IN QUEST FOR EQUITY PARTNERS: THE DETERMINANTS OF THE WILLINGNESS TO GO PUBLIC OR TO FIND A VENTURE CAPITAL PARTNER

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Introduction

Asymmetric information among managers, controlling shareholders and external investors and non competitiveness in the market of investors and financiers may significantly affect availability, conditions and the choice of external equity finance for small and medium sized firms which cannot entirely satisfy their investment needs with retained earnings. The quest for external equity partners may then be a crucial moment in which the financial sector affects real aggregate growth through its impact on the distribution of investment profits and therefore on incentives to run efficiently investment projects. The recent literature focuses on the determinants of the choice of equity financiers with several empirical and theoretical contributions. The main strand analyses costs and advantages of going public (Bolton-Von Thadden, 1998; Ransley, 1984; Pagano et al., 1995a and b; Pagano-Roell, 1996), while only a few papers compare the relative advantage of this choice with the alternative of looking for venture capital partners (Chemmanur-Fulghieri, 1996 and 1999; Barry et al., 1990; Yosha, 1995; Campbell, 1979). On the empirical side, Becchetti-Cavallo (2000) develop a binomial logit test of the determinants of the going public-venture capital choice on a sample of around 4000 small-medium firms and find that investment size, credit rationing (strength of local crime and the inefficiency of the judicial system) positively (negatively) and significantly affect the willingness to look for a venture capital partner, while proxies of the capacity to reduce informational asymmetries with financiers (i.e. product quality certification) positively and significantly affect the decision to go public (see Tab A1 in the Appendix).

The paper adresses these theoretical issues and aims to explain these empirical stylised facts with a simple model which analyses the effect of different variables such as ownership structure, stock market volatility and informational asymmetries among managers, controlling and minority shareholders, on the choice between going public and looking

for a venture capital partner. Under the first option controlling shareholders (from now on CSs) maximise investment profits after satisfying manager reservation wage and minority shareholders reservation value required for the provision of equity finance. Under the second option they bargain their share of investment project with the venture capital partner in a framework in which CSs expected returns under the going public choice represent their "outside option" in case of agreement failure and therefore affect the bargaining outcome.

After outlining this framework the model analyses the effects of project intrinsic value, small shareholders monitoring costs, discount rates, ex ante available cash flow and investment size on the equilibrium CSs profit shares under the two different options. It then draws some testable implications on the effects of changes in the above variables on the relative profitability of the two choices and shows which conditions may generate a divergence between the controlling shareholder and the socially optimal choice between the two options. In the last section it presents some extensions of the base model by analysing how informational asymmetries between the manager and the CSs, stock market volatility, competition in real and financial sector, a more efficient market for corporate control and weak institutional framework allowing illegal diversion of funds may affect the going public-venture capital choice. [1]

2. The base model under feasibility of the going public financing choice

We consider a firm with cash flow CF and an investment project which costs I and can not be entirely internally financed ($I>CF$). The investment project is profitable and yields $(q+e)$, where q is the project intrinsic value and e is managerial effort. The control group[2] of the firm has an ex ante share α_0 of property rights on firm profits where $\alpha_0=1-\alpha_{MS}$. α_{MS}, the share of shareholders which are not in the control group is set equal to zero for simplicity in this base version of the model.

[1] Chemmanur-Fulghieri (1999) is the paper next to ours. The main difference is that we: i) endogenise the venture capitalist bargaining power; ii) implicitly consider the liquidity-control trade-off by linking managerial effort to CSs property rights, ii) evaluate the effect of institutional weakness, market for corporate control and competition in real and financial sector on the venture capital-going public choice; iv) present some empirical findings on the issue which are consistent with model results.

[2] A control group is intended here as a coalition of shareholders with common strategies who have, through their voting rights, a determinant influence on medium-long term firm investment and strategies (and specifically, in our model, on the choice of equity financiers).

The model analyses the interaction among five types of actors. Three are internal to the firm (the manager, the controlling shareholders, the minority shareholders already existing before the decision to finance the new investment is taken), two are external (the venture capitalist if the firm opts for venture capital and new minority shareholders if the firm opts for going public). The manager is in charge of operating the firm and his utility function is equal to $U_M=t-\psi(e)$ where t is its wage, e his effort and $\psi(e)$ effort measured in monetary terms.

Since existing financial slack is not sufficient to finance the new investment the control group must decide whether to finance it by going public or by choosing a venture capital partner. The control group may finance a share $\alpha_0 = CF/I$ of the new investment while it needs from external financiers a share[3] $(1-\alpha_0)= (I-CF)/I$.

We assume here that when the CSs decide to go public they maximise their ex post profit share after remunerating the manager and the new minority shareholders. We consider for simplicity that both the manager and the new minority shareholders are dispersed and have no bargaining power so that it is enough to replace the zero profit condition of the manager and the reservation value of the new minority shareholders in the profit function to solve the controlling shareholders problem.

New minority shareholders are willing to finance the project only if their profits are higher or equal to their reservation value. Imagine for simplicity that this reservation value is equal to $w=(1-\alpha_0)(q+e)$. The rationale is that if the CSs give them a share which is lower than their contribution to the project they may easily find another equivalent project on financial markets where they obtain at least $(1-\alpha_0)(q+e)$.[4] With perfect information and full bargaining power with external financiers $\alpha_1=\alpha_0$ In this case the control group does not dilute its ownership share of more than $(1-\alpha_0)$. On the contrary, when external financiers are imperfectly informed over the

[3] We do not model here firm demand of bank debt. We then implicitly consider that I represents the financing need in excess of the maximum amount of investment which may be debt financed.

[4] We may think for instance that the expected shareholder return in an equivalent project is $[(1-\alpha_0)(q+e)-(I-CF)]/(I-CF)$ and that shareholders invest only if the project has at least this return. The reservation value may seem high as it implies that investment and managerial labour costs fall on CSs. On the other hand, though, $(q+e)$ may be seen as revenues minus investment and managerial labour costs shared by CSs and minority shareholders, while t and I may be interpreted as extra investment and managerial labour costs falling only on CSs. In particular a positive t indicates that part of monitoring costs ensuring managerial efficiency falls only on CSs.

quality of the firm investment and must pay a monitoring cost *mc* proportional[5] to the project value to obtain this information, their reservation value becomes: $(1-\alpha_0+mc)(q+e)=0$.[6]

By replacing manager zero profit conditions and new shareholders reservation value ex post profits of the controlling shareholders may be written as:

$$W_{CS}=[1-(1-\alpha_0+mc)](q+e)-\gamma(e)-CF. \quad (1)$$

or $W_{CS}=\alpha_1(q+e)-\gamma(e)-CF$ where $\alpha_1=\alpha_0-mc$ is the ex post CSs profit share. CSs then choose the optimal effort of the manager so that in equilibrium their marginal benefit be equal to their marginal cost from managerial effort. The solution is: $\alpha_0-mc=\gamma'(e)$. If we conveniently formalise the manager effort as $\gamma(e)=e^2$, $e \in [0,1]$, we obtain the desirable property that $\gamma'(e)>0$ and $\gamma''(e)>0$ and an ex post equilibrium level of effort of the manager which may be written as: $e^*_P=(\alpha_0-mc)/2$. By replacing the optimal effort, the controlling shareholders profits when they choose to go public become: $W^*_{CS}=[(\alpha_0-mc)](q+(\alpha_0-mc)/2)-((\alpha_0-mc)/2)^2-CF$ (2)

Consider what may happen instead if the controlling shareholders decide to obtain external finance from a venture capital partner. In this case we must consider that the ex post controlling shareholders (and therefore the venture capitalist) share of profits must be bargained between the two counterparts. We may therefore write the following generic Nash maximand:[7]

$$\max \Omega = (V_{CS} - \overline{V}_{CS})^b (V_{VC} - \overline{V}_{VC}) \quad (3)$$

where V_{CS} and $\overline{V}_{CS}$ are respectively the income in case of agreement and the fallback income of the controlling shareholders, while V_{VC} and $\overline{V}_{VC}$ are respectively the income in case of agreement and the fallback income

[5] The monitoring cost is assumed to be proportional to the project value as we imagine that the value of the project also proxies its complexity. For instance, in financing high tech projects versus traditional projects small shareholders have relatively higher returns but also higher informational asymmetries. We remove the assumption of proportional monitoring costs in section 4.1 of the paper.

[6] There are several ways in which controlling shareholders may increase new shareholders profit share in excess to their contribution to the venture to compensate them for monitoring costs. An example is giving free shares.

[7] Theoretical references on bilateral bargaining and on the approach we follow may be found on Rubinstein, 1982; Binmore et al., 1986; Sutton, 1986; Layard et al., 1991.

of the venture capital partner. β is the index of relative impatience of the two counterparts or the ratio between the venture capital (r_{VC}) and the controlling shareholders (r_{CS}) discount rates. We assume that r_{VC} ,$r_{CS} \in [r,\infty]$, where the lower bound r is the rate of return of the riskless asset. To define the fallback income of the CSs we consider that, if the agreement is not reached, CSs may go public if they obtain positive ex post profits from this choice. Otherwise the firm is liquidated and the existing cashflow is invested in the risk free asset. Therefore, agreement and fallback incomes for the two counterparts may be written as:
$V_{CS}=\alpha(q+e)-t-CF$, $\overline{V}_{CS} = \max\left[a_1(q+e_P^*)-t-CF, rCF\right]$, $V_{VC}=(1-\alpha)(q+e)-M$ and $\overline{V}_{VC} = rM$ where $M=I-CF=I(1-\alpha_0)$. In this simple case the firm and the venture capitalist are both monopolist so that, if the agreement is not reached, there is not any possibility of finding any other venture capital partner.[8] To find the equilibrium CSs profit share we maximise the log of the Nash maximand with respect to the ex post controlling shareholders share:

$$\max \log\Omega = b\log\left\{\alpha(q+e)-t-CF-\max\left[a_1(q+e_P^*)-t-CF, rCF\right]\right\}+\log\left[(1-\alpha)(q+e)-(1+r)M\right]$$

.

By examining this Nash maximand we may see that there are two factors affecting relative bargaining power. The first is β, which we call relative impatience. The second is the relative size of gains from bargaining for the two counterparts which are represented by the difference between the value of the agreement and the value of the fallback income. When $a_1(q+e_P^*)-t-CF > rCF$ the fallback income for the controlling shareholders is given by the decision of going public (as this is more convenient than firm liquidation). First order condition gives:

$$\alpha = \frac{b(q+e-(1+r)M)+a_1(q+\frac{a_0-mc}{2})}{(1+b)(q+e)} \qquad (4).$$ [9]

[8] We relax the assumption of bilateral monopoly in section 4.2 of the paper.

[9] α^*_{VC} cannot be lower than zero given the venture capitalist participation constraint (q+e>(1+r)M). α^*_{VC} cannot be higher than one as this would imply that $(q+e)<a_1(q+\frac{a_0-mc}{2})-b(1+r)M$ or that the total revenues from the investment be lower than the CSs revenues from the going public choice minus a positive term. In this case the CSs would never choose the venture capital choice.

The equilibrium value of α and e is given by the solution of the system including (4) and the following first order condition of the controlling shareholder maximising problem when he chooses venture capital financing: $2e = \frac{\partial a}{\partial e}(q+e)+a$. By solving the system we find that the solution for the optimal effort under venture capital financing is $e^*_{VC}=\beta/2(1+\beta)$. It may seem counterintuitive that optimal effort depend only on β. The rationale for this result is that any exogenous change which positively (negatively) affects the equilibrium share has a positive impact on equilibrium effort, but higher (lower) equilibrium effort has a negative (positive) feedback effect on CSs equilibrium share as it increases (reduces) CSs relative gains from agreement and then weakens their bargaining position. For all factors which affect only the relative size of the cake trough the equilibrium CSs share the feedback effect (plus the potential increase in effort costs) exactly offsets the positive effect. A change in β is an exception as it affects both relative impatience and the relative size of gains from bargaining. Therefore in this case the negative feedback less than compensates the positive effects and equilibrium effort is higher.

PROPOSITION 1 (comparative statics). When going public is relatively more profitable than investing in a risk free asset, the controlling shareholders share under the venture capital financing choice is increasing in β (index of CSs relatively lower impatience), in the venture capitalist discount rate, in the CSs share under the going public choice, in the ex ante CSs share and in the optimal managerial effort under the going public choice. It is decreasing in the interest rate of the riskless asset, in the CSs discount rate, in the venture capitalist financial support, in the investment cost and in the monitoring cost of new shareholders if the firm goes public. It is increasing in the project intrinsic value if optimal effort when going publicoptimal effort is not too much higher than optimal effort when choosing a venture capital partner.

To analyse comparative statics effects on the optimal controlling shareholders share we must consider that: $\frac{da}{dx} = \frac{\partial a}{\partial x} + \frac{\partial a}{\partial e^*_{VC}}\frac{\partial e^*_{VC}}{\partial x}$. The partial derivative on β has positive sign as $\frac{\partial a}{\partial b} = \frac{[q+e-(1+r)M]-a_1(q+e^*_P)}{[(1+b)^2(q+e)]} > 0$ The condition ensuring the sign of this derivative is that the sum of the potential gains from the agreement is positive as $[q+e-(1+r)M-a_1(q+e^*_P)]>0$. This

means that if the bargaining occurs (a cake of positive value has to be shared or $q+e>(1+r)M+q+e_P^*$) then $\frac{\partial a}{\partial b}>0$. $\frac{\partial a}{\partial e}=\frac{\left[b(1+r)M-a_1(q+e_P^*)\right]}{(1+b)(q+e)^2}$, though, has uncertain sign which depends on the relative size of the two outside options. Therefore $\frac{da}{db}=\frac{2\left[(1+b)(q+e)\left[q+e-(1+r)M-a_1(q+e_P^*)\right]+b(1+r)M-a_1(q+e_P^*)\right)}{2\left[(1+b)^3(q+e)^2\right]}>0$ under reasonable conditions.[10] If $b=r_{VC}/r_{CS}$ then $\frac{\partial a}{\partial r_{VC}}=\frac{\partial a}{\partial b}\frac{\partial b}{\partial r_{VC}}>0$ and $\frac{\partial a}{\partial r_{CS}}=\frac{\partial a}{\partial b}\frac{\partial b}{\partial r_{CS}}<0$ under the conditions specified above.

When we look at the project intrinsic value we find that $\frac{\partial a}{\partial q}=\frac{\left[a_1(e-e_P^*)+b(1+r)M\right]}{\left[(1+b)(q+e)\right]^2}$. A sufficient condition for this expression to be higher than zero is $e^*_{VC}\pounds e^*_P$. The intuition behind the partial derivative result on q is that a higher intrinsic value of the investment project affects both agreement and fallback income of the controlling shareholders but only the agreement income of the venture capitalist. This increases gains from the agreement more for the venture capitalist than for the controlling shareholders. The venture capitalist therefore has more interest in the agreement not to be left out from a project with high intrinsic value. We also find that: $\frac{\partial a}{\partial r}=\frac{-bM}{\left[(1+b)(q+e)\right]}<0$, $\frac{\partial a}{\partial e_P^*}=\frac{a_1}{\left[(1+b)(q+e)\right]}>0$, $\frac{\partial a}{\partial M}=\frac{-b(1+r)-(1/I)(q+2e_P^*)}{\left[(1+b)(q+e)\right]}<0$ as $M=I(1-\alpha_0)$ and $\frac{\partial a}{\partial a_1}=\frac{q+a_0-mc}{\left[(1+b)(q+e)\right]}>0$ when going public is profitable for CSs. The interpretation is straightforward if we check how these variables affect bargaining agents' outside options. In addition, given that $M=I-CF=I(1-\alpha_0)$, then $\frac{\partial a}{\partial I}=\frac{-b(1+r)\ (1-a_0)}{(1+b)(q+e)}<0$ and $\frac{\partial a}{\partial a_0}=\frac{q+a_1+b(1+r)I}{\left[(1+b)(q+e)\right]}$. If we compare this with $\frac{\partial a_1}{\partial a_0}=1$ under the going public choice, we can tell that a change in the ex ante controlling shareholders share can reduce the relative share of

[10] A sufficient condition for being higher than zero is that the total bargaining cake times total project profits is higher than the difference between the VC and the CSs outside option.

the going public solution vis-à-vis that of the venture capital solution if project investment is not too low.

The relative convenience of looking for a venture capitalist increases for higher monitoring costs if the condition $mc < a_0$ still holds after the change as: $\left.\frac{da_1}{dmc}\right|_{mc<a_0} < \left.\frac{da}{dmc}\right|_{mc<a_0}$ when $-1 < \frac{[-q-a_0+mc]}{[(1+b)(q+e)]}$ or $a_1 < b(q+e)+e$.

PROPOSITION 2 (effect of changes in exogenous variables on the relative convenience of the going public versus the venture capital choice for controlling shareholders). The going public choice becomes relatively more convenient for controlling shareholders when CSs discount rate increases, VC discount rate decreases, project intrinsic value decreases, CSs bargaining power decreases, investment costs decrease. It becomes relatively more convenient when monitoring costs decrease if beta is high and if project value is reasonably high.

Proof. To avoid confusion consider W(.) and V(.) as CSs wealth respectively under the going public and the venture capital choice. After replacing optimal effort and rearranging, CSs profits under venture capital financing may be written as:

$$V_{CS}^{*} = \frac{b\left(q+\frac{b}{2(1+b)}-(1+r)M\right)+a_1\left(q+\frac{a_0-mc}{2}\right)}{(1+b)} - \left(\frac{b}{2(1+b)}\right)^2. \qquad (5)$$

This expression compared with (2) gives the following comparative statics results:

$\frac{\partial W_{CS}^{*}}{\partial r_{CS}} = 0$, $\frac{\partial V_{CS}^{*}}{\partial r_{CS}} < 0 \cdot \frac{\partial W_{CS}^{*}}{\partial r_{VC}} = 0$, $\frac{\partial V_{CS}^{*}}{\partial r_{VC}} > 0 \cdot \frac{\partial W_{CS}^{*}}{\partial q} < \frac{\partial V_{CS}^{*}}{\partial q}$ when $a_0 - mc < 1$.

When $a_0 < mc$, $\frac{\partial W_{CS}^{*}}{\partial mc} < \frac{\partial V_{CS}^{*}}{\partial mc}$ as $(1-b)(a_0-mc) < 2qb$, $\frac{\partial W_{CS}^{*}}{\partial CF/I} > \frac{\partial V_{CS}^{*}}{\partial CF/I}$ when $b(q-(1+r)I) > (1-b)(a_0-mc)$

$\frac{\partial W_{CS}^{*}}{\partial b} = 0$, $\frac{dV_{CS}^{*}}{db} = \frac{\partial V_{CS}^{*}}{\partial b} + \frac{\partial V_{CS}^{*}}{\partial e_{VC}^{*}}\frac{\partial e_{VC}^{*}}{\partial b} > 0$. $\frac{\partial W_{CS}^{*}}{\partial I} = \frac{\partial W_{CS}^{*}}{\partial CF/I}\frac{\partial CF/I}{\partial I} < \frac{\partial V_{CS}^{*}}{\partial I} = \frac{\partial V_{CS}^{*}}{\partial CF/I}\frac{\partial CF/I}{\partial I}$ since $\frac{\partial CF/I}{\partial I} < 0$ ■

Intuition behind these results is straightforward. A project requiring higher investment increases, coeteris paribus, the amount of external finance needed, reducing both CSs share and equilibrium effort under the going public option, while it increases venture capitalist outside option and bargaining power, therefore reducing CSs share but not equilibrium

effort under the VC option. The opposite reasoning needs to be done for an increase in CSs cash-flow. Higher project intrinsic value does not affect equilibrium share and effort under the going public option, but weakens the bargaining power of the venture capitalist (as shown in Proposition 1) and therefore increases CSs equilibrium share under the venture capital choice.

PROPOSITION 3. When controlling shareholders have high ex ante property rights, they prefer the VC solution to the going public solution even if the first choice leads to lower output and managerial effort further from first best social optimum.

Proof: to find the social optimum in our model we neglect the difference between agents and maximise effort as if the firm were operated by the same agent: $W^*_{CS}(\alpha, e^*_P) = (q+e)-\gamma(e)-CF_0$. The socially optimal level of effort is therefore $e^*_P=1/2$ when $\gamma(e)=e^2$. It is easy to check that this level of effort is reached i) under the going public option only when $mc=0$ and $\alpha_1=1$; ii) under the venture capital option when $\beta=1$ while, with $\beta=1$ we get $e^*_{VC}=1/4$ and, with $\beta=2$ we get $e^*_{VC}=1/3$.

Consider now a case in which $mc>0$ and the venture capital choice and the going public choice are equally efficient so that: $\frac{b}{2(1+b)} = \frac{\alpha_0 - mc}{2} < 1/2$ (6) (which is lower than social optimum). Figure 1 in the Appendix shows that social indifference[11] under $mc>0$ may occur only for high levels of the ex ante CSs ownership. [12] Which is in this case the controlling shareholder choice? To check it consider that, with equal effort under the two alternative choices, is enough to compare the two controlling shareholders profit shares which, when the above written equality holds, may be re-

[11] Equal effort under the two choices corresponds to social indifference only if we consider that the VC incurs in a sunk cost before starting its activity which is equal to total monitoring costs of small shareholders. Otherwise equal effort corresponds only to output and not social effort equivalence

[12] Remember that value ranges for α_0 and mc must respect the following two constraints $mc \geq 0$ and $\alpha_0 \geq mc$. While the second is always true under social indifference, only when the first constraint is respected we may check if optimal CSs shares satisfy proposition 3.

written respectively as: $\frac{b}{1+b}$ and

$$\frac{b\left(q+\frac{b}{2(1+b)}-(1+r)M\right)+a_1\left(q+\frac{a_0-mc}{2}\right)}{(1+b)\left(q+\frac{b}{2(1+b)}\right)} \quad (6)$$

since $M=(1-a_0)I$, If $\alpha_0 \cong 1$ choosing a venture capital partner is more profitable for CSs if $\frac{b}{1+b}\left(q+\frac{b}{2(1+b)}\right)>0$.[13]. Figure 2 in the Appendix shows that CSs always have a larger share under the VC choice, even for relatively low profit margins. Therefore CSs prefer the venture capital solution even though it is socially indifferent. This implies that, for slightly lower levels of β, going public is socially optimal but the CSs still prefers the venture capital option ■

Why more concentrated ex ante CSs ownership generates this distortion ? Because an increase in ex ante CSs ownership generates a change in the difference between the social value of the going public versus the venture capital choice which is higher than the change in the difference between the private value of the going public versus the venture capital choice. In fact, ex ante CSs ownership positively affect CSs share under both choices, but equilibrium effort (social value) only under the going public choice. This is because, as explained before, the feedback effect of effort on CSs bargaining power compensates the positive effect of ex ante CSs ownership on the equilibrium effort under the venture capital choice.

3. The base model when the going public financing choice is not profitable

PROPOSITION 4. A) If monitoring costs are so high that the going public solution is not profitable, we may fall in a case in which the CSs share under the VC financing choice is decreasing in the project intrinsic value (or less increasing than in the situation in which going public is profit-

[13] Consider that under $\alpha_0 \cong 1$ (6) implies reasonable values for relative impatience and monitoring costs as $b=\frac{1-mc}{mc}$.

able). Therefore non feasibility of the going public choice may weaken CSs incentives to pursue VC financed projects of high intrinsic value.
B) Optimal effort under the VC choice is unchanged with respect to the base model, therefore it is not affected by the feasibility of the going public solution.

When *mc* is such that it is not convenient for the firm to go public - $a_1(q+e_P^*)-t-CF<rCF$ - the equilibrium CSs share under venture capital financing becomes:

$$a=\frac{-\big(b(1+r)M-t\big)+b(q+e)+(1+r)CF}{(1+b)(q+e)} \quad [14] \qquad (7)$$

In this case:

$$\frac{\partial a}{\partial b}=\frac{\big[q+e-(1+r)M\big]-(1+r)CF-t}{(1+b)^2(q+e)}>0 \qquad (8)$$

Again, the sign of the derivative is positive as the sum of the potential gains from the agreement is positive or $[q+e-(1+r)M-(1+r)CF-t]>0$. It is easy to check that optimal effort under venture capital financing is unchanged $e^*=\frac{b}{2(1+b)}$. After replacing optimal effort, CSs wealth becomes:

$$V_{CS}^*=\frac{-b(1+r)M+t+b(q+e)+(1+r)CF}{(1+b)}-\left(\frac{b}{2(1+b)}\right)^2.$$

Therfore

$$\frac{da}{db}=\frac{\partial a}{\partial b}+\frac{\partial a}{\partial e_{VC}^*}\frac{\partial e_{VC}^*}{\partial b}=\frac{2\big[(1+b)^2\big]\big[q+e-(1+r)M-(1+r)CF\big]+b(1+r)M-(1+r)CF}{2\big[(1+b)^4(q+e)\big]}>0$$

under reasonable conditions (see section 2 footnote 10).

If $b=r_{VC}/r_{CS}$, then $\frac{\partial a}{\partial r_{VC}}=\frac{\partial a}{\partial b}\frac{\partial b}{\partial r_{VC}}>0$ and $\frac{\partial a}{\partial r_{CS}}=\frac{\partial a}{\partial b}\frac{\partial b}{\partial r_{CS}}<0$.

Consider also that: $\frac{\partial a}{\partial r}=\frac{-bM+CF}{\big[(1+b)(q+e)\big]}<0$, $\frac{\partial a}{\partial M}=\frac{-(1+r)(1+b)}{\big[(1+b)(q+e)\big]}<0$ as *CF=I-M*, $\frac{\partial a}{\partial t}=\frac{1}{\big[(1+b)(q+e)\big]^2}$ and $\frac{\partial a}{\partial q}=\frac{\big[-(1+r)CF-t+(1+b)(1+r)M\big]}{(1+b)\ (q+e)^2}$. The effect of a change in *(q)* on a is now uncertain as the increase in the intrinsic value

[14] α cannot be higher than one as this would imply $q+e<(1+r)CF-b(1+r)M+t$ or that total revenues from the investment minus managerial compensation are lower than the CSs outside option. In this case it is not convenient for CSs to finance the investment.

of the project has no more effect on CSs fallback income. Consider also that $\frac{\partial a}{\partial e} = \frac{\partial a}{\partial q}$. In addition in this case a change in manager compensation *t* affects α^*_{VC} as it reduces controlling shareholders gains from the agreement, thereby increasing their equilibrium share.

A main difference with respect to the previous comparative static analysis is then that the impossibility of going public eliminates the impact of an increase in the intrinsic value of the project on the fallback income. The increase in controlling shareholders gains from the agreement is therefore larger and its bargaining position is weaker.

4.1 The effects of lump sum monitoring costs and changes in the number of small shareholders

Consider that if the firm decides to go public, it is financed by N new shareholders.

The reservation value of the individual shareholder will be $w=((1-\alpha_0)/N)(q+e)+mc(q+e)$. By aggregating individual shareholder reservation values we get: $(1-\alpha_0)(q+e)+Nmc(q+e)$. As a consequence, the effect of considering an increase in the number of new stock exchange shareholders when the firms goes public is equivalent to an increase in *mc*.

If monitoring costs are not assumed to be proportional to ex post cash flow we get the following reservation value for the individual shareholder $w=(1-\alpha_0)(q+e)+mc$. And the following profit function for the controlling shareholders: $W_{CS}=[1-(1-\alpha_0)](q+e)-\gamma(e)-mc-CF$.

In this case *mc* does not appear in the first order condition of the controlling shareholders maximisation problem so that $\alpha_1 = \alpha_0$ and $e^*_P = \alpha_0/2$. Effort is higher than under the base case.

It appears though in the controlling shareholders share when they opt for a venture capital partner. In fact: $\overline{V}_{CS} = \max\left[a_0(q+e^*_P) - t - mc - CF', (1+r)CF'\right]$. Therefore:

$a = \frac{b(q+e-(1+r)M) + a_0(q+\frac{a_0}{2}) - mc}{(1+b)(q+e)}$ if going public is profitable for CSs. The difference in controlling shareholders share between the base case and this one is $\frac{-mc(q+\frac{a_0}{2}) - \frac{a_0 - mc}{2} + mc}{(1+b)(q+e)}$. The new share is higher.

When solving for optimal effort under the venture capital choice we get again $e^*_{VC} = \frac{b}{2(1+b)}$.

Under social indifference we have $\frac{b}{2(1+b)} = \frac{a_0}{2}$. To check if there is any impact on proposition 3 consider that, under social indifference, between the two options CSs prefer venture capital if:

$$\left(\frac{b}{1+b} - \frac{b\left(q + \frac{b}{2(1+b)} - (1+r)M\right) + a_0\left(q + \frac{a_0 - mc}{2}\right)}{(1+b)\left(q + \frac{b}{2(1+b)}\right)} \right)\left(q + \frac{b}{2(1+b)}\right) - mc < 0 \quad (9).$$

Since $a_1 = \frac{b}{1+b}$ the expression becomes:

$\left(b(1+r)M - \frac{b}{1+b}\left(q + \frac{b}{2(1+b)}\right) + mc \right)\left(q + \frac{b}{2(1+b)}\right) - mc < 0$ which is weaker with respect to that of the base model.

Consider that when $mc < a_0$ a change in monitoring costs which are not proportional to project value make sharper the advantage of venture capital over the going public solution. In fact:

$\frac{\partial W^*_{CS}}{\partial mc} = -1$ and $\frac{\partial V^*_{CS}}{\partial mc} = \frac{-mc}{(1+b)}$ and therefore $\frac{\partial W^*_{CS}}{\partial mc} < \frac{\partial V^*_{CS}}{\partial mc}$ since $(1+b) > mc$ by definition.

4.2 The effect of competition in real and financial markets

PROPOSITION 5. Under the assumption of venture capitalists and controlling shareholders homogeneity, the optimal share of controlling shareholders and the optimal effort under the venture capital choice do not change after changes in the relative density of the two types.

Proof: in the base model we reasoned as if only one control group and one venture capitalist exist. We show here that results of the base model apply also to the case in which the relative number of the two counterparts changes under the assumption of homogeneity of types.

We define $p_{CS} = f(nVC/nCS))$ as the probability that the controlling shareholders may reach an agreement with another venture capitalist if the agreement with the first is not reached, with *nVC* and *nCS* being respectively the total number of venture capitalists and control groups with an

investment project in the market. We also define $p_{VC} = f(nCS/nVC))$ as the probability that the venture capitalist may reach an agreement with another controlling shareholder if the agreement with the first is not reached.

The new Nash Maximand may therefore be rewritten as:

$$\max \log \Omega = \beta \log\{\alpha(q+e) - t - CF - p_{CS}(\alpha(q+e) - t - CF) + (1 - p_{CS}) \max[a_1(q + e_p^*) - t - CF, rCF]\} + \\ + \log(1 - p_{VC})[(1 - \alpha)(q+e) - (1+r)M] \qquad (10)$$

Consequently, if the decision to go public is profitable for CSs - or when $_1(q + e_P^*) - t - CF > rCF$ -, we get:

$$a = \frac{-(b(1+r)M) + b(q+e) + a_1(q + \frac{a_0 - mc}{2})}{(1+b)(q+e)} \qquad (11)$$

When the going public solution is profitable for CSs a change of density in the venture capital market has no effect on the bargaining as it affects in the same way the gains from the agreement for the two counterparts.

The situation does not change when the going public solution is no more convenient for CSs. In this case we get:

$$\max \log \Omega = b \log\{a(q+e) - t - (1+r)CF\} + \log(1 - p_{VC})[(1-a)(q+e) - (1+r)M] \qquad (12)$$

and, after maximising:

$$a = \frac{-(b(1+r)M - t) + b(q+e) + (1+r)CF}{(1+b)(q+e)} \qquad (13)$$

Again, when the going public solution is not profitable for CSs, a change in the degree of competition in the venture capital market has no effect on bargaining under the VC choice. ■

The rationale for these results is that competition reduces the two counterpart gains from the agreement in the same proportion. Given that is the relative (and not the absolute) size of the two gains from the agreement that matters the equilibrium split of profit shares is unaffected.

4.3 The effect of illiquidity in the venture capital market

PROPOSITION 6: under reasonable conditions the presence of liquidity costs in the VC market reduces CSs advantage in looking for a VC partner. When the ex ante property right share of the controlling shareholder is high the divergence between social and individual optimum is reduced.

In this second extension we consider that profit shares are relatively less liquid in the venture capital market than in the stock exchange.[15] We therefore apply a liquidity discount $TC<1$ on profits under the VC choice.

The Nash maximand becomes:

$$\max \log \Omega = \beta \log\left\{\alpha TC(q+e) - CF - t - \max\left[a_1(q+e_P^*) - t - CF, rCF\right)\right\} + \\ + \log\left[(1-\alpha)TC(q+e) - (1+r)M\right] \qquad (14)$$

and first order condition gives:

$$a = \frac{b(q+e-(1+r)M/TC) + a_1(q+\frac{a_0 - mc}{2})/TC}{(1+b)(q+e)} \qquad (15).$$

The effect on CSs share is given by: $\frac{\partial a}{\partial TC} = \frac{(1+r)M - a_1(q+\frac{a_0 - mc}{2})}{(1+b)(q+e)(TC)^2}$ while optimal effort under the VC financing choice is unchanged.

The presence of illiquidity costs is therefore equivalent to an increase in the fallback income of both the venture capitalist and the controlling shareholders. The bargaining position of the venture capitalist gets stronger only if its outside option is larger than that of the CSs.[16]

The total change in profitability of the VC choice for CSs with illiquidity is therefore: $\frac{\partial a}{\partial TC} TC(q+e) - a(q+e)$. In this case divergence between social and individual optimum when ex ante property right share of the controlling shareholders is high is reduced as, under social indifference, we have that CSs find more profitable venture capital financing if:

$$\frac{b}{1+b}\left(q + \frac{b}{2(1+b)}\right) - b(1+r)M/TC + TC(q+e) > 0 \ .$$

4.4 The effects of poor shareholder protection in a weak institutional environment

In many developing (and developed) countries the weakness of the institutional system is an important variable which affects the decision

[15] Amihud-Mendelson (1986) emphasise this point in their analysis of the determinants of venture capital financing

[16] Outside the model this condition should be reasonably met if we consider that its decision to sell is likely to come earlier than that of the CSs (which may not sell at all) so that the illiquidity problem is more urgent for him.

of going public versus that of choosing a venture capital equity partner. In this case being private (or going public in a market where small shareholder protection is insufficient) makes easier for CSs to find forms of legal or illegal collusion with the manager or influential external financiers at the expense of small minority shareholders. We may conceive different forms of legal or illegal collusion. Illegal collusion may be easier when the firm is private as the possibility of ex post hidden information may in this case be enhanced. Legal collusion may involve practices which are not legally forbidden but which obtain as a result the reduction of the profit share of minority shareholders. An example may be the discounted sale of firm assets to another company in which controlling shareholders shares are less diluted. Or alternatively the purchase of overvalued assets of the other company with firm profits. These forms of legal collusion would be possible also if the firm decides to go public. But in this case, given the assumption of transparency and perfect information, the market value of the firm would drop as a reaction to the news therefore reducing returns for the colluding agents which may find the strategy no longer profitable (Bigelli, 1999). This extension of the model tries to address these issues in a simple framework.

PROPOSITION 7. Suppose that institutional weakness leads to illegal collusion of manager, CSs and venture capitalist at the expense of minority shareholders under the venture capital financing choice, while collusion is generally not profitable or not possible under the going public choice. In case of illegal collusion (when collusive profits are equally divided and non collusive profits are bargained between the two colluding agents) without significant penalties both effort and CSs share are higher with respect to the base model and the potential divergence between socially and individually optimal choice is enhanced.

As a difference from the base model consider the presence of minority shareholders with a property right share of $\alpha_{MS}>0$. Total available internal finance is that provided by both control and minority shareholders. The property right share of the control group before the investment is then: $\alpha_{CS}=\alpha_0-\alpha_{MS}$. The share of external finance needed on total investment costs is *(I-CF)/I.*

We assume here that controlling shareholders, the manager and external financiers may decide to collude to hide project profits to minority shareholders. If expected penalties are not high for the weakness of the judicial system and if the managerial labour market is tight, as assumed in the

base model, illegal profits are equally shared between CSs and the venture capital financier. This strategy will provide each of them an additional share $d\alpha_{MS}/2$, of firm profits, where $d \hat{I} [0,1]$ is a measure of the weakness of the institutional environment. We assume here that going public involves more transparency versus minority shareholders and therefore collusion is possible only under the venture capital choice. The utility function of the manager under collusion is: $U_M = t - \gamma(e)$.

The CSs and the venture capital financier bargain a share of non collusion profits of the firm. Therefore the value of the agreement for the two counterparts may be written respectively as: $V_{CS} = (\alpha(1-\alpha_{MS}) + \delta(.)\alpha_{MS}/2)(q+e) - \gamma(e)$ or $V_{CS} = (\alpha(1-\alpha_{MS}) + \delta(.)\alpha_{MS}/2)(q+e) - \gamma(e) - CF'$, where $CF' = \alpha_0/(\alpha_{MS} + \alpha_0)$CF and $V_{VC} = ((1-\alpha)(1-\alpha_{MS}) + \delta(.)\alpha_{MS}/2)(q+e) - CF'$. The values of the two fallback incomes are: $\overline{V}_{CS} \max\left[a_1'(q + e_P^{*}') - t - CF', (1+r)CF'\right]$, and $\overline{V}_{VC} = rM$ where $a_1' = a_0 - a_{MS} - mc,$ and $e_P^{*}' = (a_0 - a_{MS} - mc)/2$. When the fallback income for the controlling shareholders is given by the decision of going public (as this is more convenient than firm liquidation) - $a_1'(q + e_P^{*}') - t - CF' > (1+r)CF'$ - we get that:

$$\alpha_C = \frac{-\left(b(1+r)M\right) + b(q+e)(1-\alpha_{MS}) + a_1'(q + \frac{a_0 - a_{MS} - mc}{2}) + (q+e)\frac{1}{2}[d\alpha_{MS}](b-1)}{(1+b)(q+e)(1-\alpha_{MS})}$$

$+ \delta(.)\alpha_{MS}/2.$ (16)

the controlling shareholders share is increasing in the degree of institutional weakness if $\frac{\partial \alpha}{\partial \delta} = \frac{\frac{1}{2}(\alpha_{MS})(b-1)}{1+b} + \frac{\alpha_{MS}}{2} > 0$ which is always true if $\beta > 1$.

To check if the controlling shareholder share is higher under collusion we must consider that if $\alpha_{MS} = 0$ the two shares coincide. It is enough then to check that $\frac{\partial \alpha}{\partial \alpha_{MS}} > 0$. This occurs if:

$$(q+e)\frac{d}{2}\left[b(2-\alpha_{MS}) - \alpha_{MS} + \left[\frac{(b-1)\alpha_{MS}}{1-\alpha_{MS}}\right]\right] - \frac{b(1+r)M}{1-\alpha_{MS}} + a_1'\left(q + \frac{a_0 - a_{MS} - mc}{2}\right)\frac{1}{1-\alpha_{MS}} > 0$$

(17).

Therefore sufficient conditions for $\frac{\partial \alpha}{\partial \alpha_{MS}}$ to be positive are: i) CSs outside option larger than VC outside option; ii) $\beta \geq 1$ and iii) $\alpha_{MS} \leq .5$. With managerial zero profit condition optimal effort becomes

$e = \frac{b}{2(1+b)}\left[\frac{2b(1-a_{MS}) + bda_{MS} + da_{MS}(1-a_{MS})[2(1+b)-1]}{2b(1-a_{MS})}\right]$ which is higher than in the model without collusion.

Under a weak institutional environment and not too low b the equilibrium effort under the venture capital choice is higher when CSs and the venture capitalist decide to collude.

Another clear result is that CSs wealth is relatively higher under the VC choice if the institutional system is weaker as $\frac{\partial V^*_{CS}}{\partial d} > 0$ and $\frac{\partial W^*_{CS}}{\partial d} = 0$.

Which are the effects on proposition 3? Imagine again that equilibrium efforts are equal under the two financing choices so that: $\frac{a_0 - mc}{2} = \frac{b}{2(1+b)}\left[\frac{2b(1-a_{MS}) + bda_{MS} + da_{MS}[2(1+b)-(1-a_{MS})]}{2b(1-a_{MS})}\right]$. To check if social and private indifference coincide we must compare CSs share under the two different choices, since $V^*_{CS}=(a(1-a_{MS})+d(.)a_{MS}/2)(q+e)-y(e)$ and $W^*_{CS}=[1-(1-a_0+mc)]$ $(1-\alpha_{MS})$ $(q+e)-y(e)$. Given that if $a_{MS}=0$ the optimal CS share under venture capital financing is equal , if $\frac{\partial a}{\partial a_{NS}} > 0$ private convenience of venture capital financing will be higher under collusion than under non collusion and the divergence between private and social optimum will be enhanced. This condition is highly likely to be met as, under equivalence of effort in the two financing choices we found that $\frac{\partial a}{\partial a_{MS}}$ tends to be positive if: i) CSs outside option is larger than VC outside option; ii) $b \geq 1$ and iii) $a_{MS} \leq .5$. ■

PROPOSITION 8: In case of illegal collusion without significant penalties if both collusive profits and non collusive profits are bargained between the two agents both effort and CSs share are higher with respect to the base model and the potential divergence between socially and individually optimal choice is enhanced.[17]

[17] This example of collusive profits without significant legal penalties may help to explain also the effect of transparency costs (i.e. revelation of firm features to competitors) on the decision to go public as it has the same analytical treatment if we consider $(1-a_{MS})$ as transparency costs from going public proportional to firm profits and $(1-d)$ the proportion of these transparency costs which may be reduced through tax allowances.

Compare CSs wealth without collusion $V'_{CS}=\alpha'(1-\alpha_{MS})\ (q+e')-\gamma(e')-CF$ and with collusion $V''_{CS}=\alpha''[1-(1-\delta)\alpha_{MS})](q+e'')-\gamma(e'')-CF$ under the venture capital financing choice. $V''_{CS}>V'_{CS}$ *if* $\frac{\partial V''_{CS}}{\partial \delta}>0$ since $V'_{CS}=V''_{CS}(\delta=0)$.

$\frac{\partial V''_{CS}}{\partial \delta}=\frac{\partial \alpha''}{\partial \delta}(1-(1-\delta)\,\alpha_{MS})(q+e'')+\alpha''\,\alpha_{MS}(q+e'')+\alpha''(1-(1-\delta)\,\alpha_{MS})\frac{\partial e''}{\partial \delta}$ the third term is zero as $e''=\frac{b}{2(1+b)}$. By manipulating the above expression we find that the sum of the first and second term is positive if $(q+e)\left\{(1+b)\left[-(b(1+r)M)+b(q+e)(1-(1-\delta)\alpha_{MS})+\alpha_1'(q+\frac{\alpha_0-\alpha_{MS}-mc}{2})\right]-\alpha_1'\right\}+b(1+r)M$

Since the term in square brackets is positive and $(1+b)$ is higher than α_1' CSs welfare is enhanced by collusion when they choose VC financing. ■

PROPOSITION 9 Under illegal collusion with infinite penalty an egalitarian split among the three colluding agents occurs at the expense of minority shareholders with no distortion between privately and socially optimal financing choice

The egalitarian split of collusive profits is the result when prosecution of the crime leads to infinite penalty. In this case if one of the three agents is left with less than one/third he may credibly threaten the other two agents that he will go to court if he is left out of the agreement. This means that in a bargain between him and the other two agents, the other two agents outside option is minus infinity and their equilibrium share is zero. Therefore there are no profitable deviations from the egalitarian split.[18] The bargaining on legal profits is subject to the same rule so that each of the three agents gets 1/3. The maximising function of controlling shareholders under the venture capital option is: $W_{CS}=(2/3)(q+e)[1-(1-\delta)\alpha_{MS}]-\gamma(e)-(\delta/3)[1-(1-\delta)\alpha_{MS}]\ (q+e)$ or
$W_{CS}=(1/3)(q+e)[1-(1-\delta)\alpha_{MS}]-\gamma(e)$.

[18] To have a robust equilibrium we must assume either a fairness argument in the utility function of the agents which induce them to prefer the failure of the agreement to a non egalitarian split (unfair share of profits minus the fairness argument lower than the outside option). Or the awareness of the agents threatening the other two will loose more from the failed agreement and will then accept the egalitarian split.

Then $e_{VC}^*=(1/6)[1-(1-\delta)\alpha_{MS}]$. Under social indifference $(1/6)[1-(1-\delta)\alpha_{MS}]=(\alpha_0-mc)/2$. Then $W_{CS}>W_{CS}$ if $(1/3)[1-(1-\delta)\alpha_{MS}] > \alpha_0-mc$. Given that $(1/3)[1-(1-\delta)\alpha_{MS}] = \alpha_0-mc$ there is no distortion under the egalitarian split.[19]

PROPOSITION 10 With perfect information on the stock market legal collusion increases the relative profitability of the VC choice for CSs when project intrinsic value is sufficiently high.

Proof: Imagine that controlling shareholders own a second firm that is part of the same group. Then collusion may be legal by selling assets of the first firm to the second at a discounted price.

In this case imagine that the CSs invest all expected profits of the first firm in capital goods and then sell the capital goods to the second firm with a discount of $(1-\delta)$. The first firm has now a debt of $\delta(q+e)$ before making profits, while the second firm has a profit of $\delta(q+e)$ which may arise when selling the capital goods at their market value. If the first firm goes public new minority shareholders are informed and increase their reservation value needed to become equity financiers. Without the intra-group sale their investment would have been $M=(I-CF)$ and their revenues $(1-\alpha_0+mc)(q+e)$ with a return of $[(1-\alpha_0)(q+e)-(I-CF)]/(I-CF)$. After the intragroup sale minority shareholders need a compensation of $\delta(q+e)(1-\alpha_0+mc)$. Therefore total CSs wealth with collusion under the going public choice will be: $W_{CS(LC)}=\alpha_1(q+e)(1-\delta)+(q+e)\delta-\delta(q+e)(1-\alpha_0+mc)-CF'-\gamma(e)$. The new equilibrium effort will be: $e^*_{(LC)}=(\alpha_1+\delta\alpha_{MS})/2$ which is higher than equilibrium effort under the base case. The marginal increase in CSs welfare with legal collusion under the going public choice is:

$$\frac{\partial W_{CS(LC)}}{\partial d}=a_{MS}(q+e)+\left[a_{=}-mc-a_{MS}(1-d)-2e\right]\frac{\partial e_{(LC)}}{\partial d}=a_{MS}(q+e)+\left[a_{=}-mc-a_{MS}(1-d)-2e\right]\frac{a_{MS}}{2}$$

If the CSs opt for VC financing they have to bargain profits of both the first and the second firm with the VC partner. CSs will get from the original company: $\alpha(q+e)(1-\alpha_{MS})(1-\delta)$-t-CF and $\alpha(q+e)\delta$ or

[19] Note that in this case optimal effort and optimal CSs share are not necessarily higher with than without collusion. This is because the advantage of a share of minority shareholder profits must be traded off with the disadvantage of a higher participation of the manager to firm profits.

$a(q+e)(1-(1-d)a_{MS})$-t-CF which is equal to CSs profit share under proposition 8. Therefore $e_{VC(LC)} = \frac{b}{2(1+b)}$ and $a = \frac{-(b(1+r)M) + b(q+e)(1-(1-d)a_{MS}) + a_1'(q + \frac{a_0 - a_{MS} - mc}{2})}{(1+b)(q+e)(1-(1-d)a_{MS})}$. The marginal increase in CSs welfare with legal collusion under the venture capital choice is: $\frac{\partial V_{CS}''}{\partial d} = \frac{\partial a''}{\partial d}(1-(1-d)a_{MS})(q+e'') + a''a_{MS}(q+e'') + a''(1-(1-d)a_{MS})\frac{\partial e''}{\partial d}$ which is higher than zero (see proposition 8). Under effort equivalence and for high values of project intrinsic value $\frac{\partial V_{CS}''}{\partial d}$ is higher than $\frac{\partial W_{CS(LC)}}{\partial d}$. The difference between the two marginal gains is that, under the VC choice CSs "steal" the old minority shareholders share of profits but have to divide it with the venture capitalist, while under the going public choice they entirely enjoy old minority shareholders share but only after compensating new minority shareholders for the loss in their expected returns.

Tab. 1 Synthesis of results on collusion

	Illegal with infinite penalty	Illegal with weak judicial system (weak penalty)	Legal collusion
Collusive profit split	1/3 each among CSs, the manager and the venture capitalist	1/2 each between CSs and the venture capitalist (or bargained between CSs and the venture capitalist).	bargained between CSs and the venture capitalist if the firm opts for VC financing. All for CSs under the going public choice
Legal profit split	1/3 each among CSs, the manager and the venture capitalist	Bargained	bargained between CSs and the venture capitalist if the firm opts for VC financing. All for CSs under the going public choice
Ex post CSs share under the going public choice	Illegal collusion is not possible	Illegal collusion is not possible	Higher
Equilibrium effort under the going public choice	Illegal collusion is not possible	Illegal collusion is not possible	Higher than in the base case
Ex post CSs share under the venture capital choice	$1/3[1-(1-\delta)\alpha_{MS}]$	Higher if : i) CS outside option larger than VC outside option; ii) $\beta<1$ and iii) $\alpha_{MS} \leq .5$.	Higher
Equilibrium effort under the venture capital choice	$1/6[1-(1-\delta)\alpha_{MS}]$	Higher if illegal profits are split, equal if they are bargained	Unchanged
Distortion between CSs private and social optimum (Proposition 3)	No distortion	Enhanced as VC with collusion better than VC without collusion both when illegal profits are split or bargained	Enhanced as legal collusion increases the relative profitability of the VC choice for CSs

4.5 The effects of asymmetric information between controlling shareholders and the manager

In the base model we assumed no opacity between the controlling shareholders and the manager. Therefore, controlling shareholders could regulate managerial effort up to the point where their marginal benefit were equal to their marginal cost from manager effort. The problem was not entirely trivial as part of costs of managerial effort could not be shared

with new minority shareholders and the manager itself. In fact, after satisfying with equality the reservation utility and the reservation wage of these two types of agents, controlling shareholders remained residual claimants of firm profits and residual payers of manager costs. For this reason, optimal managerial effort resulted to be proportional to their ex post property right share.

If we remove this simplistic assumption and postulate asymmetric information between controlling shareholders and the manager we find significant changes in the optimal effort under the going public choice, in the optimal CSs share under the VC option and therefore in the relative profitability of the choice between the two financing options.

PROPOSITION 11 Informational asymmetry between CSs and the manager reduces optimal effort under both choices and reduces CSs share under the venture capital option. Therefore the CSs relative convenience in looking for a VC partner is lower.

Consider the existence of two types of managers. The good quality manager which has in mind a project of high intrinsic value $(\overline{q})$ and the bad quality manager which has a project of relatively lower intrinsic value $(\underline{q})$. Utility function and total (effort plus intrinsic value) project values for the two managers may be written as:

$\overline{U} = \overline{t} - y(e)$, $\underline{U} = \underline{t} - y(e)$, $\overline{\Delta p} = \overline{q} + e$, $\underline{\Delta p} = \underline{q} + e$, $\overline{U} = \overline{t} - y(\overline{\Delta p} - \overline{q})$, $\underline{U} = \underline{t} - y(\underline{\Delta p} - \underline{q})$.

The controlling shareholders offer the following scheme $\{\overline{t}, \underline{t}\}$ The scheme achieves a separating equilibrium if good quality manager chooses $\overline{t}$ and bad quality manager chooses $\underline{t}$. To get a separating equilibrium the scheme must satisfy the following incentive compatibility and individual rationality constraints: $IC_1 : \underline{t} - y(\underline{\Delta p} - \underline{q}) \geq \overline{t} - y(\overline{\Delta p} - \underline{q})$, $IC_2 : \overline{t} - y(\overline{\Delta p} - \overline{q}) \geq \underline{t} - y(\underline{\Delta p} - \overline{q})$, $IR_1 : \underline{U} \geq 0$ and $IR_2 : \overline{U} \geq 0$. We can easily check that, when IC_2 and IR_1 are met, also IR_2 is respected as: $IC_2 : \overline{t} - y(\overline{\Delta p} - \overline{q}) \geq \underline{t} - y(\underline{\Delta p} - \overline{q}) \geq \underline{t} - y(\underline{\Delta p} - \underline{q}) \geq 0$ and therefore $\overline{t} - y(\overline{\Delta p} - \overline{q}) \geq 0$.

Consider the following ex ante distribution of probability of finding good and bad quality managers for the CSs. The distribution of managerial types is such that $n = prob(q = \overline{q})$, $1 - n = prob(q = \underline{q})$. CSs therefore maximise

$W_{CS} = nW_{CS}(\overline{q}) + (1-n)W_{CS}(\underline{q})$.

s.t. IC_2, IR_1, IC_1. Following the usual approach (Laffont-Tirole, 1986).We neglect IC_1 and check ex post if it is satisfied. Rewriting IC_2 as $\overline{U} \geq \underline{t} - y(\Delta\underline{p} - \overline{q})$ and given that $\underline{U} = \underline{t} - y(\Delta\underline{p} - \underline{q})$ we find that $\overline{U} \geq \underline{U} + f(\underline{e})$, where $f(e) = y(e) - y(e - \Delta q)$ and $\underline{e} = (\Delta\underline{p} - \underline{q})$.We may therefore rewrite the maximisation as: $W_{CS} = n\left[a_1(\overline{q} + \Delta\overline{p} - \overline{q}) - y(\Delta\overline{p} - \overline{q}) - l\overline{U}\right] + (1-n)\left[a_1(\underline{q} + \Delta\underline{p} - \underline{q}) - y(\Delta\underline{p} - \underline{q}) - l\underline{U}\right] - CF$

where $\overline{U} = f(\Delta\underline{p} - \underline{q})$ by IC_2 and $\underline{U} = 0$ by IR_2. Maximising with respect to effort we get $a_1 = y'(\Delta\underline{p} - \underline{q}) + lf'(\Delta\underline{p} - \underline{q})\frac{n}{1-n}$, $\underline{e} < e_P^*$

and $a_1 = y'(\Delta\overline{p} - \overline{q})$, $\overline{e} = e_P^*$. We then get efficient effort and a rent for the efficient type and inefficient effort for the inefficient type, since $e_{P(AI)}^* = n\overline{e}_P - (1-n)\underline{e}$. Therefore when $y(e) = e^2$ $f(e) = y(e) - y(e - \Delta q) = e^2 - (e - \Delta q)^2 = -2e\Delta q + \Delta q^2$, $\overline{e}_P = (a_0 - mc)/2$ and $\underline{e}_P = \frac{a_0 - mc}{2} - \frac{l\Delta q n}{1-n}$, as $f'(\Delta\underline{p} - \underline{q}) = -2\Delta q$ and average manager wage is $t' = v(t + R) + (1-n)t$.

The controlling shareholders share under the VC option is smaller as the outside option for CSs is less profitable.

$$a = \frac{b(\overline{\overline{q}} + \overline{\overline{e}} - (1+r)M) + a_1(\overline{\overline{q}} + e_{P(AI)}^*)}{(1+b)(\overline{\overline{q}} + \overline{\overline{e}})} \tag{18}$$

where $\overline{\overline{e}} = n\overline{e}_{VC} - (1-n)\underline{e}_{VC}$ and $\overline{\overline{q}} = n\overline{q}_{VC} - (1-n)\underline{q}_{VC}$.

To find optimal effort under venture capital financing CSs maximise the following function:

$$V_{CS} = n\left[a(\overline{e})(\overline{q} + \Delta\overline{p} - \overline{q}) - y(\Delta\overline{p} - \overline{q}) - l\overline{U}\right] + (1-n)\left[a(\underline{e})(\underline{q} + \Delta\underline{p} - \underline{q}) - y(\Delta\underline{p} - \underline{q}) - l\underline{U}\right] - CF \tag{19}$$

First order conditions are:

$$n\left[a + \frac{\partial a}{\partial \overline{e}}(\overline{q} + \Delta\overline{p} - \overline{q}) - y'(\Delta\overline{p} - \overline{q})\right] + (1-n)\left[\frac{\partial a}{\partial \overline{e}}(\underline{q} + \Delta\underline{p} - \underline{q})\right] = 0 \tag{20}$$

$$(1-n)\left[a + \frac{\partial a}{\partial \underline{e}}(\underline{q} + \Delta\underline{p} - \underline{q}) - y'(\Delta\underline{p} - \underline{q})\right] + n\left[\frac{\partial a}{\partial \underline{e}}(\overline{q} + \Delta\overline{p} - \overline{q}) - lf'(\underline{e})\right] = 0 \tag{21}$$

Considering that:

$\frac{\partial a}{\partial \overline{e}} = \frac{n\left[(1+r)M - a_1(\overline{\overline{q}} + e_{P(AI)}^*)\right]}{(1+b)(\overline{\overline{q}} + \overline{\overline{e}})^2}$ and $\frac{\partial a}{\partial \underline{e}} = \frac{(1-n)\left[(1+r)M - a_1(\overline{\overline{q}} + e_{P(AI)}^*)\right]}{(1+b)(\overline{\overline{q}} + \overline{\overline{e}})^2}$.

And replacing them in the extended first order conditions for the high and low quality manager we get respectively:

$$2n\bar{e} = n\frac{\left[(1+r)M - a_1(\bar{\bar{q}}+e^*_{P(AI)})\right]}{(1+b)(\bar{\bar{q}}+\bar{\bar{e}})^2}(\bar{q}+\bar{e}) + \left[\frac{b(\bar{\bar{q}}+\bar{\bar{e}}-(1+r)M)+a_1(\bar{\bar{q}}+e^*_{p(AI)})}{(1+b)(\bar{\bar{q}}+\bar{\bar{e}})}\right]n \qquad (20')$$

and:

$$2\underline{e}' + l\Delta q\frac{n}{1-n} = \frac{\left[(1+r)M - a_1(\bar{\bar{q}}+e^*_{P(AI)})\right]}{(1+b)(\bar{\bar{q}}+\bar{\bar{e}})^2}(\bar{q}+\bar{e}) + \frac{b(\bar{\bar{q}}+\bar{\bar{e}}-(1+r)M)+a_1(\bar{\bar{q}}+e^*_{p(AI)})}{(1+b)(\bar{\bar{q}}+\bar{\bar{e}})} \qquad (21')$$

By simplifying the first order conditions we find: $\underline{e} = \frac{b}{2(1+b)} - \frac{l\Delta qn}{1-n}$ and: $\bar{e} = \frac{b}{2(1+b)}$.

It is easy to check that proposition 3 changes. Optimal effort under the two options changes in the same proportion with respect to the base model. The optimal share changes under the venture capital option as equilibrium effort and equilibrium intrinsic quality of the project are different. Consider that average intrinsic quality is the same under the two cases (the average intrinsic quality of the project is equal to the homogenous type intrinsic quality of the project in the base model). The difference with the base model then is a lower average effort which will reduce the optimal CSs share as: $\frac{\partial a}{\partial e^*_P} = \frac{a_1}{[(1+b)(q+e)]}$. Proposition 3 is therefore weakened as, for an equivalent change in effort, CSs wealth is reduced more under venture capital than under going public with respect to the base case ■[20]

The rationale for the general result stated in this proposition is that the weaker bargaining position of the CSs in the VC with respect to the going public choice makes CSs private costs of asymmetric information with manager higher under the venture capital choice and this reduces its relative convenience.

4.6 The effects of volatility and financial crises

PROPOSITION 12: any change in stock price volatility which creates a wedge between firm market value when it goes public and its fundamental value does not affect effort under both financing choices and optimal CSs

[20] It is interesting to note that asymmetric information on managerial types reduces less the optimal CS share under venture capital financing when going public is not profitable for CSs. In fact in that case: $a = \frac{-(b(1+r)M - t') + b(\bar{\bar{q}}+\bar{\bar{e}}) + (1+r)CF}{(1+b)(\bar{\bar{q}}+\bar{\bar{e}})}$ with $t'>t$.

share under the going public choice. It reduces the optimal CSs share under the VC choice, CSs wealth and the utility of risk averse CSs under both choices. Since the negative wealth effect under the going public choice is stronger than the negative CSs share effect under the VC choice, CSs willingness to go public is weakened.

Consider now that if the going public decision is taken, the controlling shareholders are exposed to noise trading risk, which may shift the share price away from fundamental value. This is a cost for risk averse controlling shareholders or new minority shareholders if they are liquidity constrained or if they have less than infinite patience and live in a world where noise traders exist and "create their own space" (De Long et al,.1990).

We formalise the first type of uncertainty by simply rewriting the profit function of the controlling shareholders when they go public. If the fundamental value of the share is $\pi = q + e$, the share price is $s = q + e + \varepsilon$ where ε is the shock due to noise trading, with ε ~N(0, σ^2). The wealth of the controlling shareholders in the presence of risk may be written as: $\tilde{W}_{CS} = \alpha_1(q+e+\varepsilon)$-$t$-$CF$ with $E(\tilde{W}_{CS}) = \alpha_1(q+e)$-$t$-$CF = W_{CS}$ and $Var(W_{CS}) = \alpha_1^2\sigma^2$. Assume that both new potential stock exchange shareholders and the control group are risk averse and have a Von Neumann-Morgenstern CARA utility function of the form $U(W) = -\exp(-\gamma W)$, where is the coefficient of risk aversion. It is well known that maximising the CARA is equivalent to maximising its conditional equivalent, that is:

$V[E(W_{CS}), Var(W_{CS})] = E(W_{CS}) - \frac{1}{2}\gamma Var(W_{CS})$. Therefore the controlling shareholders utility function is changed into: $U(W_{CS}) = \alpha_1(q+e) - t - CF - \frac{1}{2}\gamma\sigma^2\alpha_1^2$. If the problem is just noise trading and if minority stockholders are risk averse and have the same utility function as controlling shareholders they also have a different reservation value. In fact without noise: $U(\overline{W}_{SSH}) = (1-a_0+mc)(q+e)$-$M$ while with noise their utility changes into: $U(\tilde{W}_{SSH}) = (1-a_0+mc)(q+e) - M - \frac{1}{2}\gamma\sigma^2(1-a_0-mc)^2$. (22)

Therefore to be compensated they re quire:

$W'_{SSH} = (1-a_0+mc)(q+e+\varepsilon) + \frac{1}{2}\gamma\sigma^2(1-a_0+mc)^2$. (23)

The wealth of the controlling shareholders therefore becomes: $W'_{CS} = a_1(q+e+e) - CF - y(e) - \frac{1}{2}gs^2(1-a_0-mc)^2$ and their utility

$$U(W'_{CS}) = a_1(q+e+e) - CF - y(e) - \frac{1}{2}gs^2(1-a_0-mc)^2 - \frac{1}{2}gs^2(a_0-mc)^2 \qquad (24)$$

Therefore evaluating the effect of an increase in noise trader uncertainty on the equilibrium controlling shareholders share under venture capital is similar to evaluating the effect on it of an increase of *(e)*. The main difference is that the value to be subtracted from the controlling shareholders wealth depends on the dimension of their initial share a_0. Controlling shareholders with a small initial share are more penalised by noise trader uncertainty.

In the Nash bargaining equilibrium noise trading corresponds to a decrease in the fallback income of the controlling shareholders. The modified fallback incomes for the controlling shareholders may be written as: $\tilde{V}_{CS} = \max\left[a_1(q+e_P^*) - t - CF - \frac{1}{2}gs^2(1-a_0-mc)^2, rCF)\right]$. In this case we maximise:

$$\max \log\Omega = b\log\left\{a(q+e) - t - \max\left[a_1(q+e_P^*) - t - CF - \frac{1}{2}gs^2(1-a_0-mc)^2, rCF)\right]\right\} +$$
$$+ \log[(1-a)(q+e) - (1+r)M] \qquad (25)$$[21]

When the fallback income for the controlling shareholders is given by the decision of going public (as this is more convenient than firm liquidation) or $a_1(q+e_P^*) - t - CF - \frac{1}{2}gs^2(1-a_0-mc)^2 > rCF$,

first order condition gives:

$$a = \frac{b(q+e-(1+r)M) + a_1(q+\frac{a_0-mc}{2}) - \frac{1}{2}gs^2(1-a_0-mc)^2}{(1+b)(q+e)} \qquad (26)$$

that is lower than the equilibrium share obtained in absence of uncertainty. Why is the position of CSs weaker under the VC option than under the going public option? Because VC are needed to avoid noise traders and this increaser their bargaining power.

The equilibrium value of e will be given by the solution of the system including (26) and the first order condition of the controlling shareholder maximising problem when he chooses venture capital financing. Again

[21] Remember that noise trading volatility affects counterpart wealth and utility only under the going public choice.

$e^*_{VC} = \frac{b}{2(1+b)}$ so uncertainty decreases the optimal controlling shareholder share under venture capital, but does not affect the optimal effort. In conclusion it is easy to check that the negative wealth effect under the going public choice is stronger than the negative CSs share effect under the VC choice, therefore CSs willingness to go public is weakened.

4.7 The effects of a more efficient market for corporate control

PROPOSITION 13 Under reasonable assumptions the possibility of takeovers in the stock exchange (implying an efficient market for corporate control) generates an increase in effort under the going public choice and an increase in CSs share under the VC choice if the intrinsic value of the project and the property right shares of old minority shareholders are high. It generates a reduction in CSs effort under the going public choice and a reduction in CSs share under the VC choice if the productive innovation introduced by the takeover is high.
If the effort effect under the going public choice is lower than the bargaining effect under the VC choice higher intrinsic value of the project and higher property right shares of old minority shareholders (higher productive innovation introduced by the takeover) increase (reduces) the likelihood of the VC choice.

Consider that, under an efficient market for corporate control, existing minority shareholders may, with probability $\lambda(e)<1$, come out with a project with higher intrisic value $v_{MS}=q+i$ (where $i > e$ represents the superior ability of the new management or the innovation brought into by the minority shareholder) and take over the firm. The hypothesis is that the CS initial share α_{cs} is lower than 50%, and that the old minority shareholders can acquire the control share on the market when the firm goes public. We also assume that $\lambda'(e)<0$ as higher effort from the CSs may reduce the probability of takeover. Incorporating in a simple framework the Grossman-Hart (1980) idea we state that the higher the ex ante property right share of minority shareholders the lower the *winner curse* effect and therefore the compensation of the CSs for releasing control over the firm. CSs anticipate the hypothesis that a takeover occurs in choosing the financing option. The winner curse effect occurs as CSs actions are individually taken implying that control group members can re-

fuse to tender if the compensation is not adequate. The control group under the going public option therefore maximises:

$W_{CS}=(1-\lambda(e))[\alpha_1' (q+e)-t-CF']+ \lambda(e) (1-\alpha_{MS}) [\alpha_1'(q+i)-CF']$

where $\alpha_1 = \alpha_{cs} - mc = \alpha_0 - \alpha_{MS} - mc$ and $CF' = \alpha_{cs} I$

We assume here that, if the takeover occurs, manager wage will be paid by the new control group. $\lambda(e) (1-\alpha_{MS}) [\alpha_1'(q+i)-CF']$ is CSs compensation in case of takeover. The ex post share of CSs profits is unchanged as only CSs and not new minority shareholders have disadvantages from takeover risk. Therefore takeover risk has no effects on the reservation value of new minority shareholders. The equilibrium effort changes as the new first order condition is:

$(1-\lambda(e))\alpha_1-\lambda'(e))[\alpha_1' (q+e)-t-CF']+\lambda'(e) [(1-\alpha_{MS}) [\alpha_1'(q+i)-CF']]+$
$-(1-\lambda(e))\psi'(e)$

Assuming that $\lambda(e)$ is linear in $e(\lambda''(e)=0)$ and given that $\psi(e)=e^2$, optimal effort solves the following second order equation:

$\lambda'(e)e^2 - e[2(1-\lambda)+\lambda'\alpha_1]+(1-\lambda)\alpha_1 - \lambda'[\alpha_{MS}\alpha_1 q-(1-\alpha_{MS})\alpha_1 i]$

where : $a=\lambda'(e)<0$; $b=-[2(1-\lambda)+\lambda'(e)\alpha_1]<0$; *if* $2(1-\lambda)>|\lambda'(e)\alpha_1|$;

$c=(1-\lambda)\alpha_1 - \lambda'[\alpha_{MS}\alpha_1 q-(1-\alpha_{MS})\alpha_1 i]>0$ when q is much larger than *i*, $|\lambda'|$ small and α_{MS} large.

Ruling out the possibility of negative effort, The solution is: $e=\frac{b-\sqrt{b^2-4ac}}{2a}$. Since $\frac{\partial e}{\partial b}>0$, $\frac{\partial e}{\partial c}>0$, $\frac{\partial e}{\partial a}>0$.

An increase in the efficiency of the market for corporate control has an uncertain effect, affecting both *b* and *c*.

An increase in *i* has a negative impact on effort (discouragement effect), since $\frac{\partial c}{\partial i}<0$ and $\frac{\partial e}{\partial c}>0$. External innovating ideas which may improve firm profits are a positive externality for the existing CSs, the higher they are, the more waisted CSs effort to implement their relatively less profitable project. Increases in q and in α_{MS} have a positive impact on effort (incentive effect), since $\frac{\partial c}{\partial q}>0$, $\frac{\partial c}{\partial \alpha_{MS}}>0$ and $\frac{\partial e}{\partial c}>0$. In fact the effect of α_{MS} reduces the winner curse phenomenon, thereby lowering CSs

benefits from a takeover. Therefore this effects leads them to increase effort.

We may therefore imagine that effort may be higher (than under the base case) under the possibility of takeover when project intrinsic value is high and when the share of existing minority shareholders is high, while it is lower the more market regulation reduces the possibility of takeovers.

The change in the optimal effort under the going public option must affect the optimal CS share under the venture capital option. In fact: $\frac{\partial a}{\partial e_P^*} = \frac{a_1}{[(1+b)(q+e)]}$. The equilibrium share will be higher if $e^*_{P(CC)} > e^*_P$ or lower if $e^*_{P(CC)} < e^*_P$. Therefore when the going public option yields a relatively higher equilibrium effort, the venture capital option yields a relatively higher equilibrium share for controlling shareholders and viceversa.

If the effort effect under the going public choice is higher than the bargaining effect under the VC choice higher intrinsic value of the project and higher property right shares of old minority shareholders should increase the likelihood of the VC choice.

Tab. 2 Synthesis of results on the effect of asymmetric information, stock market volatility and more efficient corporate control on the decision of external equity financiers

	Asymmetric information between CSs and the manager	Stock market volatility generated by noise trading	More efficient market for corporate control
Ex post CSs share under the going public choice	Equal to the base case	Equal to the base case	Equal to the base case
Equilibrium effort under the going public choice	Lower than in the base case	Equal to the base case	Higher for high intrinsic value of the project and high property right shares of old minority shareholders. Lower than in the base case for high productive innovation introduced by the takeover
Ex post CSs share under the venture capital choice	Lower than in the base case	Lower than in the base case	Higher for high intrinsic value of the project and high property right shares of old minority shareholders. Lower than in the base case for high productive innovation introduced by the takeover
Equilibrium effort under the venture capital choice	Lower than in the base case	Equal to the base case	Equal to the base case
Distortion between CSs private and social optimum (Proposition 3)	Weakened	Enhanced	Enhanced for high intrinsic value of the project and high property right shares of old minority shareholders when effort effect is larger than bargaining effect

Conclusions

The paper presents a theoretical analysis of the determinants affecting the controlling shareholders choice between going public and looking for a venture capital partner when they are in need of external equity financiers. In the model the two choices are strictly connected as expected controlling shareholders profits under the going public option represent their outside options in case of failure of reaching an agreement in the bargaining process with the venture capital partner.

Another feature of the model is that controlling shareholders regulate managerial effort up to the point where their marginal benefit is equal to their marginal cost from manager effort. Therefore, under the going public choice, they remain residual claimants of firm profits and residual payers of manager costs after satisfying reservation utility of small shareholders and the reservation wage of the manager. For this reason, optimal managerial effort is proportional to their ex post property right share. On the contrary, under the VC choice CSs fully bear managerial costs while they enjoy effort benefits only in proportion to their bargaining power.

As a consequence, the main advantage of going public for CSs is that they have a stronger bargaining position as they face dispersed small shareholders and not one strong shareholder. The main disadvantage is that small shareholders suffer more from informational asymmetries and are risk averse so that the compensation they require to participate to the venture may be too costly for CSs under high financial volatility or when the firm is not well known to them.

In addition, we find that for high values of their ex ante property right share controlling shareholders prefer the venture capital to the going public financing solution even if the first is socially inefficient. This is because an increase in ex ante CSs ownership generates a change in the difference between the social value of the going public versus the venture capital choice which is higher than the change in the difference between the private value of the going public versus the venture capital choice.

The paper also shows how a weak institutional environment which fosters legal and illegal collusion under the VC choice at the expense of small shareholders reduces the relative collusion under the VC choice, reduces the desirability of going public and enhances the divergence between private and social optimum when the control group has a

high ex ante ownership share. In the same way, an increase of stock market volatility reduces the relative convenience of the going public choice for a negative wealth effect on CSs which need to compensate risk averse new minority shareholders.

The results provide a theoretical framework which helps to explain recent empirical findings on a large sample of Italian small medium firms which show that proxies of informational asymmetries, investment size and the weakness of the institutional environment are crucially and positively related to the willingness to prefer the venture capital to the going public choice (Becchetti-Cavallo, 2000). These results may also provide a theoretical framework which helps to interpret the links among three more general and well known stylised facts of the Italian economy such as its low stock market capitalisation/GDP ratio, the concentrated ownership of small-medium sized firms and their difficulties in upsizing.

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Appendix

TABLE A1 Different characteristics of firms which want or do not want to go public (firms choosing the alternative option are excluded from the sample)

	Unfiltered sample			Filtered sample		
	Firms which intend to look for a venture capital partner	Firms which do not intend to look for a venture capital partner	Firms which intend to go public	Firms which do not intend to go public	Firms which intend to go public	Firms which do not intend to go public
Employees	96.88	123.57	327.15	123.30	357.42	139.92
Foundation year	1974	1974	1974	1974	1973	1973
Group affiliation (percent)	26.86	23.08	50.54	22.95	56.09	27.54
Family owned firms (percent)	66.15	63.73	57.95	63.64	58.22	64.30
Avg. Number of controlling shareholders	2.13	1.93	1.83	1.93	1.71	1.91
Avg. share of the controlling group	89.58	82.92	84.24	83.05	83.36	83.32
Share of firms declaring a successful product or process innovation in the 1995-97 period (percent)	79.10	72.07	79.12	72.14	80.48	72.40
Share of subsidised firms (percent)	59.70	40.56	53.33	40.04	56.79	40.33
Share of subsidised investment (percent)	12.03	11.76	12.25	11.75	11.92	11.31
Share of firms which declare to be credit rationed (percent)	37.87	14.83	16.66	14.86	14.63	14.39
Share of firms with product quality certification (percent)	30.30	27.81	54.44	27.84	58.02	29.88
Share of investment financed by retained earnings (percent)	35.37	48.19	42.77	48.32	43.55	49.27
Share of investment financed by long term bank debt (percent)	28.04	22.45	23.07	22.77	21.65	21.86
Share of investment financed by short term bank debt (percent)	10.71	6.99	4.84	6.91	3.31	6.77
Share of credit with the first bank (percent)	32.16	30.18	26.95	30.20	26.85	30.19
Number of banks with whom the firm has relationship	8.26	6.11	10.45	6.11	10.96	6.19

Average yearly 1995-1997 physical investment per employee (million liras)	111.46	27.68	15.67	27.77	16.94	26.57
Average yearly 1995-1997 R&D investment per employee (million liras)	3.02	1.65	3.40	1.66	3.62	1.58
Leverage (percent)	11.88	8.48	10.65	8.48	11.04	7.83
1997/1995 Net sales growth (percent)	13.21	18.34	48.23	18.23	51.99	19.78