \{1, 2\} \times \{0\} \cup [x, \bar{x}] \times Y \rightarrow [-k, X - k],$$

as a function of the continuation decision, action and type of entrepreneur and the decision  $\hat{y}(y|x)$ . Again with  $\hat{y} = y$ , we have:

$$\begin{aligned} \pi_i(x, 0, \cdot | R_i) &= -R_i(0, \cdot) \\ \pi_i(x, 1, 1 | R_i) &= x - k - R_i(1, x) && \text{for } x > 0 \\ \pi_i(x, 1, 2 | R_i) &= \varepsilon X - k - \varepsilon R_i(1, X) - (1 - \varepsilon) R_i(1, 0) && \text{for } x > 0. \end{aligned} \quad (2)$$

Finally, let  $\chi(R, \hat{\mathfrak{R}})$  be the set of types that accept the contract offer  $R$  while the set of contract offers is  $\hat{\mathfrak{R}}$ , i.e.  $x \in \chi(R, \hat{\mathfrak{R}})$  if and only if  $r(x) = R$ .

**DEFINITION 1.** A strategy configuration  $\{(r(x), p(x), q(x), \hat{y}(y|x))$  for every  $x \in E\}$  and  $\mathcal{R} = \{R \text{ such that } R_i = R \text{ for some } i \in I\}$  constitutes an equilibrium if and only if:

1. For every set of contracts,  $\mathfrak{R}'$ , offered, each  $x \in E$  chooses  $r(x) \in \mathfrak{R}'$ ,  $p(x) \in \{0, 1\}$ ,  $q(x) \in \{1, 2\}$  and  $\hat{y}(y|x)$  to maximize  $u(p, q, r, \hat{y}(y|x))$ .
2.  $R_i \in \mathfrak{R}$  only if

$$R_i \in \arg \max_R \int_{x \in \chi(R, \mathfrak{R})} \pi_i(x, p(x), q(x), \hat{y}(y|x) | R) dG(x)$$

where  $p(x)$ ,  $q(x)$  and  $\hat{y}(y|x)$  are given by condition 1.

Although the requirement that financial intermediaries make zero-profit is not formally part of the equilibrium definition, given the unlimited supplies of funds, it is implied by condition 2 of equilibrium: namely, if an intermediary were making positive profits, one of the inactive intermediaries

could undercut and also make positive profits. Finally, I define  $\{(p(x), q(x), \hat{y}(y|x)) \text{ for every } x \in E\}$  as an allocation of this economy since the final output is determined by these decisions.

#### 2.4. Analysis

First, I characterize the first-best allocation which would arise in the absence of informational asymmetries, i.e. if both  $q$  and  $x$  were perfectly observed.

**PROPOSITION 1.** *In the first-best,  $p(x) = 1$  and  $q(x) = 1$  for all  $x \geq k + \alpha$ , and  $p(x) = 0$  for all  $x < k + \alpha$ .*

Therefore in the efficient allocation, only projects that are sufficiently profitable go ahead and they all choose action 1. Before characterizing the decentralized equilibrium we can gain some insight by diagrammatically analyzing two special contracts. First, consider an equity contract whereby a financial intermediary holds a fraction  $1 - s$  of the shares of the project. Mathematically, this corresponds to  $R(1, \hat{y}) = s\hat{y}$ . This contract is drawn in Figure 1, in the space of realized returns,  $\hat{y}$ , and entrepreneurial rewards,  $R$ , as a ray from the origin with slope  $s$ ; the entrepreneur receives a fraction  $s$  of the realized return of the project. Next, we can also draw the indifference curves of different types of entrepreneurs in this graph. Consider type  $\underline{x}$ . If he proceeds with the project and chooses action 1 ( $p = q = 1$ ), he will produce  $\underline{x}$ . Therefore, he can get utility  $R(1, \underline{x}) - \alpha$ . But also he can achieve  $R(1, \hat{y}) - \alpha$  for all  $\hat{y} \leq \underline{x}$  by destroying part of his returns. Hence, his indifference curve is flat to the left of  $\hat{y} = \underline{x}$ : i.e. he is indifferent between receiving \$1 for  $\hat{y} = \underline{x}$  and receiving \$1 for  $\hat{y} \leq \underline{x}$ . As an alternative, he can choose  $q = 2$ , in this case he will produce  $X$  with probability  $\varepsilon$ , and nothing with probability  $1 - \varepsilon$ . Therefore, his utility for choosing  $q = 2$  is  $(1 - \varepsilon)R(1, 0) + \varepsilon R(1, X) - \alpha$ . A \$1 increase in  $R(1, \underline{x})$  and in  $R(1, X)$  are clearly not equivalent since the entrepreneur receives the latter only with probability  $\varepsilon$ , hence at exactly  $\underline{x}$  there is a jump upwards in the indifference curve as drawn in Figure 1. The figure also draws an indifference curve for type  $\bar{x}$  which has the same general shape but jumps up at  $\hat{y} = \bar{x}$ . It is important to note that the indifference curves of  $\underline{x}$  intersect those of  $\bar{x}$  twice, implying that preferences do not satisfy the single-crossing property.

Next consider the choice of different types of entrepreneurs when faced with an equity contract. Let us also suppose for the time being that  $R(0, \cdot) = R(1, 0) = 0$ , that is an entrepreneur who abandons the project and one who goes ahead and produces nothing receives zero (see the proof of Proposition 2 for why this has to be so). It is then straightforward that  $x \geq \alpha/s$  will accept finance and go ahead. Also, since  $sx > s\varepsilon X$  for all  $x$  by assumption 1, all entrepreneurs will choose  $q = 1$ . Therefore, with equity contracts there is



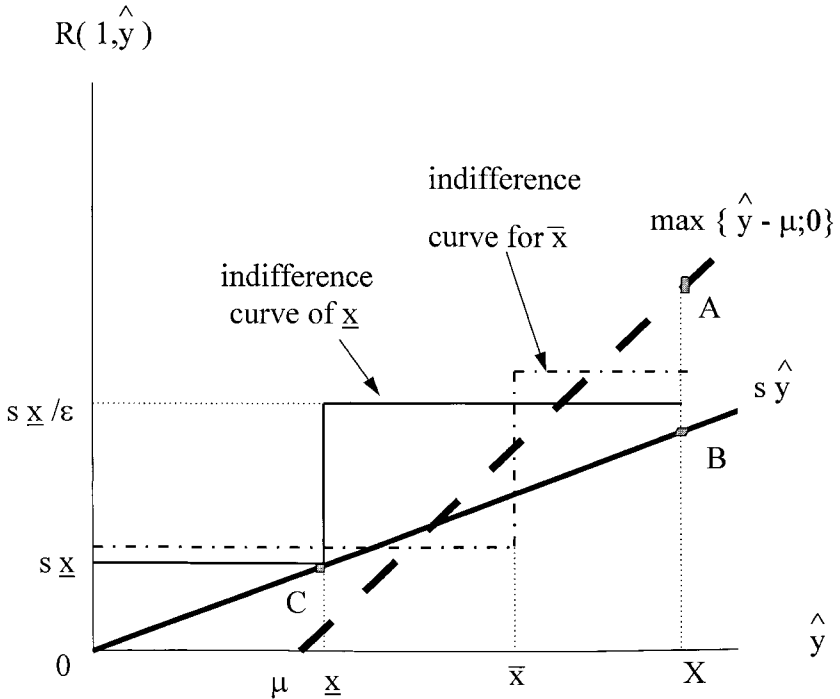


FIG. 1. Indifference curves.

no “risk-shifting”: Figure 1 illustrates this as the highest indifference curve for type  $\underline{x}$  along the equity contract is reached at point C, i.e. when  $\underline{x}$  chooses action 1 and produces  $\underline{x}$ . Note that as long as  $\alpha$  is sufficiently small, i.e.,  $\alpha/s < k$ ,  $\underline{x}$  prefers accepting this equity contract to abandoning his project, despite the fact that  $\underline{x} < k$ . We can refer to this as “overvaluation of stock” [18]. Overvaluation of stock is a form of *cross-subsidization*: financial intermediaries are losing money on types with  $x < k$  and making money on types with  $x > k$ .

Next consider a debt contract,  $R(1, \hat{y}) = \max\{\hat{y} - \mu, 0\}$ , that is the entrepreneur has to pay  $\mu$ , and keeps the rest for himself. If his revenues do not cover  $\mu$ , then he receives 0. This contract is drawn in Figure 1 as the thick dashed line. In this case, it is clear that there can be no overvaluation of stock: no entrepreneur with  $x < \mu$  would go ahead and choose action 1. Instead, there is now “risk-shifting”. An entrepreneur with  $x < \mu$  can accept finance, choose  $q=2$ , and be better off than not going ahead as long as  $X - \mu > \alpha/\epsilon$ . This situation can again be seen in Figure 1 where, if faced with that particular debt contract,  $\underline{x}$  would reach the highest indifference curve at point A with  $q=2$ . Therefore, with debt contracts too there will

often be some degree of cross-subsidization. Also quite importantly, debt contracts create more inefficiency since some of the projects choose action 2 which has lower net present value.

A complete characterization of the unique equilibrium allocation, where competition among intermediaries will determine the form of contracts, can now be given.

**PROPOSITION 2.** *There exists an equilibrium in which a number  $n \geq 2$  financial intermediaries offer the following contract to entrepreneurs:*

$$\hat{R}(0, \cdot) = 0 \quad \text{and} \quad \hat{R}(1, \hat{y}) = \begin{cases} z & \text{if } \hat{y} \geq k + z \\ \hat{y} - k & \text{if } \hat{y} \in [k + \varepsilon z, k + z) \\ \varepsilon z & \text{if } \hat{y} \in [\underline{x}, k + \varepsilon z) \\ 0 & \text{if } \hat{y} < \underline{x}. \end{cases} \quad (3)$$

1. *Suppose there exists  $\zeta \in [\alpha/\varepsilon, \bar{x}]$  such that*

$$\int_{\underline{x}}^{k + \varepsilon \zeta} (x - \varepsilon \zeta) dF(x) + \int_{k + \varepsilon \zeta}^{k + \zeta} k dF(x) + \int_{k + \zeta}^{\bar{x}} (x - \zeta) dF(x) - k = 0. \quad (4)$$

*Then  $z$  is given by the largest root  $\zeta \in [\alpha/\varepsilon, \bar{x}]$ . In this case, all entrepreneurs with  $x = 0$  choose  $p(x | \hat{R}) = 0$ . All entrepreneurs with  $x > 0$  accept finance from a randomly chosen intermediary, and choose  $p(x | \hat{R}) = q(x | \hat{R}) = 1$ . Off the equilibrium path (i.e. when  $\mathfrak{R} \neq \{\hat{R}\}$ ), all entrepreneurs choose with equal probability among contracts that give them the same utility.*

2. *Suppose no root  $\zeta \in [\alpha/\varepsilon, \bar{x}]$  to (4) exists. Then contract (3) applies with  $z = \alpha/\varepsilon$ , all  $x \geq k + \alpha$  and a proportion  $\lambda(x)$  of entrepreneurs  $x < k + \alpha$  accept finance from a randomly chosen intermediary and play  $p(x | \hat{R}) = q(x | \hat{R}) = 1$ . The remaining  $1 - \lambda(x)$  proportion of entrepreneurs with  $x < k$  choose  $p(x | \hat{R}) = 0$ .  $\lambda(x)$  is such that*

$$\int_{\underline{x}}^{k + \alpha} (x - \alpha - k) \lambda(x) dF(x) = \int_{k + \alpha/\varepsilon}^{\bar{x}} \left( x - \frac{\alpha}{\varepsilon} - k \right) dF(x). \quad (5)$$

*Off the equilibrium path, all entrepreneurs randomly choose among contracts that give them the same utility.*

*The allocations described here are the only equilibrium allocations.*

The equilibrium contract is drawn in Figure 2. Proposition 2 does not describe strategies fully, since behavior off the equilibrium path is not uniquely pinned down. However, it proves that any other equilibrium must also give exactly the same allocation. As the proposition shows, the nature of the equilibrium depends on the value of  $\alpha$ . If  $\alpha$  is sufficiently small, then

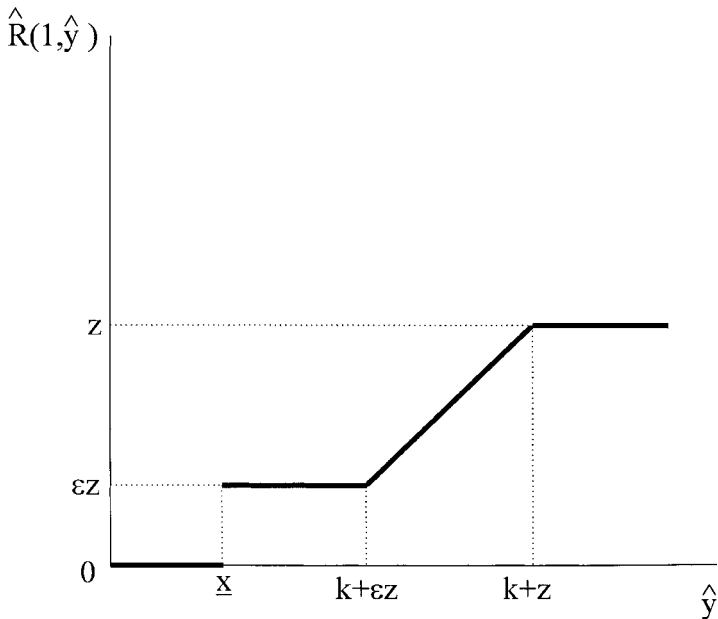


FIG. 2. Equilibrium contract.

there will exist a root to (4) in  $\zeta \in [\alpha/\epsilon, \bar{x}]$ , and in this case all projects with  $x > 0$ , including those with  $x < k$ , will receive finance. In contrast if  $\alpha$  is sufficiently large, then no such root will exist. In this case, as described in part 2 of the proposition, not *all* of the unprofitable projects will go ahead. In fact, since  $z = \alpha/\epsilon$ , unprofitable types are indifferent between going ahead and abandoning their projects. If  $\alpha/\epsilon > \bar{x}$ , then type  $x$  can make  $x - k$ , giving zero profits to intermediaries; unprofitable types will not be enticed to go ahead and the allocation will be efficient. Whereas with  $\alpha/\epsilon < \bar{x}$ , if unprofitable types abandoned their projects, intermediaries would be making positive profits with the contract of Proposition 2, thus to ensure an equilibrium configuration in this case, a certain fraction of the unprofitable projects will also have to go ahead.

Let us try to understand the shape of the contract (and concentrate on part 1 for expositional ease). First, note that  $R(1, \underline{x}) < \epsilon z$  cannot be part of an equilibrium because type  $\underline{x}$  can always choose  $q = 2$ . This would guarantee him  $\epsilon R(1, X) = \epsilon z$  in expected return. Therefore, the only way to reduce  $R(1, \underline{x})$  is to reduce  $R(1, X)$ . However, because of free-disposal  $R(1, X)$  cannot fall below  $R(1, \bar{x})$ . And finally,  $R(1, \bar{x})$  cannot be reduced freely either: it has to be chosen so that financial intermediaries make zero-profits (since there is excess supply of funds). Equation (4) ensures this.

What would happen if intermediary  $i$  reduced  $R(1, \hat{y})$  for  $\hat{y} \in [\underline{x}, k + \varepsilon z)$ , and left the rest of the contract unchanged? The answer depends on the off-the-equilibrium path behavior of entrepreneurs in  $x \in [\underline{x}, k + \varepsilon z)$ . They have two options that would give them exactly the same utility: (i) accept finance from an intermediary other than  $i$  and get  $\varepsilon z - \alpha$  by choosing  $q = 1$ ; (ii) accept the contract of intermediary  $i$  and choose  $q = 2$ , again making  $\varepsilon z - \alpha$ . Since action 2 has lower expected value, intermediary  $i$  would lose more money from every project  $x \in [\underline{x}, k + \varepsilon z)$  that it finances than other intermediaries would, and therefore, randomization between contracts that give the same utility supports the allocation of Proposition 2 as the equilibrium. Similarly, no intermediary can change  $R(1, \hat{y})$  for  $\hat{y} \geq k + z$  and increase its profits. Such a contract would attract all  $x \leq k + \varepsilon z$  and since  $z$  is equal to the largest root of (4), the intermediary would surely lose money.

An important feature of this unique equilibrium allocation is that there is *cross-subsidization*: types  $x > k + z$  receive less than the profits they generate and  $x < k + \varepsilon z$  get more. This is in contrast to the results in [8, 21, and 22] who obtain no cross-subsidization in equilibrium. The key difference is that the combination of moral hazard and adverse selection leads to preferences that do not satisfy single-crossing as Figure 1 demonstrates. Intuitively, a contract that has a high value for  $R(1, \bar{x})$  is very attractive for  $\bar{x}$  but also for  $R(1, \underline{x})$  who can accept the same contract and choose  $q = 2$ . This lack of single-crossing makes a fully separating equilibrium impossible. The only way to exclude unprofitable types is to reduce  $R(1, \bar{x})$  (or  $R(1, X)$ ), but this is impossible without violating zero-profit for intermediaries. Therefore, inefficiency in this economy is intimately related to the fact that the zero-profit constraint forces intermediaries to offer high returns to successful entrepreneurs, i.e. a high level of  $z$  in terms of contract (3). These high returns in turn create *high powered incentives* for all entrepreneurs and entice low types to go ahead, and unless encouraged otherwise, to choose action  $q = 2$ . The equilibrium contract (3) then ensures that these unprofitable types do *not* choose action 2.

*Remark 1.* As it is the case more generally, only the equilibrium allocations are uniquely determined. An equilibrium could for instance include some (*but not all*) intermediaries offering  $R(1, \hat{y}) < \hat{y} - k$  for  $\hat{y} \in [k + \varepsilon z, k + z)$ . These intermediaries would not attract any of these types but since these types break-even, they would still be making zero-profit. There are also other mixed strategies off the equilibrium path which sustain the allocation of Proposition 2 as an equilibrium.

*Remark 2.* The results do not depend on the assumption that expected return for action 2 is independent of type. But, the presence of action 2 is important. In the absence of this risk-shifting option, because each type

would have a non-stochastic return, first-best can be implemented by a debt-contract. The results here would generalize to a model in which there is only action 1 but the probability distribution of returns for all types has full support. Also, in such a model, the free-disposal assumption would not be needed. Here, it only ensures that contracts that punish  $y = X$  are not feasible.

*Remark 3.* Assumption 2 regarding  $\theta$  is also not strictly necessary. Similar results can be obtained with  $\theta > 0$  but less than imposed in Assumption 2. However, with  $\theta = 0$ , there would be a contract superior to (3) in Proposition 2:  $R(0, \cdot) = \varepsilon z$ , that is an intermediary paying unprofitable entrepreneurs not to go ahead. This contract is very fragile as soon as there is some uncertainty regarding the identity of an entrepreneur:  $\theta > 0$  introduces this type of uncertainty. Namely, a contract with  $R(0, \cdot) = \varepsilon z$  would also attract all potential entrepreneurs without a project and lose money (see the proof of Proposition 2).

## 2.5. Efficiency

In this subsection, I show that a social planner subject to the same informational restrictions can improve the total surplus in the economy. For this purpose, let  $\chi_S$  be the set of the projects with  $p(x) = 1$  and let

$$SS = \int_{x \in \chi_S} (\pi(x, p, q | R) + u(p, q, R | x)) dF(x).$$

**PROPOSITION 3.** *The planner can maximize SS by offering the equity contract  $R(1, \hat{y}) = \hat{s}\hat{y}$  and  $R(0, \cdot) = 0$  to all entrepreneurs where  $\hat{s} = \alpha/(k + \alpha)$ . With this contract,  $p(x) = 0$  for all  $x < k + \alpha$  and  $p(x) = q(x) = 1$  for all  $x \geq k + \alpha$ . This allocation is on the unconstrained Pareto frontier.*

Therefore, a planner can improve total surplus and achieve an efficient allocation by offering a very simple contract: equity as in Figure 1 (though other contract choices by the planner would also ensure the same allocation). The only difference from the equity contract of Figure 1 is that the slope is not determined to satisfy zero-profit but to exclude the unprofitable types. As a consequence, the allocation in Proposition 3 cannot be supported as an equilibrium since contracts would be making positive profits. This result demonstrates that the zero-profit condition plays a crucial role in the inefficiency of the decentralized equilibrium. It forces intermediaries to offer high returns to successful projects, and thus makes it impossible to exclude unprofitable types.

The equilibria in the analyses of [8, 21, and 22] are also inefficient, but the reasons are very different. In these papers, inefficiency was due to the

fact that cross-subsidization was ruled by competition. Here, the source of inefficiency is not lack of cross-subsidization—there is always cross-subsidization in the equilibrium of Proposition 2—and the results are not sensitive to the equilibrium concept that is used—nothing would be different, if the equilibrium concepts introduced in [21] or [25] were used. The key difference from these previous approaches is that in Proposition 2, the zero-profit condition on the intermediaries (i.e., competition) creates rents for entrepreneurs. The presence of these rents leads to *very high powered incentives* for entrepreneurs, making it impossible to prevent unprofitable types from going ahead. The planner relaxes the zero-profit constraint and reduces *the power* of the incentives of the entrepreneurs. In other words, she separates incentives from the distribution of economic rents. This intuition is very important: we will see in the next section that separation of ownership and control will similarly reduce the power of incentives, but this time without relaxing competition among intermediaries.<sup>1</sup>

### 3. SEPARATION OF OWNERSHIP AND CONTROLS

This section modifies the economic environment by allowing entrepreneurs to separate ownership and control by hiring a manager at  $t=0$ . The analysis will establish that even though the manager is no different than the entrepreneur (in particular, she has exactly the same preferences and no funds), separation of ownership and control will restore efficiency. Essentially, key decisions can be delegated to the manager, but she does not need to be made the residual claimant, thus does not have as *high powered incentives*. As a result, the adverse implications of the zero-profit condition will be avoided as in Proposition 3, but this time without the planner's intervention.

Formally, there is now a third type of agent, a "manager". At time  $t=0$ , there is an unlimited supply of homogenous managers. They have no funds to invest in the project, and are *uninformed* about the quality of the projects. Each entrepreneur can hire at most one manager and write a *publicly observable employment contract* with this manager. There is a disutility cost  $\delta$  for the entrepreneur from hiring a manager, which can also be interpreted as the agency cost of introducing a manager. If the manager goes ahead with the project ( $p=1$ ), just as the entrepreneur running the project in the previous section, she incurs the effort cost  $\alpha$ .

<sup>1</sup> There are also other policies that would improve efficiency. For instance, as long as taxation is not distortionary, efficiency could be achieved by taxing financial intermediaries sufficiently, and transferring this wealth to entrepreneurs. The solution suggested in the next section has the attractive feature that it does not require government intervention.

### 3.1. *Timing of Events*

$t = -1$ : entrepreneurs discover projects.

$t = 0$ : they offer employment contracts,  $w$ , to managers. If a manager accepts this contract, she inspects the project and discovers the type.

$t = 1$ : intermediaries offer financial contracts,  $R$ . These contracts can be conditioned upon whether an entrepreneur has hired a manager, and *what the contract* of the manager is. Entrepreneurs choose among financial contracts.

$t = 2$ : entrepreneurs without managers and managers in charge, who have received finance, decide whether to continue with the project or not ( $p = 0$  or  $p = 1$ ) and which action to choose ( $q = 1$  or  $q = 2$ ).

$t = 3$ : returns are realized and divided between entrepreneurs, managers and intermediaries according to  $w$  and  $R$ .

Note that at  $t = 0$ , when entrepreneurs make employment offers to managers, they have superior information. Then at  $t = 2$ , entrepreneurs or managers have superior information relative to intermediaries.

### 3.2. *Analysis*

Suppose that the entrepreneur can offer a non-renegotiable contract to a manager such that all decisions are delegated to her, and her monetary compensation is given by:  $w: \{0, 1\} \times [0, X] \rightarrow \mathbb{R}_+$  where the first argument is  $p$  and the second is the realized return  $\hat{y}$ . Let us denote the set of all managerial contracts by  $W$ . Then the financial contract offered by intermediaries becomes

$$R: \{0, 1\} \times \{0, 1\} \times [0, X] \times W \rightarrow \mathbb{R}_+,$$

where the first argument,  $h$ , denotes whether the entrepreneur hired a manager or not. The second indicates whether the project has gone ahead. The third is the realized return and the fourth is the managerial employment contract that intermediaries also observe. Again the range of entrepreneurial rewards and managerial payments is  $\mathbb{R}_+$  since neither managers nor entrepreneurs have any funds, and cannot receive negative payments. Because both  $w$  and  $R$  take non-negative values, we have to make sure that  $w(p, \hat{y}) + R(h, p, \hat{y}, w) \leq \hat{y}$  and the return to the financial intermediary is  $\hat{y} - w(p, \hat{y}) - R(h, p, \hat{y}, w)$ . Note that if the project obtains finance and subsequently the manager decides to abandon it, she receives  $w(0, \cdot)$ , the entrepreneur receives  $R(1, 0, \cdot, w)$ , where  $w(0, \cdot) + R(1, 0, \cdot, w) \leq k$ , and the remaining  $k - w(0, \cdot) + R(1, 0, \cdot, w)$  is paid back to the intermediary.

When the entrepreneur hires no manager, his return is given by (1) as in Section 2. When a manager is hired and the observed output is  $\hat{y}$ , then the

entrepreneur's return is again given by the monetary reward,  $R(h = 1, p, \hat{y}, w)$ , minus the effort cost, but this time the effort cost is  $\delta$ , i.e. the cost of hiring a manager. The payoff to the manager, conditional on being hired, is similarly given by her monetary reward,  $w(p, \hat{y})$ , minus the effort cost  $\alpha$  when she runs the project. Finally, when there is no manager hired, the return to the intermediary financing the project is the same as (2) in Section 2, whereas when there is a manager and the observed output of the project is  $\hat{y}$ ,  $\pi(\hat{y}, h = 1, p | R, w) = \hat{y} - k - R(h = 1, p = 1, \hat{y}, w) - w(p = 1, \hat{y})$ , thus intermediaries again receive whatever is not paid to the entrepreneur and the manager.

Finally, because the structure of the game has now changed, and the informed party, the entrepreneur is moving before the uninformed intermediaries, the previous concept of equilibrium is not strong enough. Here I use the simplest refinement, the Intuitive Criterion of [4], to strengthen the equilibrium.<sup>2</sup> Since the definition of an allocation and equilibrium are very similar to before, I do not repeat those once more.

**DEFINITION 2.** (The Intuitive Criterion). Let  $E$  be the set of entrepreneur types as above,  $h$  and  $w$  be the hiring decision and managerial contract offer of the entrepreneur,  $R$  be the financial contract offer of the intermediaries, and  $u(h, w, R | x)$  be the utility of type  $x \in E$  when he plays  $h$  and  $w$  and obtains finance with contract  $R$  (and the manager follows the equilibrium continuation play). Let us also define  $BR(\Delta, h, w)$  as the best-response set of the intermediaries against actions  $h$  and  $w$  and when they believe  $x \in \Delta \subset E$ , and let  $BR(E, h, w) = \bigcup_{\Delta \in E} BR(\Delta, h, w)$  be the union of the best-response sets over all possible subsets of  $E$ .

Consider a candidate equilibrium with actions  $h^*$ ,  $w^*$  and  $R^*$ . Now form for each action  $(h, w)$  of the entrepreneur, the set  $S(h, w)$  such that  $x \in S(h, w)$  if and only if:

$$u(h^*, w^*, R^* | x) > \max_{R \in BR(E, h, w)} u(h, w, R | x).$$

If for any  $(h, w)$ , there exists  $\hat{x} \notin S(h, w)$  such that

$$u(h^*, w^*, R^* | \hat{x}) < \min_{R \in BR(E \setminus S(h, w), h, w)} u(h, w, R | \hat{x}),$$

then the candidate equilibrium  $h^*$ ,  $w^*$  and  $R^*$  fails the Intuitive Criterion.

In words, if an entrepreneur can take an out-of-equilibrium action that could only be profitable for a good type, and thus reveal his type (by

<sup>2</sup> There can sometimes be technical problems in applying the Intuitive Criterion when there is a continuum of types. Even though there is potentially a continuum of types ( $F(x)$  is not restricted one way or the other), the Intuitive Criterion serves the required purpose here.



showing that he must be in the set  $E \setminus S(h, w)$  rather than  $E$ ), he should not be able to get a higher return than in the equilibrium, even when the new piece of information revealed by his deviation is incorporated into the best-response of the uninformed players. As is well-known, in simple games this refinement rules out unreasonable equilibria whereby an action which normally would benefit a good type (for instance hiring a manager in this context) is interpreted as a “bad signal”. In the rest of the paper, I only consider equilibria that pass the Intuitive Criterion. Further, to focus the discussion on the case where inefficiencies are most pronounced, I assume that (4) has a root in  $\zeta \in [\alpha/\varepsilon, \bar{x}]$ , so that we are in part 1 of Proposition 2. Also I use  $\omega(x)$  to denote the managerial contract choice of entrepreneur type  $x$ . I write the decisions of the manager conditional on her employment contract as  $p(x|w)$  and  $q(x|w)$ , and use  $p(x|R)$  and  $q(x|R)$  to denote the choices of an entrepreneur managing his firm.

**PROPOSITION 4.** *Assume that (4) has a root  $\zeta \in [\alpha/\varepsilon, \bar{x}]$ . Suppose also that entrepreneurs are allowed to hire a manager at time  $t=0$  and that  $\delta \rightarrow 0$ . Let  $\hat{W}$  be the set of managerial contracts such that all  $\hat{w} \in \hat{W}$  have the form*

$$\begin{aligned} \hat{w}(p=0, \cdot) &= 0 \\ \hat{w}(p=1, y) &= \alpha \quad \text{if } y \geq k + \alpha \\ \hat{w}(p=1, y) &< \alpha \quad \text{if } y < k + \alpha. \end{aligned} \quad (6)$$

*Then in all equilibria that pass the Intuitive Criterion, for projects run by entrepreneurs, we have  $R(h=0, p=0, \cdot) = 0$ ,  $R(h=0, p=1, \hat{y}) = \max\{0, \hat{y} - k\}$  for  $\hat{y} \leq k + \alpha/\varepsilon$  and  $R(h=0, p=1, \hat{y}) = \alpha/\varepsilon$  for  $\hat{y} > \alpha/\varepsilon$ . For projects that separate ownership and control, we have:  $R(h=1, p=0, \cdot, \hat{w}) = 0$  and  $R(h=1, p=1, y, \hat{w}) = \max\{y - k - \alpha, 0\}$  for all  $\hat{w} \in \hat{W}$ .*

*All  $x \leq k + \alpha/\varepsilon$  choose  $h(x) = 0$  (do not hire a manager),  $x \in [k + \alpha, k + \alpha/\varepsilon]$  have  $p(x|R) = q(x|R) = 1$ , and  $x < k + \alpha$  have  $p(x|R) = 0$ . All  $x > k + \alpha/\varepsilon$  have  $h(x) = 1$  and  $\omega(x) = \hat{w} \in \hat{W}$ . A manager hired with contract  $\hat{w} \in \hat{W}$  chooses  $p(x|\hat{w}) = q(x|\hat{w}) = 1$  if  $x \geq k + \alpha$  and  $p(x|\hat{w}) = 0$  if  $x < k + \alpha$ .*

*All equilibria that pass the Intuitive Criterion achieve first-best efficiency in the limit  $\delta = 0$ .*

The equilibrium allocation is now radically different. Finance offers to entrepreneurs who separate ownership and control with a contract inducing the manager to abandon unprofitable projects is on much better terms. Since only profitable projects are separating ownership and control, they will all pay back their loans from the intermediaries. Therefore, competition among intermediaries implies that these entrepreneurs should receive output minus  $k$  and the cost of effort incurred by the manager,  $\alpha$ . As a result, they face

a substantially lower cost of capital. Entrepreneurs who do not separate ownership and control receive a contract that gives them a maximum of  $\alpha/\varepsilon$ , thus unprofitable types ( $x < k + \alpha$ ) neither separate ownership from control nor accept this finance offer.<sup>3</sup> As a result, the inefficiency of the equilibrium of Section 2 where all projects  $x > 0$  went ahead is replaced by one where only profitable projects receive finance (recall we are in part 1 of Proposition 2). Broadly speaking, as the equilibrium managerial contract (6) makes it clear, managers have *low-powered incentives*. This contrasts starkly with the high powered incentives of entrepreneurs in the previous section where unprofitable types wanted to go ahead with the hope that, if successful, they would get the high returns. Instead managers are not the full residual claimants, they only receive  $\alpha$  even when the project is very successful, so it is not worthwhile to choose action 2 nor to go ahead with a project that has  $x < k + \alpha$ .

A different way of obtaining the intuition for why the separation of ownership and control is useful is to note that the manager obtains a monetary return equal to  $\alpha$  if she is successful (thus utility 0), and gets punished by receiving less when the project is not successful (i.e.,  $\hat{y} < k + \alpha$ ). Why could we not achieve the same result without managers? Because in Section 2, the return to low quality projects was linked to  $R(1, \bar{x})$  since they could choose  $q = 2$ , and  $R(1, \bar{x})$  was determined from the zero-profit condition of the intermediaries. With managers,  $R(1, \bar{x})$  is still high, and this ensures that intermediaries make no profit, but incentives are now freed from the value of  $R(1, \bar{x})$ . Therefore, separation of ownership from control also separates incentives from *rent-seeking* by ensuring that the decision-maker does not have too high powered incentives. Note the importance of the fact that managers are not in short-supply: if managers were in short-supply, then they would also get some rents when entrepreneurs competed to attract them, and in this case, their incentives would not be as low-powered as here.

Observe that efficiency is not achieved by allowing simple cross-subsidization as in [25]. In the equilibrium of Proposition 4, there is no cross-subsidization among entrepreneurs but a high degree of cross-subsidization among managers. This is the flip-side of separation of ownership and control ensuring low powered incentives. In this sense, the result is related to the delegation literature, for example, [7] and [24], but in contrast to these papers, here there is no assumed incompleteness of contracts, and all the

<sup>3</sup> To see why entrepreneurs running their firms are still receiving finance, note that when all the high types (i.e.  $x \geq k + \alpha/\varepsilon$ ) separate ownership and control, a contract offered to an owner-manager can break even without paying out more than  $\alpha/\varepsilon$ , thus types with  $x < k + \alpha$  prefer not to go ahead when offered finance. But, when they accept such a contract, types  $x \in [k + \alpha, k + \alpha/\varepsilon]$  will get a higher payoff because they would save the cost  $\delta$  of separating ownership and control. Therefore, they would choose not to hire a manager for all  $\delta > 0$ .

results are due to the fact that managers have low powered incentives and do not exploit their superior information in the same way as entrepreneurs do. Finally, in this economy informational imperfections lead to a very different organizational form as compared to the one that would emerge in a first-best world; this result is similar to that of [15] where a hierarchical employment relation may arise even though partnerships are more efficient, but the reason here is to achieve the appropriate incentives in the credit market.

Overall, the *low powered incentives* of managers, which the previous literature has emphasized as an important cost of separation of ownership from control, emerges as a potentially useful tool to reduce agency costs. Therefore, the theory in this paper offers a microfoundation for the beneficial performance of managerial organizations and their good relations with financial markets, as documented, among others, in the work of Chandler ([2, 3]).

*Remark 4.* The equilibrium in Proposition 4 is for  $\delta$  arbitrarily small. With  $\delta > 0$  but not too large, this type of equilibrium still exists, but separation ownership and control can happen even when it reduces social surplus. The details are available upon request.

*Remark 5.* Approximate efficiency can also be achieved via an alternative arrangement. The entrepreneur could hire a manager and let her discover the type of the project but then rather than delegating control to her, they can engage in a reporting game (e.g. [16]). If this mechanism is chosen appropriately, it will have a Nash Equilibrium in which the true type of the project is reported. However, it will not be possible in general to rule out other equilibria, therefore, this mechanism design approach can at best achieve the same result as here. The solution given in Proposition 4 also illustrates the reason why the introduction of the third-party corrects the market failure (i.e. the low powered incentives), relates to a real world phenomenon, and, in fact, constitutes a more surprising and stronger result since the efficient outcome is the unique equilibrium allocation.

*Remark 6.* The solution suggested in Remark 5 can also be interpreted as *venture capital*. Today venture capital has become a multi-billion dollar business, and popular accounts suggest venture capitalists understand the prospects of a business much better than outside creditors. Also, the example of J. P. Morgan discussed in the introduction is reminiscent to this case. Note that even if an investor is brought in to discover the information, it has to be ensured that he has the right incentives to report it to other investors who will also put money in the venture. In practice, the decision between separation of ownership and control and venture capital will

depend on a host of factors, including whether investors have the know-how to evaluate projects, and whether managers could distort other decisions within the firm.

### 3.3. *Secret Renegotiation*

A final issue that needs to be addressed briefly is the possibility of secret renegotiation (collusion) between the entrepreneur and the manager. As an example consider the case of an entrepreneur with  $x < k + \alpha$  who hires a manager using contract (6) and makes the following offer: "You choose  $p(x) = 1$  and  $q(x) = 2$ , if the project returns  $X$ , then we will split the returns". Now if  $\alpha$  is not very high and the manager trusts the entrepreneur's promise, this renegotiation would be very attractive for her, and would destroy the purpose of the separation of ownership and control. Naturally, such renegotiation has to be *secret*, otherwise financial contracts can be conditioned on the outcome of the renegotiation, and the damage would be undone (for a general discussion of collusion in agency relations, see [23]).

A previous version of this paper demonstrated that even in the presence of secret renegotiation (collusion), separation ownership and control is useful. Here I briefly give the main idea (details available upon request). The crucial assumption for this result is that once the entrepreneur writes a contract with the manager agreeing to pay him some amount  $\hat{w}$  in some verifiable state of nature, then he can never renege on this contractual payment. Therefore, the renegotiation offer of the entrepreneur to the manager must make her at least as well off as she would be if she does not agree to renegotiate the initial arrangement. This implies that in general there will exist an attractive enough contract for the manager that even if the entrepreneur promises her all the returns when she chooses  $q(x) = 2$  and is successful, she still prefers abandoning the project and collecting  $\hat{w}(0, .)$ . In other words, when secret renegotiation is possible, the managerial contract will pay a "rent" to the manager for abandoning the project so as to prevent renegotiation. This result is important as it implies that for the general thrust of the arguments in this paper to be valid, it is not necessary to assume away secret collusion between the entrepreneur and the manager.

## 4. CONCLUSION

This paper has presented a model in which widespread inefficiencies can arise in the credit market, because asymmetric information, moral hazard and competition among financial intermediaries link the distribution of rents to the provision of incentives to agents with superior information. Excessively high powered incentives of entrepreneurs are identified as the source of inefficiencies that a planner could avoid even if subject to the

same informational constraints. In this economy, there can be strategic gains from separation of ownership and control because this organizational form will partly isolate the distribution of rents from the provision of equilibrium incentives. The reason is that managers do not receive the rents and can be given the right incentives. In equilibrium, profitable firms are induced to delegate control to managers, and this acts as a good signal to the credit market and lowers their cost of capital. It follows from the analysis that factors other than comparative advantage, specialization and economies of scale need to be considered in understanding separation of ownership from control and the emergence of managerial hierarchies. In particular, as well as the often emphasized and analyzed agency costs, there may also be significant incentive related benefits from separation of ownership and control.

## 5. APPENDIX

*Proof of Proposition 2.* To save space, I will give the proof for part 1 of the proposition, i.e. the case where there is a root to (4) in  $[\alpha/\varepsilon, \bar{x}]$ . The proof for part 2 is analogous. I will first prove that in any equilibrium, for all  $x > 0$ ,  $p(x) = 1$ ,  $q(x) = 1$  and  $\hat{y}(y|x) = y$ , that is all entrepreneurs with  $x > 0$  go ahead, choose action 1 and do not destroy any of their returns. This will prove that all equilibria induce the allocation outlined in Proposition 2. I will then prove that  $\mathfrak{R} = \{\hat{R}\}$ , that is only (3) being offered to entrepreneurs, is an equilibrium. Also, in this proof I use  $\pi(x|R)$  to denote the profit that contract  $R$  makes from type  $x$ .

*Uniqueness of Equilibrium Allocation.* Let  $\{(p^*(x), q^*(x), \hat{y}^*(y|x))$  for all  $x \in E\}$  be an equilibrium allocation and  $\mathfrak{R}^*$  be the associated set of contracts. I will show that this allocation has to be of the form characterized in Proposition 2. I will first show that all  $R \in \mathfrak{R}^*$  must have  $R(0, \cdot) = 0$ . Second, for all  $x > 0$ ,  $p^*(x) = 1$ . Third,  $q^*(x) = 1$ . Fourth that  $\hat{y}^*(y|x) = x$ .

*First:* Suppose  $i$  offers  $R_i(0, \cdot) > 0$ . Recall that  $u(\hat{R}|x=0) = 0$ , then for all  $x = 0$ , the best-response is  $r(x) = R_i$ , and  $p(x|R_i) = 0$ . This will give them  $u(R_i|x=0) > 0$ . Thus,  $i$  will lose  $\theta R_i(0, \cdot)$ . There is also a potential gain from offering  $R_i$ . If  $R_i(0, \cdot) \geq \varepsilon z - \alpha$ , then also for  $x \in [\underline{x}, k + \varepsilon z)$ , the best response is  $r(x) = R_i$ ,  $p(x|R_i) = 0$ , which will give utility  $u(R_i|x) \geq u(\hat{R}|x) = \varepsilon z - \alpha$ , i.e. greater than what they would get with  $\hat{R}$ . The upper bound on this gain is  $\int_{\underline{x}}^{k + \varepsilon z} (k - x) dF(x)$  when all projects  $x \in [\underline{x}, k + \varepsilon z)$  choose  $p(x) = 0$  rather than  $p(x) = 1$  (it is an upper bound because not all  $x \in [\underline{x}, k + \varepsilon z)$  would have otherwise chosen to accept  $i$ 's contract).

Assumption 2 ensures that even if  $i$  realizes this upper bound gain, it loses money. Therefore, it is never profitable to offer  $R_i(0, \cdot) > 0$ .

*Second:* Suppose  $\min_{R \in \mathfrak{R}^*} R(1, \bar{x}) = \rho > \alpha/\varepsilon$ , then the return to  $p(x) = 1$  for  $x > 0$  is bounded below by  $\varepsilon\rho - \alpha > \max_{R \in \mathfrak{R}^*} R(0, \cdot) = 0$ . Hence  $p^*(x) = 1$  for all  $x > 0$ . Suppose  $\min_{R \in \mathfrak{R}^*} R(1, \bar{x}) < \alpha/\varepsilon$ , then (4) could not have a root in  $[\alpha/\varepsilon, \bar{x}]$  and we would not be in part 1 of the Proposition.

*Third:* Suppose there exists  $\Delta_x$  with positive measure (i.e.  $\int_{x \in \Delta_x} dF(x) > 0$ ), such that for all  $x \in \Delta_x$ ,  $r(x) = R$  and  $q(x|R) = 2$ . Then, it must be the case that for each  $x \in \Delta_x$ ,  $R(1, \hat{y}) < \varepsilon R_i(1, y')$  for all  $\hat{y} \leq x$  and some  $y' \leq X$ . We have the profit from type  $x$  accepting contract  $R$  as  $\pi(x|R) = \varepsilon[X - R(1, \hat{y}(X|x))] - k$ . Consider a different contract  $R'$  such that for all  $x \notin \Delta_x$ ,  $R'(1, y) = R(1, y) + \xi$ , and for all  $x \in \Delta_x$ ,  $R'(1, x) = \varepsilon R(1, \hat{y}(X|x)) + \xi$  where  $\xi > 0$ . Then, by construction,  $R'$  is more attractive for all entrepreneurs, thus:  $r(x) = R'$  and  $q(x|R') = 1$  for all  $x \in [\underline{x}, \bar{x}]$ . Also for all  $x \in \Delta_x$   $\pi(x|R') = x - \varepsilon R(1, \hat{y}(X|x)) - k - \xi$ , and  $\pi(x'|R') = \pi(x'|R) - \xi$  for all  $x' \notin \Delta_x$ . Now, note that  $\lim_{\xi \rightarrow 0} \pi(x|R') > \pi(x|R)$  for  $x \in \Delta_x$  and  $\lim_{\xi \rightarrow 0} \pi(x'|R') = \pi(x'|R)$  for all  $x' \notin \Delta_x$ . Therefore, for  $\xi$  sufficiently small,  $R'$  makes positive profits, and  $R$  cannot be optimal, and this establishes that  $q^*(x) = 1$  for all  $x > 0$ .

*Fourth:* Suppose  $r(x) = R$  and  $\hat{y}(y|x, R) < x$  for  $x \in \Delta_x$  where  $\Delta_x$  is a positive measure set. Then  $R(1, \hat{y})$  must be decreasing in its second argument around  $x$  for all  $x \in \Delta_x$ . This implies that for all  $x \in \Delta_x$ ,  $\pi(x|R) = \hat{y}(y|x, R) - R(1, \hat{y}(y|x, R)) - k$ . Consider  $R'$  such that  $R'(1, \hat{y}') = R(1, \hat{y}') + \xi$  for all  $\hat{y}' \neq \hat{y}(y|x)$  and  $x \in \Delta_x$  and  $R'(1, x) = R(1, \hat{y}(y|x, R)) + \xi$  for all  $x \in \Delta_x$  where  $\xi > 0$ . Then, we have  $r(x) = R'$  for all  $x$ , and  $\hat{y}(y|x, R') = x$  and  $\pi(x|R') = x - R(1, \hat{y}(y|x)) - \xi - k$ . By the same argument as the above paragraph, for  $\xi \rightarrow 0$ ,  $\pi(x|R) < \pi(x|R')$  for all  $x \in \Delta_x$  and  $\pi(x'|R') = \pi(x'|R)$  for all  $x' \notin \Delta_x$ . Therefore  $R$  cannot be optimal, and in equilibrium it must be the case that no output is destroyed. Hence,  $\hat{y}^*(y|x) = x$ .

These four steps establish that if  $\{p^*(x), q^*(x), \hat{y}^*(y|x)$  for all  $x \in E\}$  and we are in part 1 (i.e. a root to (4) exists in  $[\alpha/\varepsilon, \bar{x}]$ ), then it must be the case that  $p^*(x) = 1$ ,  $q^*(x) = 1$  and  $\hat{y}^*(y|x) = y$ .

$\mathfrak{R} = \{\hat{R}\}$  is an equilibrium. By construction  $\hat{R}$  breaks even, thus all active intermediaries would be making positive profits. Also, since  $\hat{R}$  is non-decreasing in  $\hat{y}$ ,  $\hat{y}(y|x, \hat{R}) = y$  is best-response. Next,  $p(x|\hat{R}) = q(x|\hat{R}) = 1$  gives  $u(p = 1, q = 1, \hat{R}|x) = \hat{R}(1, x) - \alpha \geq \varepsilon z - \alpha$ , thus  $r(x) = \hat{R}$ ,  $p(x|\hat{R}) = 1$  and  $q(x|\hat{R}) = 1$  is best-response to  $\mathfrak{R} = \{\hat{R}\}$  for all  $x > 0$ .

To complete the proof, it has to be established that if  $\mathfrak{R} = \{\hat{R}, R_i\}$ , then  $\pi(R_i) \leq 0$  for all  $R_i$ . That is if all other intermediaries offer  $\hat{R}$ , then an intermediary offering a contract  $R_i$ , different than  $\hat{R}$ , makes nonpositive profits. I will establish this in four steps.

First, by the above argument,  $R_i(0, \cdot) > 0$  would lose money, and so would  $R_i(1, \hat{y}) > 0$  for  $\hat{y} \in [0, \underline{x}]$ .

Second, suppose  $R_i(1, x) \neq \varepsilon z$  for all  $x \in \Delta_x$  where  $\Delta_x$  is a positive measure subset of  $[\underline{x}, k + \varepsilon z)$  (note that if no such positive measure subset of  $[\underline{x}, k + \varepsilon z)$  existed, then we could not be in part 1 of Proposition 2). I will show that  $i$  will lose money. If  $R_i(1, x) > \varepsilon z$ , then  $u(R_i|x) > u(\hat{R}|x)$ , thus  $r(x) = R_i$  for all  $x \in \Delta_x$ . But, for all  $x \in \Delta_x$ ,  $\pi(x|R_i) < 0$ . Therefore,  $i$  would lose money for any  $\Delta_x \subset [\underline{x}, k + \varepsilon z)$ . Next suppose that  $R_i(1, x) < \varepsilon z$  for all  $x \in \Delta_x$  and also that  $R_i(1, \hat{y}) = \hat{R}(1, \hat{y}) = z$  for  $\hat{y} \geq k + z$ . Recall that  $u(\hat{R}|x) = \varepsilon z - \alpha$ , but also  $u(R_i|x) = \varepsilon z - \alpha$  with  $q(x) = 2$ . Therefore, given the equilibrium strategies as specified in the proposition, entrepreneurs will randomly choose between  $R_i$  and  $\hat{R}$ . Therefore,  $\int_{x \in \Delta_x \cap \chi(\hat{R}, \mathfrak{R})} dF(x) = \int_{x \in \Delta_x \cap \chi(R_i, \mathfrak{R})} dF(x)$  (i.e. the same number of types in set  $\Delta_x$  would accept  $R_i$  and  $\hat{R}$ ), hence, all we need to show is that  $\pi(x|R_i) < \pi(x|\hat{R})$ . We have  $\pi(x|\hat{R}) = x - k - \varepsilon z$  whereas  $\pi(x|R_i) = \varepsilon(X - z) - k < \pi(x|\hat{R})$  for all  $x \in [\underline{x}, \bar{x}]$  by assumption 1. This argument applies for any  $\Delta_x \subset (0, \underline{x})$ , establishing that  $R_i(1, x) = \varepsilon z$  for all  $[\underline{x}, k + \varepsilon z)$  is best-response to the strategies of the entrepreneurs and to  $\mathfrak{R} = \{\hat{R}\}$ .

Third, suppose  $R_i(1, x) < z$  for all  $x \in \Delta_x$  where  $\Delta_x$  is a positive measure subset of  $[k + z, \bar{x}]$ . Then, no  $x \geq k + z$  will have  $r(x) = R_i$ . Since  $\pi(x|\hat{R}) > 0$  for  $x \geq k + z$ ,  $i$  loses money. Suppose  $R_i(1, x) > z$  for  $x \in \Delta_x$  and the rest of  $R_i$  is unchanged from  $\hat{R}$ . Then, for all  $x < k + \varepsilon z$ , we have  $u(R_i|x) = \varepsilon R_i(1, x) - \alpha > \varepsilon z - \alpha = u(\hat{R}|x)$ . This implies  $r(x) = R_i$  for all  $x \in \Delta_x$ , but since  $\pi(x|R_i) < 0$ ,  $i$  loses money. Next, suppose  $R_i(1, x) = \bar{z} > z$  and also  $R_i(1, \hat{y}) = \varepsilon \bar{z}$  for  $\hat{y} \leq k + \varepsilon \bar{z}$ . But,  $z$  is the largest root of (4), therefore, no  $\bar{z} > z$  can break-even (nor make positive profits). Finally, suppose that  $R_i(1, x) = \bar{z} > z$  but  $R_i(1, \hat{y}) = \varepsilon z$  for  $\hat{y} \leq k + \varepsilon \bar{z}$ . We still have:  $u(R_i|x) = u(p = 1, q = 2, R_i|x) = \varepsilon \bar{z} - \alpha > u(\hat{R}|x)$  for all  $x \leq k + \varepsilon \bar{z}$  since they can choose  $R_i$  and then take action  $q = 2$ . Thus, we have  $r(x) = R_i$ ,  $p(x|R_i) = 1$  and  $q(x|R_i) = 2$ . Since  $\varepsilon X < \underline{x}$ , this strategy a fortiori has  $\pi(x|R_i) < 0$ .

Fourth,  $u(\hat{R}|x) = x - k - \alpha$  and  $\pi(x|\hat{R}) = 0$  for all  $x \in [k + \varepsilon z, k + z)$ . Therefore,  $\pi(x|R_i) > 0$  is not possible for any contract offer  $R_i \neq \hat{y} - k$  for  $\hat{y} \in [k + \varepsilon z, k + z)$ .

This establishes that  $\mathfrak{R} = \{\hat{R}, R_i\}$ , then  $\pi(R_i) \leq 0$  for all  $R_i$ , thus  $\hat{R}$  is best-response to  $\mathfrak{R} = \{\hat{R}\}$  and to the strategies of entrepreneurs and completes the proof. ■

*Proof of Proposition 3.* With the equity contract of Proposition 3, it is clear that  $p(x) = q(x) = 1$  for all  $x$  such that  $\hat{s}x - \alpha \geq 0$  and  $p(x) = 0$  for all  $x$  such that  $\hat{s}x - \alpha < 0$ . Since  $\hat{s} = \alpha / (k + \alpha)$ , this implies that for all  $x \geq k + \alpha$ ,

$p(x) = q(x) = 1$ , and  $p(x) = 0$  is a best-response for  $x < k + \alpha$ . This is exactly the same allocation as the first-best of Proposition 1. ■

*Proof of Proposition 4.* Recall that  $\omega(x)$  is the choice of managerial contract for type  $x$  conditional on  $h(x) = 1$ . Let  $\bar{W}$  be such that if a manager is hired with a contract  $w \in \bar{W}$ , then  $p(x|w) = 0$  for all  $x < k + \alpha$ . Let  $\Omega_{\bar{W}} = \{x | \omega(x) \in \bar{W}\}$ . Also define  $u(w, R|x)$  as the utility of type  $x$  when  $r(x) = R$  and  $\omega(x) = w$ .

First, it is straightforward to see that the strategies described in the Proposition constitute an equilibrium that passes the Intuitive Criterion. Given  $\hat{w}$ ,  $p(x|\hat{w}) = 0$  for  $x < k + \alpha$  and  $p(x|\hat{w}) = 1$  and  $q(x|\hat{w}) = 1$  for  $x > k + \alpha$  is best-response for the manager. Then, given the contract offers of intermediaries, for  $x > k + \alpha/\varepsilon$ ,  $u(h=0, p=1, R, \cdot|x) = \alpha/\varepsilon$ , and as  $\delta \rightarrow 0$ ,  $u(h=1, R, \hat{w}|x) = x - k - \alpha > \alpha/\varepsilon$ . Therefore,  $x > k + \alpha/\varepsilon$ , we have  $h(x) = 1$  and  $\omega(x) = \hat{w}$ . For  $x \in [k + \alpha, k + \alpha/\varepsilon]$ ,  $u(h=0, p=1, R, \cdot) = x - \alpha > u(h=1, R, \hat{w}) = x - \alpha - \delta$  for all  $\delta > 0$ , therefore, it is optimal to have  $h(x) = 0$  and  $p(x) = q(x) = 1$ . Finally, for  $x < k + \alpha$ ,  $u(h=0, p=1, R, \cdot) = 0$  and  $u(h=1, R, \hat{w}) = -\delta$ , thus  $h(x) = p(x) = 0$  is best response. Finally, since  $\omega(x) = \hat{w}$  only if  $x > k + \alpha/\varepsilon$ , it is best-response for intermediaries to offer  $R(h=1, p=1, \hat{y}, \hat{w}) = \hat{y} - k - \alpha$ . And since  $p(x) = 0$  for all  $x < k + \alpha$ , it is also optimal to offer:  $R(h=0, p=1, \hat{y}, \cdot) = \max\{0, \hat{y} - k\}$  for  $\hat{y} \leq k + \alpha/\varepsilon$  and  $R(h=0, p=1, \hat{y}, \cdot) = \alpha/\varepsilon$  for  $\hat{y} > k + \alpha/\varepsilon$ . Therefore, the allocation defined in the proposition is an equilibrium, and it is easily seen to pass the Intuitive Criterion. Also clearly, in the limit at  $\delta = 0$ , this allocation coincides with the first-best.

The more involved part of the proof is to show that all other equilibria that pass the Intuitive Criterion also have the form described in the Proposition. I will prove this in five steps. First, I will suppose that  $\Omega_{\bar{W}}$  is non-empty. Step 1 will show that for  $x \leq k + \alpha/\varepsilon$ ,  $\omega(x) \notin \bar{W}$  and that  $x \in [k + \alpha, k + \alpha/\varepsilon]$ , we have  $h(x) = 0$  and  $p(x) = 1$ . Step 2 will show that for  $x > k + \alpha/\varepsilon$ ,  $u(\hat{w}, R|x) = x - k - \alpha - \delta$ . Step 3 will show that for  $\delta$  sufficiently small, all  $x > k + \alpha/\varepsilon$  have  $\omega(x) = \hat{w}$ . Step 4 will then show that  $x < k + \alpha$  have  $p(x) = 0$ . The last part of the proof, Step 5, will establish that for  $\delta$  sufficiently small,  $\Omega_{\bar{W}}$  is nonempty in all equilibria that pass the Intuitive Criterion.

*Step 1.* Note that for all  $x \leq k + \alpha$  and  $w \in \bar{W}$ ,  $u(w, R|x) = -\delta$ , i.e. by construction, the manager abandons the project when  $x \leq k + \alpha$ . Therefore, types  $x \leq k + \alpha$  would never hire a manager with a contract from  $\bar{W}$ . Next, observe that it is always optimal for an intermediary to offer the following contract to entrepreneurs who do not separate ownership and control:  $R'(h=0, p=1, \hat{y}, \cdot) = \max\{0, \hat{y} - k - \xi\}$  for  $\hat{y} \leq k + \alpha/\varepsilon$  and  $R'(h=0, p=1, \hat{y}, \cdot) = (\alpha/\varepsilon) - \xi$  for  $\hat{y} > k + \alpha/\varepsilon$ , where  $\xi > 0$ . To see



this note that  $u(h=0, p=1, R'|x) < 0$  for all  $x \leq k + \alpha$ , therefore, the intermediary could never lose money but would make  $\pi(x|R') > 0$  from  $x \geq k + \alpha + \zeta$  who accepts the offer. Hence,  $h(x) = 0$  for all  $x \leq k + \alpha/\varepsilon$ . This also establishes that for all  $x \in [k + \alpha, k + \alpha/\varepsilon]$ ,  $p(x) = 1$ .

*Step 2.* Consider  $\hat{W}$  as defined in the proposition. It is clear that  $\hat{W} \subset \bar{W}$ . Then,  $u(\hat{w}, R|x) = R(h=1, p=1, x, \hat{w}) - \delta$ . From step 1, if  $\omega(x) = \hat{w} \in \hat{W}$ , then it must be that  $x > k + (\alpha/\varepsilon)$ . Therefore, competition among intermediaries, knowing that those separating ownership and control are the profitable types, ensures that  $R(h=1, p=1, y, \hat{w}) = y - k - \alpha$  (where  $\alpha$  is the salary of the manager—since  $x > k + \alpha$ ,  $p(x|\hat{w}) = 1$  and  $w(p=1, x) = \alpha$ ).

*Step 3.* Given Step 2, we can then write  $u(\hat{w}, R|x) = x - k - \alpha - \delta$  for all  $x > k + \alpha/\varepsilon$ . Now consider  $u(w, R|x)$  for  $w \notin \hat{W}$ . First, it is clear that  $w(p=0, \cdot) > 0$  and  $w(p=1, y) \geq \alpha$  for  $y < k + \alpha$  would hurt types  $x > k + \alpha/\varepsilon$ , thus these types of contracts are ruled out. Second,  $w(p=1, y) > \alpha$  for  $y > k + \alpha$  would give a payoff  $u(w, R|x) \leq x - k - \alpha - \delta$ . Fourth,  $w(p=1, y) < \alpha$  for  $y > k + \alpha$  would not be accepted by the manager, thus would give  $u(\emptyset, R|x)$ , i.e. the utility of not having hired a manager. Finally,  $h=0$  would also give  $u(\emptyset, R|x)$ . Thus, to complete this step all we need to establish is that  $u(\emptyset, R|x) < x - k - \alpha$  for all  $x \geq k + (\alpha/\varepsilon)$ . To do this I suppose this is not the case for type  $x' \geq k + (\alpha/\varepsilon)$ , so that  $R(h=0, p=1, x') > (\alpha/\varepsilon)$  (i.e. thus  $u(\emptyset, R|x') \geq x' - k - \alpha$ ), and I will derive a contradiction. The supposition implies that since  $R(h=0, p=1, x') > (\alpha/\varepsilon)$ ,  $u(h=0, p=1, q=2, R|x) = \varepsilon R(h=0, p=1, x') - \alpha > 0$  for all  $x < k + \alpha$ , i.e. unprofitable types would now accept  $R$  and go ahead. Thus there must exist  $\Delta_s \subset [k + \alpha, \bar{x}]$  such that  $R(h=0, p=1, x) < x - k$  for all  $x \in \Delta_s$  that is there must be types in a subset of profitable types which do not hire a manager and subsidize loss making projects (so that intermediaries break-even). I will derive the contradiction by showing that this set of “subsidizing projects”,  $\Delta_s$ , must be empty. Note that  $\lim_{\delta \rightarrow 0} u(\hat{w}, R|x) = x - k - \alpha$  for all  $x > k + \alpha$ , thus for all  $x \in \Delta_s$ . Therefore,  $u(\hat{w}, R|x) > u(\emptyset, R|x)$ , and  $h(x) = 1$  for all  $x \in \Delta_s$ . This implies that  $\Delta_s$  must be empty: a contradiction. Therefore,  $u(\emptyset, R|x) < x - k - \alpha$  for all  $x \geq k + \alpha/\varepsilon$  and hence, as  $\delta \rightarrow 0$ , all  $x > k + \alpha/\varepsilon$  will have  $h(x) = 1$  and  $\omega(x) = \hat{w}$ .

*Step 4.* Since all  $x > k + \alpha/\varepsilon$  have  $h(x) = 1$ , then it must be the case that  $R(h=0, p=1, \hat{y}, \cdot) \leq \alpha/\varepsilon$  for  $\hat{y} > k + \alpha/\varepsilon$  because the only way a project which has  $h(x)$  can generate such a return is by having  $q(x) = 2$ . Then,  $x < k + \alpha$  have  $p(x) = 0$  [suppose  $R(h=0, p=1, \hat{y}, \cdot) = \alpha/\varepsilon$  for  $\hat{y} > k + \alpha/\varepsilon$  and some of the types with  $x < k + \alpha$  chose  $p(x) = 1$ , then the intermediaries would make losses, and thus this could not be an equilibrium].

*Step 5.* Consider a candidate equilibrium with  $\Omega_{\bar{w}} = \emptyset$ . Then, the equilibrium of Proposition 2 part 1 must apply and we have  $\hat{R}(1, \bar{x}) < \bar{x} - k$ . Now consider the following deviation by  $\bar{x}$ : choose  $h(\bar{x}) = 1$  and  $\omega(\bar{x}) = \hat{w}$  as given by (6) (recall that  $\hat{w} \in \bar{W}$ ). Next define the set  $S(h = 1, \hat{w})$  as in Definition 2. By construction, the manager will choose  $p(x | \hat{w}) = 0$  for all  $x < k + \alpha$ , whereas by assumption  $\hat{R}(1, x) > \alpha$  for all  $x > 0$ . Therefore, we have that any  $x < k + \alpha$  is in the set  $S(h = 1, \hat{w})$ , i.e. no unprofitable type would ever benefit from such a deviation. This implies that for all  $R' \in BR(E \setminus S(h, w), h, w)$ , we must have  $R'(h = 1, p = 1, y, \hat{w}) = y - k - \alpha$  (otherwise another intermediary would bid higher and make positive profits). Therefore, as  $\delta \rightarrow 0$ , we have  $\min_{R \in BR(E \setminus S(h, w), h, w)} u(h = 1, \hat{w}, R | \bar{x}) = \bar{x} - k - \alpha - \delta > \hat{R}(1, \bar{x})$ , and the candidate equilibrium with  $\Omega_{\bar{w}}$  empty does not pass the Intuitive Criterion. Thus, in all equilibria that pass the Intuitive Criterion,  $\Omega_{\bar{w}} \neq \emptyset$ .

Steps 1 to 5 together demonstrate that in all equilibria that pass the Intuitive Criterion, types  $x > k + \alpha/\varepsilon$  separate ownership and control, and there is approximate efficiency. ■

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