The Case of the Errant Executive : Management and Control in Corporate Cheating

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Abstract

A manager, his board and outside shareholders play a three-way repeated game with stochastic outcomes and asymmetric information**.** Firms require a minimum size and at least one individual with managerial ability. Two credibility concerns emerge: outside shareholders limit their stake to eliminate insiders' incentives to cheat them; and boards offer managers a contractual wage sufficient to deter cheating. When capital is too expensive, such a contract is infeasible, agency structures within the firm collapse and owner-managers rule. Where it is feasible, managers invest their all in their firms. The combined wealth of manager and board must suffice for viable firm size, given the ceiling on outsider financing. Individuals with managerial ability endogenously prefer working for entrepreneurs to establishing their own firms, and the latter to playing a non-managerial role while hiring another manager. We endogenize entry and establish a unique equilibrium for any wealth–distribution. Our model helps explain dominance of family firms in poor countries, moral hazard-induced vicious circles that retard industrialization and the stimulus that inequality *may* provide to it.

Keywords: Moral hazard, entrepreneurs, managerial compensation, repeated games, owner-managed firms, inequality and development.

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1.Introduction

The explosion of corporate cheating in recent years has rekindled interest in problems of moral hazard in corporate governance. The classical context of moral hazard – the two-party agency problem as in Holmstrom and Tirole (1989) – fits the relationship between the investor and the firm. It yields insights like the rationing of credit by the investor to the entrepreneur on the basis of the latter's personal stake in the venture, insights that can be extended from debt- to share-capital. However, in all major recent episodes of cheating, a key role has been played by executives with interests that diverge from both the firm's and the investor's. In this paper we examine this three-way interaction and consider whether it modifies the strategies deployed by the three players in the face of the possibility of cheating. In our model, in particular, investors must decide not just whether the firm is interested in playing fair with them but also whether it has the ability and the incentive to make its manager do likewise.

We visualize an asymmetric information set-up in which the 'firm' (identified by us with the 'board') and the manager are the knowledgeable insiders, with interests that differ from each other's and from those of the outside shareholders. While the manager decides whether or not outside shareholders are cheated, or whether indeed he should help himself out of the corporate till, the board – which has its own axe to grind, separate from that of the outside investors – may seek to influence him through instruments like the managerial compensation contract and threats of dismissal. It may be felt therefore that if managerial contracts were common knowledge, investors would be able to decide whether they are likely to be cheated. However, public observability of managerial contracts does not itself eliminate moral hazard, given the possibility of secret renegotiation between the board and the manager; the requirement of renegotiation – proofness of managerial contracts imposes a "credibility ceiling" on the ratio of outsider to insider financing. This limit pins down firm size in equilibrium as a function of the personal wealth of the insiders.

People with managerial ability have two options – to set up firms on their own or to join with another (who may or may not have managerial ability). The distribution of managerial talents in the population is exogenously determined by nature**.** In an owner-managed firm, there is no question of a managerial contract: the credibility ceiling on the

outsider's stake in the firm is not just necessary but also sufficient to protect him against being cheated. However, we show that capable managers prefer working for a non-managerial owner to managing their own firms. This in turn requires a credible managerial contract with a managerial salary high enough to deter the manager from cheating (*a la* Shapiro-Stiglitz (1984)). Such a salary is feasible only below a specific cost of outsider capital. When capital costs are below this level, partnerships between a manager and a non-managerial entrepreneur represent the preferred form of organization. Owner-managed firms develop when capital costs exceed this critical level or when no partners can be found, assuming of course that the owner-manager is wealthy enough.

As credibility limits the amount of outsider finance forthcoming, the personal wealth of potential owner-managers or of entrepreneur-manager pairs has to exceed a certain floor if there is a minimum size requirement on the enterprise. Further, the number of firms is limited by the supply of individuals with managerial ability, even when there is a surplus of wealthy individuals without managerial ability. On the other hand, even when the supply of individuals without managerial ability runs out, new firms may be formed by those with managerial ability, either singly or in pairs, provided they have enough wealth. We also show that managers will generally prefer to invest all their wealth in the firm for which they work[1].

This enables us to endogenize entry into entrepreneurship and characterize possible equilibria (there is a unique equilibrium for a given distribution of initial wealth). Apart from implications for firms and managers, our model also explains features of poor countries such as the prevalence of family firms, moral hazard induced "vicious circles" retarding industrialization, and the possible advantages of inequality in the industrialization of a small open economy. The link with development economics lies in the fact that our equilibria are influenced by the level and the distribution of wealth.

Market outcomes in our model are stochastic, and the true performance of a firm is only observable by insiders. Insiders can therefore exploit their asymmetric information about firm performance to pretend to outsiders that the firm has been unlucky, appropriating the excess returns due to outsiders in a good state. We explicitly introduce an incomplete contracting feature in the agreement between insiders and outside investors, due to the inability of the latter to observe firm performance.

Investor payoffs are common knowledge, but this does not tell the public whether the insiders have cheated. This is because outcomes being stochastic, poor investor returns may reflect either bad luck or cheating by insiders. This is similar in some sense to the Green-Porter (1984) models of games with imperfect public information[2].

The manager has the ability to cheat outside investors in the manner described. A public signal detects cheating with a probability of q – but only in the next period. Past cheating by a firm, once exposed, is collectively remembered for ever.

Our work is connected to many strands in the literature. Agency conflicts between managers and shareholders have of course been the subject of a vast literature in corporate finance (eg. Aghion and Bolton [1992], Jensen [1986], and Zwiebel [1996]). All these papers consider managers whose objectives differ from those of shareholders, or of investors in general. The difference in objectives may be reflected in the manager's choice of projects inimical to investor interests, or in his diverting free cash flow into his own pocket. The latter option is closer to the situation we study in this paper. Our focus is on a three-way relationship between boards, managers and outside investors, rather than only on manager-shareholder conflicts.[3] Moreover, we endogenize individuals' entry into entrepreneurial, managerial, owner-manager or outside investor roles, subject to two exogenous requirements – one, that firms need to reach a minimum size to be operational, and second, that at least one person with managerial ability is required to run a firm.

Our problem is closest to Legros and Newman's [1996] study of firm formation in a general equilibrium context, but differs in several significant aspects. While theirs is a one-period model, ours is an indefinitely repeated game. Cheating runs the gauntlet of a costly random audit in their formulation, while in ours it incurs the risk of exposure by a public signal which is costless but delayed. In Legros and Newman, punishment after detection would presumably require legal penalties (which must be harsh enough to deter); our cheats are punished on exposure by loss of investor confidence and consequent inability to establish enterprises ever after – whether this deters or not is endogenously determined. All members of a Legros and Newman world are identical except in wealth and firms are simply coalitions of such individuals; we have individuals differing not just in wealth, but in managerial ability as well and both these inputs are

essential for firm formation. Suppliers of external finance are outside Legros and Newman's model and the return to outside capital is exogenous. In our model, however, outside investment is simply one of the possible roles that a wealth-holder may assume: his choice of this role and the rate of return it entails is endogenized in general equilibrium. Effort is a variable in Legros and Newman's firm and affects expected profit: monitoring of effort is a major concern. We, on the other hand, make expected profit a function only of luck so as to focus exclusively on cheating and its preemption.

A consequence of these differences in assumptions is a substantial difference in results. While Legros and Newman endogenize the formation of externally-financed M-firms and internally-financed I-firms, we are concerned only with firms that need outsider funds: within this group, we endogenize the formation of owner-managed firms and of entrepreneur-manager pairings. As for the latter subgroup, we examine the matching process and show that it leads to wealthier managers teaming up with wealthier boards (positive assortative matching, indeed segregation), in contrast to Legros and Newman's result that rich individuals may prefer poorer ones as partners (heterogeneous, or negative assortative matches). We also show that risk-neutral managers and boards prefer to invest all their wealth in their own firms.

Our model belongs to a broader class (eg. Bernanke and Gertler [1989], Banerjee and Newman [1993]) in which moral hazard in a corporate setting serves to restrict long run firm size. Our model pinpoints two distinct ways in which firm size could be limited due to credibility concerns. The first – due to insider-outsider tensions – is common to owner-managed firms as well as firms with both a manager and a non-managerial financier; given a minimum size requirement on enterprise, it translates into a floor to the personal wealth of entrepreneurs and is also a feature of Banerjee and Newman. The second is specific to firms run by separate financiers and managers: here the manager has to be paid a high enough salary to credibly deter him from cheating and this ensures that the firm cannot pay too high a rate of return on outside capital. When outside capital is expensive, only owner-managed firms will be credible. Such firms have access to less insider capital (from one individual rather than two) and are therefore smaller.

This brings up the issue of profit-based executive compensation. Many have pointed out the incentive effects of such compensation, arguing that bonuses induce

greater efficiency. However in our story, output, though stochastic, does not depend on the manager's effort but on luck. So the effect of giving the manager a share in insider profits is to increase his incentive to cheat the investors by exploiting his asymmetric information about whether the firm has experienced good or bad fortune.

In section 2, we provide a detailed discussion of the assumptions underlying our model. In section 3, we characterize the requirements for equilibrium while in section 4, we describe the timing of the game. Our main results are presented in sections 5, 6 and 7. Section 8 discusses some implications of our model, while section 9 concludes.

2. Assumptions

Individuals live forever in a closed population with fixed and inelastic wealth. There is no saving[4], depreciation or borrowing, though lending is possible at an outside opportunity cost R. Agents are all risk-neutral.

Individuals differ, not only in personal wealth, but in managerial ability as well. Managerial talent is a binary variable with values 0 and 1: its distribution in the population is independent of that of wealth. There is thus a separate class of individuals with managerial ability. But members of this class do not necessarily work as managers in firms set up by wealthy people without managerial talent: they also have the option of working as managers for wealth-holders with managerial talent who do not however have a managerial role, or of maintaining exclusive control over their firms as owner-managers; sometimes, they may not find any employment for their managerial ability but only for their wealth. In a later section, we endogenize this choice of roles.

Each enterprise must reach a minimum size $\underline{I}$ before operation is possible. Thus entrepreneurs whose funds F are less than this must recruit investment either from managerial partners or from the public in order to set up business. F may represent the collective funds of a group of insiders who combine to set up a firm. Collective action problems limit the extent to which such pooling of funds is possible so that the minimum size requirement has considerable bite. Further, enterprises cannot function without an individual of managerial ability 1. Individuals lacking managerial talent cannot establish firms on their own: they must either recruit a manager or become outside investors.

Each enterprise lasts for one period after which outside investors have to decide whether to refinance the enterprise, or to transfer their capital to the outside option.

Enterprises earn a rate of profit G with probability p (the probability of "good luck"), and B otherwise, with G > B. The expected rate of profit is H = pG + (1 - p)B and exceeds R, justifying the existence of the industry. Here G and B are exogenous - we are operating in a small open economy facing fixed world prices and exogenous shocks to output.

In the 'understanding' between insiders and outsiders (essentially a promise by insiders to outsiders), outsiders are to receive an (endogenous) expected dividend of D on their capital S, the actual amount received in any period being proportional to G/H or B/H depending on whether good or bad luck has been realized. Insiders as a whole are to receive this expected dividend of D on their capital (M owned by managers and F) plus an extra amount such that the insiders' and outsiders' payoffs sum to total firm profits. Insiders on average must get at least as much as outsiders do, otherwise they prefer to be investors in other people's firms rather than to set up firms of their own. To simplify the analysis, we assume that this is true not only ex ante, but ex post as well. The firm's assets are redeployable so that if the enterprise is dissolved, erstwhile insiders may still invest their assets in other firms or in the outside option.

The understanding between insiders and outsiders is not enforceable because the state of firm performance (whether the firm has experienced good or bad luck) is observable only by insiders - it is not observable or legally verifiable by outsiders. Insiders can cheat by paying the outsiders their "bad luck" dues even when good luck has occurred – appropriating the excess. M, F, S, G, B and p are all taken as exogenous by the individual outsider. Moreover, outsiders can observe the aggregate ratio of outsider to insider capital, which we denote by s.

A publicly observable signal detects cheating with an accuracy (probability) q but only after it has occurred. The information it conveys is available to all investors at the beginning of the next period.

We assume that DB/H < R, so that investors prefer not to enter the industry if they expect to receive only their bad luck dues. A sufficient condition for this to hold for all

non-negative D and positive R is that B should be non-positive. A weaker sufficient condition is that B should be smaller than R. This is sufficient because as we will argue below, D can never credibly exceed H as this would be known to violate the insider's participation constraint, making potential insiders more eager to become outside investors in other firms than to set up their own firms.

We also introduce an agency structure within the firm. We assume that the firm is characterized by an internal division of labor - all executive decisions are taken by an executive[5] with his personal objective function while the "firm" is broadly defined as the authority that hires and fires him. The firm can use two instruments to control the executive – the compensation contract (assumed to be perfectly verifiable and enforceable) and the threat of dismissal (where this threat is credible). The executives unconditionally maximize their expected payoff. We assume further that the supply of executives is infinitely elastic at price zero up to the limit set by the number of individuals with managerial talent, and perfectly inelastic thereafter. However the capital they own has an outside option.

Traditionally the agency problem has been viewed as a conflict between the interests of the shareholders and the manager. A vast body of literature in corporate finance (Aghion and Bolton(1992), Innes (1990), Jensen(1986) etc) deals with a manager who either because of his private objectives or due to the nature of his compensation contract, may take decisions which are sub-optimal for the firm – whether such decisions involve exerting too little effort, or choosing the wrong kinds of projects. In our treatment of the theme, we emphasize that the "investors" or "outside shareholders" are distinct from the "firm insiders" while at the same time, we also stress a possible conflict of interests *within* the insiders - the board and the executive. The distinction we draw between insiders and outsiders is that only insiders, who directly run the firm, know the true state of firm performance. We also assume that the outside shareholders do not have an active say in decisions such as hiring and firing managers, which is typically something the board of directors would do. However the outsiders can observe such actions taken by the board and may draw their own inferences. Thus in our setup shares may be too widely dispersed for individual outside shareholders to be able to effectively exercise control over management.

As for the conflict of interest between the manager and the board, the manager can siphon off private gains for himself beyond those envisaged by the board while setting his compensation package. Thus, a manager, while cheating investors, can also appropriate some "private gain" (subject to a cap that is linked to the size of the firm) which comes out of the firm. The maximum that he can steal – with impunity for the moment – is proportional to the size of the firm: we assume that it is a fraction ε of total insider assets (F + M). A larger theft would be provable in a court of law, and therefore may be ruled out by sufficiently harsh penalties. The introduction of private gains drives a possible wedge between the board's interests and the manager's.

We also assume that cheating, once exposed, becomes common knowledge and part of collective memory, so that firms that have been dissolved due to the exposure of cheating and a consequent exodus of investors cannot be set up again. Executives who have been exposed as cheats are dismissed and never rehired.

Of our assumptions, the one that needs further discussion is that of no savings. We assume zero savings so as to focus on the distinctive consequences of cheating without our results being obscured by the changing dynamics of the accumulation and distribution of wealth. Zero saving makes the distribution of wealth exogenous. It eliminates complex feedback effects such as the possibility that firms that go public may ultimately save enough out of current income to raise entrepreneurial wealth above the threshold needed to set up business without reliance on outside capital.

In our model, the no-savings assumption can possibly be justified as follows. With the standard postulate of risk-neutrality and constant time-preference, the intertemporal utility function can be written as

$$U = \sum \delta^t c_t$$

where c_t is consumption in the t-th period. The net gain in utility from a one-period postponement of a unit of t-th period consumption is then

$$\delta^t[-1 + \delta(1 + r_t)]$$

where r_t is the return to capital in the t-th period. With risk-neutrality, savings are no longer needed to smooth consumption. They now reflect only the difference, if any, between the rates of time-preference and of return to capital. When these are independent of consumption, savings have a bang-bang character. If capital is consumable and time

preference higher than the rate of return, all wealth is consumed in the first period. If the rate of return is higher, all income is saved and consumption perpetually deferred. Savings will be exactly zero if (1) capital is not consumable (again a standard assumption, see Bernanke and Gertler, 1989) and (2) time preference is higher than the rate of return.[6] In a model where the highest rate of return is H, it is sufficient for zero savings if $H < (1 - \delta)/\delta$ – a restriction not inconsistent with any of our results.

One question of course remains. Where did the wealth come from if there are no savings? All wealth could be land, where output has a life-span of just one period. In an industrial economy, wealth could be machinery that the country receives through foreign aid or as war reparations. We wish to focus on the problem of cheating independently of the level or distribution of wealth; and all we need is that the zero-savings assumption should be self-consistent, not that it should be realistic.

3. Requirements for Equilibrium

Equilibrium in our model has a variety of requirements. First, it should be possible for outsiders, in the light of observable parameters and known managerial contracts, to invest in a firm, at least up to a limit, without concern about being cheated. Second, given such outsider behavior, boards should be able and willing to design contracts that induce managerial honesty. Third, boards and managers should be able to achieve mutually satisfactory one-to-one matches, to the extent that their relative numbers allow. (Note that the number of boards is endogenous). Fourth, the number of firms should be no larger than the number of managers in the economy or the (endogenous) number of boards. Fifth, given the exogenous opportunity cost of capital, the supply and demand for outsider capital should balance at its current rate of return – except for the possibility of excess supply when rate of return is just equal to opportunity cost. Finally, the market for holders of wealth (whether possessing managerial ability or not) should clear in the sense that their choice between entrepreneurial or managerial and outsider roles, given their wealth levels, the rate of return and the number of firms, is compatible with the market demand for entrepreneurial or managerial insiders and outsiders implied by the demand for capital and for managers

Fortunately, the first three requirements are analytically separable from the last three. We can solve for the first three equilibrium conditions for a given rate of market

return to capital in the first stage. In the second stage, we endogenize this rate of return in terms of the last three requirements which are essentially market-clearing conditions.

4. The Time Profile of the Game

The timing of moves is as follows. First, firms announce compensation contracts. Boards recruit from the pool of available executives. Then outside investors decide whether to invest or not. The information available to them at this point relates to the managerial contract, the firm's choice of managers, the payoffs distributed by the firm earlier and the public signal that gives a clue as to whether the insiders cheated in the previous period. Finally, firms realize their outcomes. Managers distribute payoffs to shareholders, having decided whether to be honest or to cheat (their outside shareholders and also perhaps their boards) in the process. The public signal indicates cheating by the executive with probability q. Firms decide whether to retain their executives or to dismiss them. Investors decide whether to reinvest in their existing firm or withdraw and invest elsewhere. This cycle is then repeated indefinitely.

5. The Outsider and the Insider.

We begin our analysis of this game by examining how different agents react to a given market rate of return D on capital. Assume that there is a managerial contract that induces honest behavior by managers and is common knowledge. When will manager and board have no incentive to secretly renegotiate to form an insider coalition in order to cheat outsiders? The answer to this question is provided by

Theorem 1. There is a ceiling to the ratio of outsider to insider capital below which insiders would reduce their combined income by cheating. This ceiling is positive if and only if $\frac{(1-\delta)DL}{H} > \delta q(H-D)$, where L = G-B**.** If, on the other hand, $\frac{(1-\delta)DL}{H} < \delta q(H-D)$, the ceiling is negative, so that no outsiders will invest and the firm cannot form.

Proof of Theorem 1: Outsiders can only expect to lose by maintaining their stake in a firm that has been exposed as a cheat: they will seek to deter cheating by the credible

threat of withdrawal which implies dissolution of the firm and permanent loss to the insiders of any surplus they may have enjoyed[7]. Given these threat strategies, we can work out when the expected combined income of board and manager from the honest contract equals or exceeds that derived from cheating (followed by possible exposure). Y_h , the expected combined income of insiders from the honest contract, is given by

$$Y_h = \frac{H(F+M+S)-DS}{1-\delta} \tag{1}$$

while their combined income from cheating Y_c is

$$Y_c = H(F+M+S)-\frac{DSB}{H}+\frac{\delta pq(F+M)D}{1-\delta}+\delta(1-pq)Y_c \tag{2}$$

Here the first term on the RHS is the expected total return to capital, the second the mandatory payment to outside shareholders even when bad luck is announced, the third the present value of the outsider dividend which is all that the insiders can earn after being exposed as cheats, and the fourth the continuation payoff if they manage to escape exposure. This implies

$$Y_c = \frac{H(F+M+S)-\frac{DSB}{H}+\frac{\delta pq(F+M)D}{1-\delta}}{1-\delta(1-pq)} \tag{3}$$

Honesty is worthwhile if $Y_h > Y_c$ – which reduces to

$$s \leq \frac{\delta q(H-D)}{(1-\delta)\frac{DL}{H}-\delta q(H-D)} = s^* \tag{4}$$

where s = S/(F + M) is the ratio of outsider to insider capital and L = G-B**.**

Now s* > 0 if and only if $\frac{(1-\delta)DL}{H} > \delta q(H-D)$. In that case, outsiders, by restricting the ratio of outsider to insider capital, can preempt a collusive coalition between the insiders and forestall renegotiation. **Q. E. D.**

This leads to

Corollary 1. An implication is that the total wealth of entrepreneur and manager together must exceed $\underline{I}/(1 + s^*)$ if they are to set up an enterprise.

Corollary 2. A further implication is that, as long as H > D, so that entrepreneur and manager enjoy a combined profit of H – D on each unit of outside capital, it is in their common interest to apply for outside capital till s has been driven up to the credibility ceiling s*. Moreover, D will never exceed H as this would violate the insiders' participation constraint, since in that case being an outsider would clearly be more attractive than becoming an insider. In equilibrium therefore, $s = s^*$.[8]

6. The Board and the Manager

Even though outside investors can insure themselves against a coalition to cheat between board and executive by maintaining $s \leq s^*$, this does not guarantee that executives lack a private incentive to cheat. That would follow only if there exists a managerial contract that makes honesty individually worthwhile for the manager (with $s \leq s^*$). Managerial contracts are common knowledge when initially announced. A contract (Φ, A) specifies the manager's bonus Φ which is a share in the insiders' profits as well as a fixed salary A. Φ includes a share not only in the insiders' legitimate profits, but also in their one-time cheating gains – extracted by paying outsiders their "bad luck dues" even when luck has been good. The size of such gains would then be the difference between the outsiders' dues in the good and the bad states – that is, $DS\frac{G}{H} - DS\frac{B}{H} = \frac{DSL}{H}$ where $L = G - B$. We focus on contracts that specify non-negative values of both Φ and A and a positive value for at least one of them**.** In addition to his salary and bonus, the executive earns profits on his stock holdings in the firm – and of course he can steal from the firm. All thefts, in turn, run the risk of being detected (with a probability q) by the public signal at a later date.

Theorem 2. (1) If $\frac{DLs^*}{H} > \varepsilon$ there exists a feasible managerial contract that induces managerial honesty. This contract prescribes a zero bonus share for the manager and a salary defined in terms of observable parameters. Given such a contract**,** managers prefer wealthier boards and boards would not object to wealthier managers.

(2) If $\frac{DLs^*}{H} < \varepsilon$, no credible contract exists so a firm with an entrepreneur-manager pairing cannot form.

Proof of Theorem 2: The manager's honest one-period income I_h comprises contractual salary, bonus and profits on holdings of company stock.

$$I_h = A + \Phi[(F+M+S)H - DS - A] + \frac{M}{M+F}(1-\Phi)[(F+M+S)H - DS - A]$$

$$= A\frac{F(1-\Phi)}{M+F} + [H(F+M+S) - DS]\frac{M+\Phi F}{M+F}$$

$$= A\frac{F(1-\Phi)}{M+F} + [H + (H-D)s^*](M+\Phi F) \tag{5}$$

His surplus over his outside option is less by DM. His one-time cheating gains are

$$\varepsilon F(1-\Phi) + \frac{DLS}{H}\frac{M+\Phi F}{M+F}$$

$$= \varepsilon F(1-\Phi) + \frac{DLs^*}{H}(M+\Phi F) \tag{6}$$

He will be honest if and only

$$\varepsilon F(1-\Phi) + \frac{DLs^*}{H}(M+\Phi F) \le \frac{\delta q}{1-\delta}[A\frac{F(1-\Phi)}{M+F} + \{H + (H-D)s^*\}(M+\Phi F) - DM] \tag{7}$$

The board designs the managerial contract so as to maximize its honest one-period income

$$\Pi_h = (F + M)H + S(H - D) - I_h \tag{8}$$

subject to the manager's honesty constraint and its own participation constraint

$$\Pi_h \ge FD. \tag{9}$$

Assume that the manager's honesty constraint binds. Differentiating the resulting equation with respect to the contract parameters A and Φ,

$$\frac{1-\Phi}{M+F}\frac{dA}{d\Phi} = \frac{A}{M+F} - \{H + (H-D)s^*\} + \frac{1-\delta}{\delta q}(\frac{DLs^*}{H} - \varepsilon) \tag{10}$$

Differentiate the board's profit function with respect to the same parameters and insert the expression for $\frac{dA}{d\Phi}$. Then

$$\frac{1}{M+F}\frac{d\Pi_h}{d\Phi} = -F\frac{1-\delta}{\delta q}\left(\frac{DLs^*}{H} - \varepsilon\right) \tag{11}$$

Thus, if $\frac{DLs^*}{H} > \varepsilon$, $\frac{d\Pi_h}{d\Phi} < 0$, so that the optimal bonus of the manager is $\Phi^* = 0$. This happens when the maximum that the manager can steal from the board is less than what insiders can steal from outsiders. If this inequality is reversed, a firm which pairs an entrepreneur and a manager cannot form – only firms run solely by managers will exist.[9] (setting $\Phi^* = 1$).

If $\Phi^* = 0$, I_h reduces to

$$A\frac{F}{M+F} + \frac{M}{M+F}\{H(M+F) + S(H-D)\} \tag{12}$$

and Π_h to

$$F\{H + s^*(H-D) - \frac{A}{F+M}\}. \tag{13}$$

If the manager's honesty constraint binds so that $A = A^*$, the salary just sufficient to induce honesty, and Π_h^* is the associated one-period profit, it can be checked that

$$\frac{d\Pi_h^*}{dM} = 0 \tag{14}[10]$$

The manager who acts honestly has two sources of income, the salary A^* and insider profits on his investment. Given that $\Phi^* = 0$, the honesty constraint defines A^* as

$$A^* = (M+F)\left[\frac{1-\delta}{\delta q}\left(\frac{DLs^*M}{HF} + \varepsilon\right) - \frac{(H-D)(1+s^*)M}{F}\right] \tag{15}$$

$$= \frac{1-\delta}{\delta q}\varepsilon(M+F) \tag{15a}$$

The manager's insider profits work out to

$$P = M[H + (H - D)s^* - \frac{A^*}{M + F}]. \quad (16)$$

His total honest income per period adds up to

$$DM + \frac{1-\delta}{\delta q}(\frac{DLs^* M}{H} + \varepsilon F). \quad (17)$$

This is an increasing function of F: the manager would prefer to work for a wealthier entrepreneur. An important implication of this is that the manager's income for any positive F is higher than that for F = 0: the manager prefers working as a manager to setting up an independent enterprise even if he has enough wealth to do so.

The manager's income is also increasing in M, which means that the manager would prefer to invest all his wealth in the firm of which he is a manager.

Q. E. D.

Corollary. The existence condition for a feasible managerial contract $DLs^*(D)/H > \varepsilon$ implies $Ds^*(D) > \varepsilon H/L$. Since $Ds^*(D)$ is a decreasing function of D, this condition sets an upper limit $\check{D}$ to the return on capital given by $\check{D}s^*(\check{D}) = \varepsilon H/L$: if D exceeds this limit, a managerial contract that induces honesty is infeasible. However, people with managerial ability could still set up proprietorial firms if their personal wealth exceeds the threshold $\underline{I}/(1 + s^*)$.

How does one interpret the existence condition? It can readily be checked that for managers to be paid a salary A* that would deter them from cheating (see equation 15a) while all owners of capital, insiders as well as outsiders, receive at least the market rate of return, it is necessary and sufficient that $DLs^*/H > \varepsilon$. The condition therefore refers to the ability of the firm to pay the manager an 'honesty wage' (comparable to the Shapiro – Stiglitz 'efficiency wage').

Where $D < \check{D}$, feasible managerial contracts exist, managers prefer wealthier boards and boards have no objection to wealthier managers. Further, a person with managerial ability and wealth M has four options: (A) assuming a managerial role in a partnership and receiving an income of $M[H+s^*(H-D)]+A^*N/(N+M)$ where N is the wealth of the partner (who may or may not have managerial ability); (B) assuming a

non-managerial role in such a partnership and receiving M[H+s*(H-D)-A*/(M+N)]; (C) setting up an independent enterprise and receiving M[H+s*(H-D)]; (D) investing their capital in other firms as outsiders and earning MD. It is evident that he will prefer option (A) over (C), and both (A) and (C) over (B). Substitutions for s* and A* would also indicate that option (B) is better than (D). Those with managerial ability therefore would prefer managerial roles: they seek out individuals without managerial ability as partners (since those with managerial ability would not want non-managerial roles). If there are none available, they manage their own firms, provided they are wealthy enough to do so. If they are not, they form partnerships with others of similar status if their combined wealth reaches the entry threshold. When this option too is exhausted, they are reduced to being outside investors.

Thus, a simple two-sided matching process with full information is set up with a stable equilibrium in which positive assortative matching (indeed segregation) in the dimension of wealth occurs**:** the wealthiest board hires the wealthiest manager among those on the market, the second richest board employs the second richest manager, and so on. However, this process is subject to the constraint that the combined wealth of board and manager should be at least as large as the investment requirement for entry:

$$F + M \geq \underline{I}/(1 + s^*). \qquad (18)$$

Accordingly, the chain of matches ends either if this threshold for aggregate wealth is reached or if the supply of either boards or managers on the market runs out**.** If the chain ends because the supply of wealth-holders without managerial skill is exhausted, owner-managed firms could still be established by individuals with managerial skill, provided their personal wealth exceeds the entry threshold**.** And when this supply too is exhausted, partnerships could be formed by those whose combined wealth exceeds this limit. Outside capital would be supplied by aspiring managers whose combined wealth, even after pairing, would not reach the floor required for entry.

The terms of agreement between managers and boards depend on which of these terminal constraints to the matching process binds. If either combined wealth or the number of entrepreneurs sets the limit to firm formation, the managerial honesty constraint will determine the manager's salary. If however the scarcity of available

managers is the crucial factor, managers will be able to bargain their salaries above the minimum necessary to induce honesty. Suppose there are N managers (indexed 1, 2, …..N in decreasing order of wealth). Suppose that boards are similarly indexed and that the wealth of the (N + n)-th board, together with that of the N-th manager, just fulfils the criterion $F_{N+n} + M_N \geq \frac{\underline{I}}{1+s^*(D)}$ where the subscripts of F and M indicate the rank (in order of wealth) of the relevant entrepreneur or manager. The N-th manager can choose to link up with the N-th board or with the (N + 1)-th or with boards even lower in the hierarchy down to the (N + n)-th. The maximum he can extract from the N-th board is what he would get if the board is reduced to its reservation rate of return on capital, D. This amounts to $HM_N + (H - D)\{F_N + s^*(F_N + M_N)\}$. However, the manager's own reservation payoff in this bargain is the maximum he could have extracted from the (N + 1)-th firm: $HM_N + (H - D)\{F_{N+1} + s^*(F_{N+1} + M_N)\}$. The bargaining outcome should lie somewhere in this interval: we assume for simplicity that it will correspond to the board's participation constraint, but we can readily accommodate other bargaining processes and outcomes. Likewise, for any i < N, the i-th board and the i-th manager team up under a contract that guarantees the manager the entire surplus while leaving the board with a return of D on its capital.

7. A General Equilibrium

Having worked out the responses of different agents to a specific market rate of return on capital, we now embed our analysis in a general equilibrium model to endogenize D. A given market level of D implies a specific value of s*(D) and a fixed investment requirement $\frac{\underline{I}}{1+s^*(D)}$. However, the implications are different according to whether firms are owner-managed or set up by manager-entrepreneur pairs. If they are owner-managed, only those with managerial ability can be insiders. As D drops below H, s* increases from zero, and the wealth requirement for entry $\frac{\underline{I}}{1+s^*(D)}$ falls, more and more members of this class can set up firms and demand more outside capital. Members of this class who cannot enter at the current level of D contribute to outside

capital supply. The entire wealth of those who lack managerial ability will also be a component of outside capital supply, regardless of the value of D. The resulting demand and supply curves for outside capital are depicted as the dashed curves in Fig. 1.

If however firms are entrepreneur-manager combines, they cannot exist if D > H or D > Ď. But if Ď > D and H > D, manager-entrepreneur partnerships are feasible and will in fact be the preferred form of enterprise. Even the owner-managed firms that were the only feasible enterprises at higher levels of D would now reinvent themselves and pair off with non-managerial wealth-holders. As one reads down the list of potential firm-manager matches, the last match with a combined wealth of at least $\frac{\underline{I}}{1+s^*(D)}$ represents the last firm that is just viable at this D. No more matches may be feasible for one of three reasons: (1) though there are other potential entrepreneur – manager pairings, their combined wealth is less than the minimum investment requirement; (2) there are no more entrepreneurs to match the potential managers; (3) there are no more managers to match the potential entrepreneurs.. The first two of these reasons imply that the binding constraint on the optimal contract decision is the managerial honesty requirement, the third corresponds to the case where the board's participation constraint binds.

As D declines, s* rises, so that the investment requirement falls and, in Case (1) above, more manager-entrepreneur pairs can enter and set up firms. Further, each firm can credibly apply for more outsider capital. The demand for outsider capital X_d rises on both counts. In Case (2), despite the fall in investment requirement, there is no change in the number of partnerships due to the scarcity of entrepreneurs. However, aspiring managers who cannot find non-managerial partners may now set up proprietorial firms if their personal wealth exceeds $\frac{\underline{I}}{1+s^*(D)}$. And less wealthy people with managerial skill could pair off to form firms if their combined wealth reached this limit. As D drops, more and more of such individuals (or pairs) will switch away from the ranks of outsiders to set up business on their own. In Case (3), however, there can be no additions to the number of incumbents since we have reached the limit to firm formation set by the essential input, managerial skill. However, in all three cases, incumbent firms will demand more outside investment as the credibility ceiling rises with the decline in D.

In any event, therefore, the demand for outside capital will be a continuously decreasing function of D.

As D drops to $\delta pqH^2/\{(1-\delta)L + \delta pqH\}$, s* tends to infinity, so that the demand curve for outside capital is asymptotic to this level of D, whether firms are owner-managed or run by entrepreneur-manager pairs.

The supply of outside capital X_s comprises the wealth of all those who cannot set up firms, whether because they, singly or along with their partners, do not command the minimum necessary funds to do so, or because they cannot find managers. As D falls, as long as the supply of managers is unexhausted, more people can set up firms and the supply of outside capital diminishes in steps as more wealth is diverted by new entrants to the industry. Eventually, however, the supply of managers runs out and no more firms can be set up; further fall in D does not reduce outside capital supply until D drops to R, the opportunity cost of outside capital. For D below R, the supply of outsider capital falls to zero.

The demand and supply curves for outside capital generated by pair-wise associations of insiders are the solid curves in Fig. 1. Since such associations survive only when $D \leq \check{D}$, the composite demand and supply curves will comprise the solid curves at or below this level and the dashed curves above it. At $D = \check{D}$, there is a quantum leap in the demand for outside capital as many more wealth-owners qualify as insiders than at higher levels of D. Given the configurations actually depicted in Fig. 1, equilibrium will occur at the intersection of the solid curves with $D < \check{D}$, implying that all firms are entrepreneur-manager pairs.

What parameter values make it more likely to have an equilibrium value of D in excess of $\check{D}$? It is straightforward to prove that $\check{D} < H$. Now holding ε fixed, the equilibrium $D > \check{D}$ is likelier if q,δ and H are high, and L is small: this will result in a high credibility ceiling s* and enable each firm to demand more outside capital : therefore the demand curve for outside capital lies far to the right and is likely to intersect the supply curve of outside capital only at a high value of D. In this case, the demand for outside capital will come from sufficiently wealthy owner-managers, while the supply of outside capital will come from all other wealth holders. If no one with managerial ability

has sufficient wealth to set up an owner-managed enterprise, industry cannot take off. On the other hand, if q, δ and H are low, or L is high, s* will be low so the credible level of demand for outside capital will be low relative to its supply and the two will be equalized at a low equilibrium value of D. In this event, entrepreneur-managerial pairings are likelier to be the preferred form of enterprise and firm size will be large because of a larger insider base. Holding other parameters fixed, a small ε ensures a high $\check{D}$ so that $D < \check{D}$ is likelier. If the manager can steal a large fraction of assets from the board without legal reprisal he must be paid a high "honesty wage" to prevent this, which is more likely to rule out feasible managerial contracts so that only owner-managed firm are feasible.

The demand-supply equilibrium is illustrated in Fig. 2. Depending on the relative positions of the demand and supply curves and the corresponding intersections, a variety of outcomes is possible, of which we focus on five:

1. An equilibrium above the flat segment of the demand curve at $D = \check{D}$ where the honesty wage cannot be paid and only owner-managed firms can exist**.**
2. An interior equilibrium (the one actually depicted in the figure) in which the managerial honesty constraint binds.
3. An equilibrium on the vertical segment of the supply curve furthest to the left, where firm formation is restricted by the scarcity of managers.
4. An equilibrium on the lowest horizontal stretch of the supply curve where the return to capital has fallen to its opportunity cost. In this event, as in the previous one, an excess supply of capital (owned by the class that is in surplus) emerges and takes shelter in its outside option.
5. Non-existence of equilibrium when the maximum return to capital that the system can generate is below its opportunity cost so that industrialization is impossible.

We elaborate briefly on the interior equilibrium referred to above. Consider the two separate wealth distributions, one for individuals with managerial ability and another for those without. Consecutively pair off an individual in each group with one in the other in descending order of wealth to generate a composite wealth distribution: after

one group is exhausted, the composite wealth distribution will be identical with the distribution of wealth among the remaining members of the other group. Suppose K is the aggregate wealth of the economy and P(W) the fraction of total wealth owned by pairs or, where pairing is impossible, by individuals with composite wealth below W. Then the total demand for outside capital generated by the entrepreneurs who can enter is

$$X_d = K[1 - P(\frac{\underline{I}}{1+s^*})]s^* \tag{19}$$

Here, the term in square brackets represents the ratio of managerial and entrepreneurial capital to the total wealth of the economy. The RHS, therefore, represents the amount of outside capital that firms can apply for without compromising their credibility.

The total supply of outside capital is the total wealth of pairs and relevant individuals below the minimum threshold required for entry:

$$X_s = K\,P(\frac{\underline{I}}{1+s^*}) \tag{20}$$

We need not consider the constraints on firm formation imposed by the number of managers or boards, since these constraints do not bind here. The interior equilibrium is then defined by

$$s^* = \frac{P(\frac{\underline{I}}{1+s^*})}{1 - P(\frac{\underline{I}}{1+s^*})} \tag{21}$$

The optimal ratio of insider to outsider capital just matches the ratio of total wealth owned by pairs above the minimum wealth requirement for entry to that owned by pairs and individuals below it: it is uniquely determined by the composite wealth distribution (which in turn is uniquely determined by the wealth distributions for our two classes).

8. Discussion

We model two kinds of credibility concerns. Given asymmetric information (with regard to firm performance), outside investors realize that if they provide more than a certain amount of financing to any one firm, that firm's temptations to cheat them may be too strong. However, even if outsiders limit their stake in the firm to a level that implies that insiders collectively gain nothing from cheating, this does not suffice to ensure honesty except where there is only one insider (the owner-manager). Where there are

two, the manager individually must have no incentive to cheat, which requires a contract that pays him an "honesty wage" but no bonus share in profits. However, even if the law mandated or competition compelled public observability and transparency of managerial contracts, this would not render the credibility ceiling on the outsiders' stake redundant: the possibility of false disclosure and secret renegotiation between manager and board would persist unless outsiders impose this ceiling.

The ceiling, s*, is a decreasing function of the discount rate and of D, the cost of outside capital and an increasing function of q, the probability of detection. Depending on these parameters, it sets limits to outside participation in a firm, and, given a minimum size of enterprise, determines the wealth requirement for insiders to enter. Two people would find it easier to fulfil this requirement with their combined wealth than would one person. However, the association of two people, an entrepreneur and a manager, creates a new credibility concern: how does the entrepreneur deter the manager from cheating? We have shown that a contract exists that could accomplish this, but that this contract is feasible only for $D < \check{D}$. Above $\check{D}$, only owner-managed firms can survive, that too only if the owner-manager's wealth, singly, exceeds the entry requirement. This is outcome 1 in the previous section. It is likely to occur if a few individuals with managerial ability own a large fraction of total wealth, so that the segment of the demand curve above $\check{D}$ is wide and the supply curve (which reflects the wealth of all the others, who would be outsiders at these levels of D) far enough to the left for an intersection here. For a given distribution of wealth, the greater the fraction of insider assets a manager may feasibly steal without legal repercussions, the more the likelihood of a situation where only owner-managed firms are feasible.

We now turn to some developmental implications of our model[11]. In poor countries, industrialization is hampered not just by an aggregate scarcity of wealth but by difficulties in mobilizing and concentrating it to support large-scale industry if it is too thinly spread. This is due in part to the well-known constraints on borrowing. Our model demonstrates that raising share-capital is also subject to a credibility ceiling, a limit on the ratio of outsider to insider capital set by concerns over cheating. This is one reason why share markets are underdeveloped in most poor countries and why firms in early modern Japan, Korea and India and within the Chinese Diaspora relied so heavily on

extended family groups within which credibility was less of a concern than in an anonymous share market. This is also perhaps the reason why governments like the Korean deliberately skewed income distribution towards the chaebol, enabling the accumulation of personal fortunes that could help in building up credible large-scale industries[12].

If a market exists, if, for instance, we have a regular interior equilibrium, the return to outside capital D will decrease as the distribution of a given aggregate wealth becomes more equitable: if P( ) is higher for any W, the equilibrium ratio of outsider to insider capital s* will be higher, the demand curve for outside capital $X_d(D)$ will shift leftward, the supply curve $X_s(D)$ will shift rightward, so that D falls. With increasing equity, the equilibrium level of D may fall below R, so that the market disappears.

This view of equity as inimical to industrialization contrasts strongly with received doctrine. Murphy, Shleifer and Vishny (1989), for instance, see equity as the basis of a homogeneous mass market for manufactures that fosters industrialization. This, however, is a demand-side phenomenon. It affects output only if the production pattern reflects the consumption pattern, as it must in a closed economy. In a small open economy – as in our model - the two are independent.

Empirical evidence on the effect of initial inequality on growth is mixed. While earlier cross-sectional studies tended to suggest a negative relationship between inequality and growth, (for example, Persson and Tabellini (1994)), recent work seems to indicate otherwise. Forbes (2000) and Li and Zou (1998) discover a positive relationship. They use fixed effects and trace the negative relationship in earlier studies essentially to omitted variables. Deininger and Squire (1998) and Barro (2000) find mixed results for panels while Banerjee and Duflo (2003) find that inequality as such is neutral in its impact on growth, though changes, both positive and negative, in inequality tend to erode growth. Given traditional theoretical arguments in favor of a negative impact of inequality on growth[13], why has the empirical evidence been so mixed? Our model suggests a possible factor. Whether or not large indivisibilities are present in the form of minimum enterprise size requirements, the credibility problem we have modeled means that it will be difficult to mobilize external funds for industry. In a poor society equality beyond a point may thus hurt industrial takeoff prospects via the mobilization problem,

because individuals lack sufficient personal wealth to start an enterprise – a problem which some degree of inequality might have solved. This factor may serve to offset potential negative effects of inequality, resulting in mixed empirical evidence.[14]

Given the same Lorenz curve, a higher aggregate wealth facilitates industrialization. P(W) is smaller for a given level of P, so that, other things being equal, outside investors will enjoy a higher expected income D. A wealthier economy finds it easier to sustain a credible capital market. We have yet another factor that tends to make industrialization a cumulative process and yet another vicious circle of poverty.

Finally, if the minimum-size constraint (18) binds, an increase in minimum firm-size $\underline{I}$ with the same level and distribution of wealth will increase P for any given s*: the demand curve for outside capital will fall and the supply curve rise, reducing D and increasing s* in equilibrium. Technological indivisibilities make for missing markets.

These conclusions are valid if there is no agency structure within the firm. They also hold if there is – but in this case, the mobilization of capital is facilitated by the association of two wealthy insiders. Such an association occurs if and only if $D < \check{D}$. If $D > \check{D}$, we are back in the more difficult case of the owner-manager who has to meet the minimum capital requirement for entry all on his own.

If the aggregate ratio of outsider to insider capital can be concealed (for instance by secret selling of insider stake) cheating can occur, as the actual ratio might well be raised beyond the safe limit. Empirical evidence suggests (1) that a high ratio of outsider to insider capital intensifies moral hazard (Joh [2003], Lemmon and Lin [2003]),(2) that cheating is negatively associated with the salary component of executive pay (Peng and Roell [2004]), (3) that long term shareholder returns, presumably negatively correlated to executive cheating, are also negatively related to 'incentive payments' (share-based pay) to executives (Crystal [1991]) and (4) that the separation of managers from compensation committees has not lowered executive pay (Anderson and Bizjak [2003]). All these findings bear out our conclusion that paying the manager enough – even when he has no say in the matter – may be a condition for credibility, provided this compensation does not include a bonus share in profits.

9. Conclusion

We embed a repeated game with imperfect information and stochastic market outcomes between holders of wealth (with and without managerial ability) in a general equilibrium setting. We endogenize their choice of roles – as owner-managers, managers, financiers ("boards") or outside shareholders and show that managers will invest their wealth in their own firms. We define the optimal managerial contract (the feasibility of which determines whether the manager owns the firm or is a hired employee) and the optimal outsider stake that deters cheating. We then show how the distribution of wealth determines the equilibrium where it exists and its absence where it does not. We show that an individual with managerial ability prefers to work for an entrepreneur rather than set up his own firm, provided the cost of capital is low enough to make entrepreneur-managerial pairings credible. He also prefers running his own firm to playing a non-managerial role and hiring a second individual as a manager.

Our model helps explain the proliferation of family firms in relatively poor countries, moral hazard induced vicious circles retarding industrialization in poorer economies relative to richer ones with the same degree of inequality, and points to the effects on industrial takeoff of creating wealth inequality in a poor but open economy. It also provides a rationale for paying managers substantially more than their opportunity cost – but not in the form of profit-sharing bonuses.

APPENDIX: Would a different type of contract have done better?

Given that boards are offering their managers contracts as specified in our paper, can any one board do better by offering a different contract where the manager is compensated according to what he pays out to outside investors? Specifically, consider a managerial contract which pays $\gamma DM\frac{G}{H}$ to the manager when he distributes "good luck" payouts to outsiders, and $\gamma DM\frac{B}{H}$ otherwise, where γ is a multiple whose value will be determined below. Regardless of what precise contract is offered to the manager, renegotiation among the board and the manager remains feasible. Accordingly, the credibility ceiling in equation (4) remains relevant.

The incentive compatibility constraint is now

$$\varepsilon(F+M)+\frac{DLs^*}{H}(F+M)-\frac{\gamma DL}{H}M \le \frac{\delta q}{1-\delta}(\gamma-1)DM \qquad \text{(A1)}$$

The left hand side of (A1) shows the manager's one period cheating gains. The first term shows what he can steal from the board, the second term shows what he can steal from outside investors by lying about the firm's output. However if he does this, he himself is paid less according to the terms of his contract, as shown in the third term. The right hand side captures the discounted value of expected losses in the event of exposure by the public signal : thereafter the cheat will only get an outsider's payoff. We note that the manager's expected income from honesty averages out to γDM .

However, for a manager to accept this contract, it must offer him at least as much as what he gets by accepting the other contracts on offer, that is, it must be no smaller than the amount in (17). Thus the manager's participation constraint yields

$$DM+\frac{1-\delta}{\delta q}(\frac{DLs^*}{H}M+\varepsilon F) \le \gamma DM$$

Or

$$\varepsilon F+\frac{DLs^*}{H}M \le \frac{\delta q}{1-\delta}(\gamma-1)DM \qquad \text{(A2)}$$

From a comparison of (A1) and (A2) it is not obvious which is the more restrictive constraint – in the sense of imposing a higher floor on γ. This depends on parameter values.

Now the board maximizes its payoff subject to (A2), (A1) and its own participation constraint (9). Since its payoff is $\Pi_h = (F + M)H + S(H - D) - \gamma DM$, it will obviously choose the smallest possible value of γ which satisfies the more restrictive of (A2) and (A1). We denote by γ^* the value of γ for which (A2) holds as an equality. The γ chosen by the board will thus be either equal to γ^* (if (A2) is the binding constraint), or greater than γ^*, if (A1) is binding instead.

Now any contract which offers the manager more, must leave the board with less. Such a contract might still have been optimal, however, if it makes entrepreneur-manager pairings feasible for a greater range of parameters than in the text. We check this below.

The board's participation constraint gives us

$$(F+M)H+S(H-D)-\gamma DM > DF$$

A *necessary* condition for the board's participation constraint to hold is that it hold for $\gamma = \gamma^*$. If it does not hold for this value of γ, it will not hold for the value chosen optimally by the board (which is greater than or equal to γ^*). Substituting for γ^* using (A2) and rearranging, this necessary condition amounts to

$$(F+M)(1+s^*)(H-D) - \frac{1-\delta}{\delta q}\frac{DLs^*}{H}M - \frac{1-\delta}{\delta q}\varepsilon F > 0 \qquad \text{(A3)}$$

Based on the definition of s*, however, we have

$$\frac{1-\delta}{\delta q}\frac{DLs^*}{H} = (H-D)(1+s^*) \qquad \text{(A4)}$$

Using (A4), we may rewrite (A3) as

$$\frac{1-\delta}{\delta q}F[\frac{DLs^*}{H} - \varepsilon] > 0 \qquad \text{(A5)}$$

From (A5) it is obvious that $\frac{DLs^*}{H} > \varepsilon$ is a necessary, but not always sufficient, for the feasibility of the new managerial contract – while an identical condition was both necessary and sufficient for the feasibility of the kind of contracts considered in the text . Thus this new contract does not expand (and may contract) the range for which managerial contracts are feasible, and leaves the board with less than would the contracts offered by the other firms. Therefore, no board will offer such a contract.

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[1] Individuals are risk neutral hence the diversification motive does not apply.

[2] Green and Porter (1984) discuss how low sales may reflect either low demand or rival pricing strategies by other firms.

[3] Other work which shares the common feature of looking *within* the "black box" of the firm includes models dealing with information flows (eg, Blackwell (1953)), costly supervision limiting the number of hierarchical tiers (eg, Calvo and Wellisz (1978)), career concerns (eg, Milgrom (1988)), authority (eg, Williamson (1975)), and the possibility of side-payments in an owner-supervisor-worker relationship (Tirole (1986)).

[4] This assumption is discussed later in this section.

[5]We use the terms "executive" and "manager" interchangeably and refer to the "board" sometimes as the "entrepreneur".

[6] No individual can dissave by trading capital for output, since, if one wishes to dissave, so will everyone else – so that the potential dissaver cannot find anyone to trade with.

[7] That is, outsiders use the threat of reversion to the Nash equilibrium of the one-stage game. In a one stage game insiders cannot be punished for cheating, so outsiders are sure to get DBS/H <RS by our assumption that DB/H<R. So they would choose to invest only in the outside option.

[8] The ceiling s* is determined by the parameters of the game, for a given D (which is endogenized in general equilibrium). We rule out equilibria which are not based on fundamentals – such as those in which every one shares a common belief about some other value of s*, not necessarily based on fundamentals, and invests accordingly because of the conviction that every one else shares the same belief. This is easily justifiable if we assume the absence of co-ordination devices : in that case common knowledge of every one else's beliefs is ruled out, so each individual bases his or her behavior on fundamentals.

[9] A firm which is run by the manager without any non-managerial entrepreneur would face a similar upper limit on the ratio of outsider to insider (here, managerial) capital compatible with credibility.

[10] To derive this we use the definition of s* in (4).

[11] A related paper, in which however the agency problem within the firm is assumed away, is Guha (2005).

[12] Lal and Myint (1996) provide a good discussion of this.

[13] Apart from the Murphy et al view, which as we have mentioned applies to a closed economy, there are political economy arguments that inequality leads to redistributive policies which hamper growth (variants of which are presented in Alesina and Rodrik (1994) and Persson and Tabellini (1994)) – though Benabou (2000) has argued that neither of these premises holds true in the data.

[14] Admittedly, our problem is considerably simplified because of the static nature of the wealth distribution.

Fig. 1

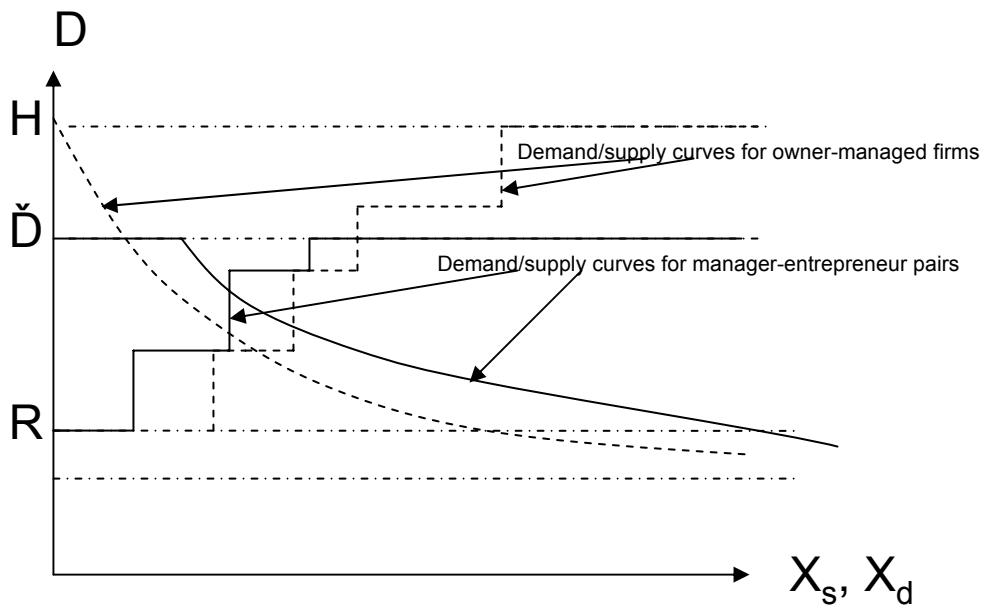
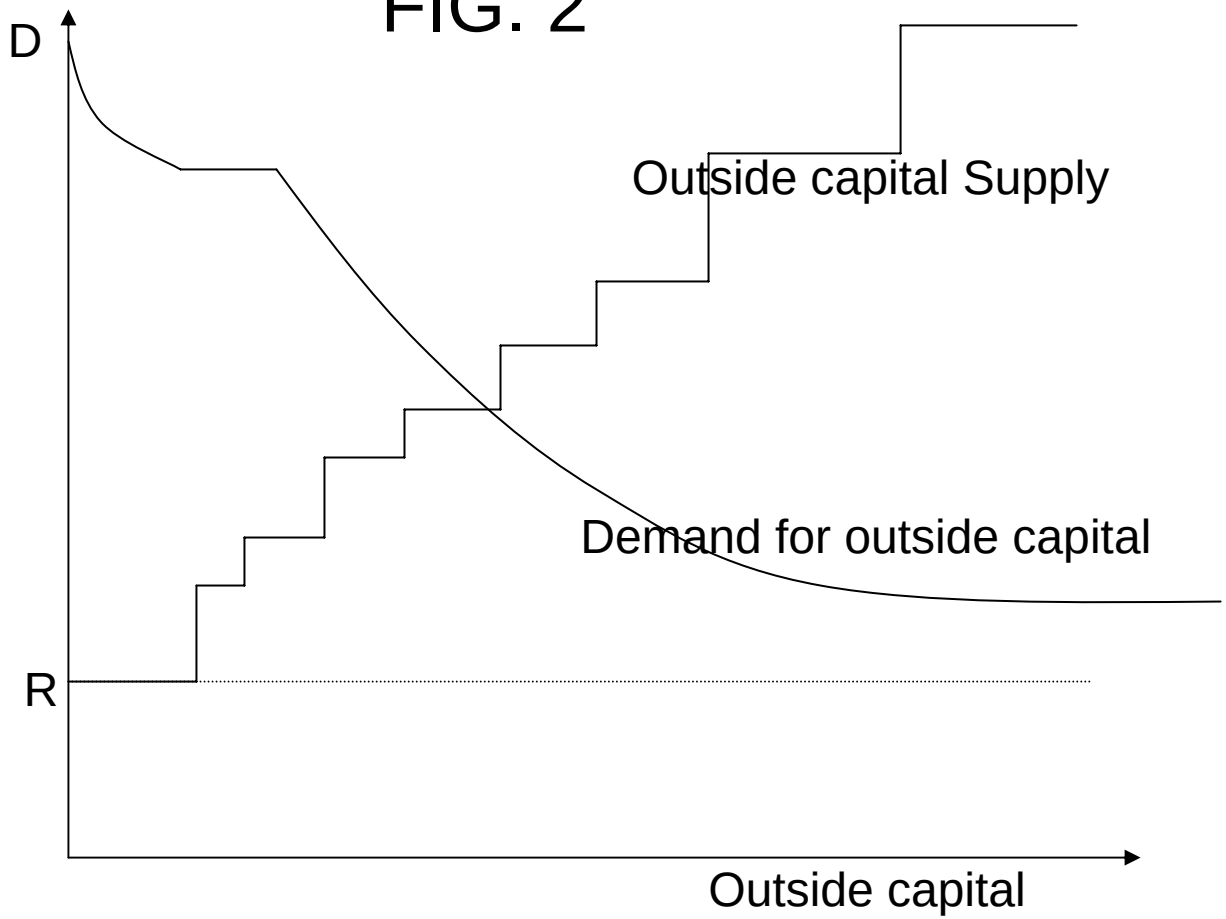

D
H
Ď
R
Demand/supply curves for owner-managed firms
Demand/supply curves for manager-entrepreneur pairs
X_s, X_d

FIG. 2


D
Outside capital Supply
Demand for outside capital
R
Outside capital