

## INFORMATION QUALITY AND THE VALUATION OF NEW ISSUES

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The prevailing belief in the marketplace holds that the choices of auditor and investment banker affect the price of an initial public offering. This belief reflects the idea that the auditor and investment banker quality provides information about the firm's true value. This paper presents a model giving this belief theoretical support. Under plausible conditions, it is shown that an entrepreneur with favorable information about his firm's value chooses a higher-quality auditor and investment banker than an entrepreneur with less favorable information. As a result, firm value is an increasing function of auditor and investment banker quality.

### 1. Introduction

An entrepreneur who has decided to bring his firm public must choose an auditor to examine the firm's financial statements and an investment banker to market the firm's securities. It is commonly believed that these choices may have an impact on the price at which the firm's shares can be sold. For example, Carpenter and Strawser (1971), in a study of auditor choice by firms selling shares nationally for the first time, report that underwriters advise their clients who are currently served by a local, or regional, auditor to switch to a national one known for higher quality standards in order to receive a higher price for the shares sold. Similarly, Logue (1973) suggests that the choice of a prestigious rather than a non-prestigious investment banker might influence the price which investors are willing to pay for the shares sold. These statements implicitly reflect the belief that when a firm sells shares for the first time its true value is imperfectly known by investors and that the quality of the auditor and investment banker chosen by the firm's owner provides information to the market about that value.

The purpose of this paper is to develop a model to demonstrate how the quality of the auditor chosen can rationally be used by investors in valuing new

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issues. The model, however, is also applicable to the choice of investment banker quality or, more generally, to the entrepreneur's choice of the quality of any outsider who can provide information about the firm. But, for convenience the discussion in the paper will be framed solely in terms of auditor choice. Auditor quality is defined here in terms of the accuracy of the information he supplies to investors; the information provided by a higher-quality auditor allows investors to make a more precise estimate of the firm's value. Given this, the basic result of this paper is that an entrepreneur with more favorable private information about his firm's value will choose a higher-quality auditor than will an entrepreneur with less favorable private information. An owner with more favorable information will be willing to pay the (presumably higher) fee of a more accurate auditor since the information provided to investors by the auditor is likely to be favorable; in contrast, it will not be worthwhile for an owner with less favorable information to pay the cost of a higher-quality auditor since the auditor's information is likely to be unfavorable. Investors, aware of this behavior, will be able to infer the nature of the entrepreneur's information from his choice of auditor quality. The higher the quality, the more favorable will investors infer the information to be and so the higher will be the price at which the new issue can be sold.

The main result of this paper, that an observable decision made by an entrepreneur can provide information to less informed investors in the new issues market, has also been demonstrated in prior research. Leland and Pyle (1977), for example, have demonstrated that the level of shareholdings retained by the entrepreneur in his firm can perfectly reveal his private information. Also, Hughes (1986), in an extension of the Leland and Pyle framework, has shown that when the entrepreneur is in possession of two pieces of information rather than one, they can both be perfectly revealed to investors through observation of the entrepreneur's shareholding level in conjunction with an announcement by him of the firm's true value. Hughes also provides a role for the investment banker in her model. However, in contrast to the model developed here, in Hughes' model the investment banker does not supply information to investors.

The equilibrium model presented in this paper is similar to the labor market model of Guasch and Weiss (1980).<sup>1</sup> In their model workers pay to take a fixed pass-fail test given by their employer with the result of the test determining their wages. How well a worker does on the test is directly related to his productivity. Therefore, a worker who perceives his productivity to be higher will be willing to pay more to take the test than will a worker with lower perceived productivity; his probability of passing and hence the expected benefit to be derived from the test will be greater. This is analogous to the main result of the model developed here, that an entrepreneur with more

<sup>1</sup>See Guasch and Weiss (1981) and Weiss (1983) for similar models.

favorable private information will choose a higher-quality auditor; his expected gain from doing so is greater than for an entrepreneur with less favorable information.

The plan of this work is as follows. In section 2 the entrepreneur's choice of auditor quality is examined and the resulting signalling equilibrium is described. This is followed in section 3 by a discussion of the properties of this equilibrium and in section 4 by comparative statics results. Suggestions for future research are discussed in section 5, and a summary section concludes the paper.

## 2. Auditor quality as a signal in the new issues market

Consider an entrepreneur with an initial wealth level of  $W_0$  who has just invested an amount  $I$  in a productive opportunity which will produce a random end of period cash flow,  $\tilde{\mu}$ . In order to diversify his portfolio the entrepreneur has decided to sell the fraction  $1 - \alpha$  of his shares in the productive asset to outside investors. This fraction will be taken as exogenous so as to focus on the entrepreneur's choice of auditor.<sup>2</sup> For simplicity it is assumed that there is only one other alternative investment, a risk-free asset, paying zero interest; therefore, the entrepreneur invests any funds raised from the sale of shares into the risk-free asset. All outside investors are assumed to be risk-neutral.

The entrepreneur, before investing in the productive opportunity, received private information about the magnitude of the firm's end-of-period cash flow,  $\mu$ , through observation of a signal,  $x$ . Specifically, given  $\mu$ ,

$$\tilde{x} = \mu + \tilde{\varepsilon}_1, \quad (1)$$

where  $\tilde{\varepsilon}_1 \sim N(0, 1/h)$  and is independent of  $\mu$ . Assuming that the prior distribution of  $\tilde{\mu}$  is diffuse,<sup>3</sup> the posterior distribution conditional on  $x$  is normal with mean  $x$  and variance  $1/h$ .

Although not observing  $x$  before the firm's shares are sold on the market, outside investors also receive information useful for estimating the firm's final cash flow. One information source is the published financial statements prepared by the firm's entrepreneur in conjunction with the auditor chosen by the entrepreneur. This information is denoted here by the variable  $\theta$  which is related to the firm's end-of-period cash flow. Specifically, given  $\mu$ ,

$$\tilde{\theta} = \mu + \tilde{\varepsilon}_2, \quad (2)$$

<sup>2</sup>Implications of relaxing this assumption are discussed in section 5.

<sup>3</sup>The assumption of diffuse priors simplifies the presentation since it implies that the entrepreneur's and investors' posteriors depend solely on the signals they receive. Dropping the assumption, however, will not affect any of the results.

where  $\tilde{\varepsilon}_2 \sim N(0, 1/q)$  and is independent of  $\mu$ . With the assumption that the prior distribution of  $\tilde{\mu}$  is diffuse, the posterior distribution conditional on  $\theta$  is normal with mean  $\theta$  and variance  $1/q$ .

For simplicity  $\tilde{\varepsilon}_1$  is assumed to be independent of  $\tilde{\varepsilon}_2$ . The assumption of independence, however, is not crucial for this analysis.  $\theta$  must just provide some information supplementary to  $x$ .<sup>4</sup> This means that the auditor must bring to the financial statements some information not previously known by the entrepreneur. This is a reasonable assumption, especially for firms that have recently begun operations. For some of these firms detailed financial statements may never have been prepared in the past. The auditor provides such firms with expertise in information processing as well as knowledge of industry conditions. This allows the auditor to provide better estimates than the entrepreneur of the values of certain balance sheet accounts. Among the most prominent are inventory, accounts receivable, some long-term assets, and contingent liabilities. The auditor may also be better able to compute some income statement amounts, the most likely one being the cost of goods sold.

The precision of the information,  $\theta$ , derived from the financial statements depends on the quality of the auditor, denoted here by  $q$ . The lowest-quality auditor is signified by  $q = q_{\min}$  with higher levels of  $q$  signifying auditors who produce more precise information. Higher-quality auditors are also assumed to charge higher fees, with  $c(q)$  representing the cost of hiring an auditor of quality  $q$ . The quality of each auditor is determined exogenously and assumed to be known by the entrepreneur and all investors.

Investors may obtain a more precise estimate of  $\mu$  than what is revealed by the financial statements by also taking into account that the entrepreneur's choice of auditor quality may reveal the nature of his private information. This will be the case if, in equilibrium, the entrepreneur's optimal choice of auditor quality,  $q^*$ , is a strictly increasing function of his information  $x$ . If it is, investors would then be able to correctly infer the entrepreneur's information from knowledge of  $q^*$ ; their inference,  $f(q^*)$ , would be such that

$$f(q^*) = x. \quad (3)$$

Investors could then use  $q^*$  along with  $\theta$  to form a more precise estimate for the expected value of the firm's final cash flow,  $\tilde{\mu}$ . Since  $\tilde{\varepsilon}_1$  and  $\tilde{\varepsilon}_2$  are independent and normally distributed, this expectation can be written as

$$E(\tilde{\mu} | \theta, q^*) = k(q^*)\theta + (1 - k(q^*))f(q^*), \quad (4)$$

where

$$k(q^*) = q^*/(q^* + h).$$

<sup>4</sup>For a further discussion of this point, see the latter part of section 3

Since investors are risk-neutral, they would value the firm at

$$v(\theta, q^*) = E(\tilde{\mu} | \theta, q^*).$$

In order to demonstrate that there is such an equilibrium, it must be shown that an inference schedule,  $f(q^*)$ , exists that motivates the entrepreneur to choose an optimal quality level,  $q^*$ , that correctly reveals his information [that is, for which condition (3) is satisfied] regardless of how favorable or unfavorable the information. This quality choice is made so as to maximize the entrepreneur's expected utility of final wealth,  $W$ , given his private information  $x$ :

$$E[U(\tilde{W}) | x] = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} U(W) g(\theta, \mu | x) d\mu d\theta, \quad (5)$$

where

$$\tilde{W} = W_0 - I + (1 - \alpha)v(\tilde{\theta}, q) - c(q) + \alpha\tilde{\mu}, \quad (6)$$

and  $g(\theta, \mu | x)$  is the joint density of  $\theta$  and  $\mu$  given  $x$ .

As seen from (4) and (6), the quality level will affect the entrepreneur's expected utility in several ways. On the positive side an increase in  $q$  will increase investors' assessment of the entrepreneur's private information, through the function  $f(q)$ , and therefore the price at which the entrepreneur's shares can be sold in the market. However, by increasing the precision of the auditor's information, an increase in  $q$  will raise  $k(q)$ , the weight placed on the auditor's information (which is an unbiased estimate of the firm's final cash flow). In addition, given that there is ex-ante uncertainty about the nature of this information, an increase in  $q$  will increase the variance of the price that the entrepreneur will receive for the shares he sells.<sup>5</sup> This will adversely affect the entrepreneur if he is risk-averse. Finally, an increase in  $q$  will directly affect the entrepreneur by increasing the cost of the auditing services.

While it cannot be shown with complete generality that a strictly monotonic function,  $f(q)$ , exists which causes the auditor quality choice,  $q^*$ , to perfectly reveal the entrepreneur's information [so that (3) is satisfied], it can be demonstrated for the case where the entrepreneur has negative exponential utility. Given a negative exponential utility function with risk aversion parameter  $a$  and given that his end-of-period wealth is normally distributed, the

<sup>5</sup> This can easily be seen by taking the variance of  $v(\theta, q^*)$  given  $x$ ,

$$\text{var}[v(\tilde{\theta}, q^*) | x] = k^2(q^*) \text{var}(\tilde{\theta} | x).$$

Substituting for  $k(q^*)$  and  $\text{var}(\tilde{\theta} | x)$ , this expression reduces to

$$\text{var}[v(\tilde{\theta}, q^*) | x] = q^*/(q^* + h)h,$$

which is increasing in  $q^*$ .

entrepreneur's objective given his private information  $x$  will be to maximize

$$Y = E(\tilde{W} | x) - (a/2)\text{var}(\tilde{W} | x). \quad (7)$$

Using (6), (7) can be rewritten as

$$\begin{aligned} Y = & W_0 - I + (1 - \alpha)E[v(\tilde{\theta}, q) | x] - c(q) + \alpha x \\ & - (a/2)\text{var}[(1 - \alpha)v(\tilde{\theta}, q) + \alpha\tilde{\mu} | x]. \end{aligned} \quad (8)$$

Substituting the expressions for the expectations and variances into (8) and rearranging terms, the entrepreneur's objective function can be reexpressed as

$$\begin{aligned} Y = & W_0 - I + (1 - \alpha)[(qx + hf(q))/(q + h)] - c(q) \\ & + \alpha x - (a/2)[(q + \alpha^2 h)/(q + h)h]. \end{aligned} \quad (9)$$

Differentiating (9) with respect to  $q$  gives the first-order condition for optimal quality choice,

$$\begin{aligned} (1 - \alpha)(x - f(q))h/(q + h)^2 + (1 - \alpha)hf'(q)/(q + h) \\ - c'(q) - a(1 - \alpha^2)/2(q + h)^2 = 0. \end{aligned} \quad (10)$$

The  $q$  chosen by the entrepreneur will perfectly reveal his information if there is a strictly monotonically increasing function  $f(q)$  which simultaneously solves the differential equation (10) and satisfies condition (3). Substituting (3) into (10) and solving for  $f(q^*)$  yields the function which investors can use to infer  $x$ ,

$$\begin{aligned} f(q^*) = & \int_{q_{\min}}^{q^*} c'(y)(y + h) dy / (1 - \alpha)h + [a(1 + \alpha)/2h] \\ & \times [\ln(q^* + h) - \ln(q_{\min} + h)] + z. \end{aligned} \quad (11)$$

Differentiation of (11) confirms that  $f(q^*)$  is strictly monotonic,

$$f'(q^*) = c'(q^*)(q^* + h)/(1 - \alpha)h + a(1 + \alpha)/2(q^* + h)h > 0.$$

There are several functions that satisfy (11), one for each feasible value of the constant  $z$ . Each function represents an equilibrium signalling schedule. However, the schedule which is expected to be observed, the Pareto-dominant signalling schedule, is the one which results in the lowest possible cost for each

entrepreneur. This is the one for which all entrepreneurs who have received the least favorable information consistent with investing in the project,  $x_{\min}$  (that level of  $x$  which makes the entrepreneur just indifferent to taking on the project), signal the minimum amount,  $q_{\min}$ . As Riley (1975, 1979) states, this schedule is the only one which 'survives plausible experimentation' by market participants. To understand why, assume that all entrepreneurs receiving information  $x_{\min}$  were to signal more than  $q_{\min}$ . If this were the case, then outside investors could profit by announcing that they will infer a value of  $x$  equal to  $x_{\min}$  for all firms where  $q_{\min}$  is signalled. This is because they would attract firms whose entrepreneurs observed  $x_{\min}$ , since those entrepreneurs would receive the same value for their firm but would incur lower signalling costs, as well as some firms whose entrepreneurs observed information more favorable than  $x_{\min}$ , who would be willing to accept a lower firm value in return for reduced signalling costs. In a competitive market such action on the part of investors would then cause entrepreneurs observing  $x_{\min}$  to signal  $q_{\min}$ .

The constant,  $z$ , in (11) corresponding to the Pareto-dominant signalling schedule can then be found by substituting the pair  $q^* = q_{\min}$  and  $f(q_{\min}) = x_{\min}$  into (11). This can easily be shown to yield a value of  $z$  equal to  $x_{\min}$ . Since by definition  $x_{\min}$  is the realization of  $x$  which makes the entrepreneur indifferent to taking on the project, its value can be found by setting his expected utility level equal to  $W_0$  (the level of expected utility that he would receive if the investment were not made) and solving for  $x$ . After rearranging terms this yields

$$x_{\min} = I + c(q_{\min}) + (a/2) \left[ (q_{\min} + \alpha^2 h) / (q_{\min} + h) h \right], \quad (12)$$

which is equal to  $z$  in the Pareto-dominant signalling schedule.

Another issue of concern is the stability of the equilibrium signalling schedule. The equilibrium schedule will be unstable if investors can make profitable offers for firms which will induce entrepreneurs who receive different private information to choose the same auditor quality level. Riley (1975) demonstrates that under certain conditions offers designed to attract entrepreneurs who are among the least favorably informed (pooling offers) will be profitable and will cause the entire signalling equilibrium to unravel. However, this unravelling may not occur in the model developed here since such a contract will also attract entrepreneurs with negative net present value projects who would not otherwise enter the new issues market. [See Leland and Pyle (1977) and Riley (1985) for a similar argument.] Riley (1985) also provides conditions under which similar pooling offers, designed to attract more favorably informed entrepreneurs, will also be unprofitable. These conditions would, in the model here, concern the shape of the audit cost function,  $c(q)$ , and market participants' priors over the distribution of the private information,  $x$ , held by the entrepreneur. (In Riley's analysis proper, not diffuse, priors are

assumed.) If these conditions are satisfied for all levels of  $x$ , the Pareto-dominant signalling schedule will not unravel and so will be a Nash equilibrium.

Further, as Riley (1979) points out, investors will never find these pooling offers to be profitable, in equilibrium, when the reactions to them by other investors are considered. He shows that if these reactions are anticipated by investors, then a stable equilibrium will result. This 'reactive' equilibrium is shown by him to be equivalent to the Pareto-dominant signalling equilibrium.

### 3. Discussion of the equilibrium

The equilibrium developed in the previous section has the property that entrepreneurs will have an incentive to choose the auditor quality level that correctly reveals their private information; the more favorable the information the higher the quality chosen. This fact yields the major result here that, cross-sectionally, equilibrium firm values are on average an increasing function of the auditor's quality. This can be seen by taking the expectation of (4) with respect to  $\theta$  and employing the condition that  $f(q^*) = x = E(\tilde{\theta} | x)$ ,

$$E[v(\tilde{\theta}, q^*) | x] = k(q^*)f(q^*) + (1 - k(q^*))f(q^*) \quad (13)$$

$$= f(q^*). \quad (14)$$

Since  $f'(q^*) > 0$  expected firm valuation increases with  $q^*$ . This result supports the conventional wisdom that the choice of a more prestigious auditor will result in a higher market price for a new issue.

Investors are able to infer that an entrepreneur who chooses a higher-quality auditor must have more favorable private information since such a choice cannot profitably be mimicked by an entrepreneur with less favorable information. But, in contrast to most signalling models, it is not the difference in marginal costs but rather the difference in marginal benefits which deters such mimicking. Specifically, if the entrepreneur with less favorable information did mimic the higher-quality choice of the entrepreneur with more favorable information, both would incur the same added cost and added risk associated with a higher  $q$ . However, the expected firm valuation would not increase as much for the entrepreneur with less favorable information because the higher the auditor quality, the more weight investors place on the auditor's information, information which is expected to be less favorable for his firm. So while it is worthwhile for the entrepreneur with more favorable information to invest in a high-quality auditor who will confirm that the firm really has a high value, it is not profitable for an entrepreneur with less favorable information to do so.

It should be clear from this discussion that higher-quality auditors must actually provide more precise information rather than just charge higher fees in



order for auditor choice to perfectly reveal the entrepreneur's information. If precision were not higher for more costly auditors, then the marginal effect on the entrepreneur's utility of hiring a more costly auditor would be independent of the entrepreneur's private information. [This can be verified mathematically by examining (10) and noting that if precision were fixed, the first term in the first-order condition would go to zero. The remaining terms do not depend on the entrepreneur's private information.] The auditor choice could then not reveal anything about the entrepreneur's information. This is in contrast to the Guasch and Weiss (1980) model, where the tests that workers take all have the same precision but where the amount that they are willing to pay to be tested perfectly reveals their perceived productivity.

It is also important in this model that the auditor's information,  $\theta$ , provide information to investors about the firm's final cash flow in addition to that given by knowledge of  $x$ . Otherwise, the quality choice could not perfectly reveal the entrepreneur's information. To see this, note that if  $q$  did perfectly reveal the entrepreneur's information and if  $\theta$  did not provide information in addition to that given by  $x$ , then  $\theta$  would not enter into investors' valuation of the firm as long as they knew  $q$ . But if  $\theta$  were ignored by investors, an entrepreneur with less favorable private information could successfully mimic the quality choice of an entrepreneur with more favorable information and receive the same value for his firm. Hence, the quality choice could not perfectly reveal the entrepreneur's information in this case.<sup>6</sup>

#### 4. Comparative statics

The preceding analysis yields several comparative statics results. The first involves the precision of the entrepreneur's private information,  $h$ . To see how an increase in precision affects the auditor quality level chosen, (11) must be differentiated with respect to  $h$ . Doing so yields

$$\begin{aligned} \frac{\partial f(q^*)}{\partial h} &= \int_{q_{\min}}^{q^*} -c'(y)y \, dy / (1-\alpha)h^2 \\ &\quad - [a(1+\alpha)/2h^2] [\ln(q^*+h) - \ln(q_{\min}+h)] \\ &\quad + [a(1+\alpha)/2h] [1/(q^*+h) - 1/(q_{\min}+h)] \\ &\quad + \partial z / \partial h, \end{aligned} \tag{15}$$

<sup>6</sup>It may be possible, however, to achieve a partially revealing equilibrium in this case where the quality level chosen gives an imprecise signal of the entrepreneur's private information. For an example of such an equilibrium, see Titman and Trueman (1984).

which can easily be seen to be negative. The quality level which correctly signals the entrepreneur's information therefore increases as the precision of the information increases.

Intuitively, this is because an increase in precision increases the marginal benefit and decreases the marginal cost of raising the level of auditor quality. The greater the precision, the more weight investors place on the entrepreneur's information, inferred from the auditor choice, and hence the greater the gain from increasing auditor quality. Further, the greater the precision, the less uncertainty the entrepreneur faces over the nature of the auditor's information,  $\theta$ , and therefore the smaller will be the increase in the variance of the market price he obtains for his shares as auditor quality increases.

The preceding result suggests that if the entrepreneur were able to choose the level of precision,  $h$ , there would be opposing factors influencing this choice. On the one hand, more precise private information improves the entrepreneur's ability to decide whether or not to invest in his productive opportunity. However, on the other hand, more precise information results in a higher-auditor-quality level, and therefore higher signalling costs, being required in equilibrium.<sup>7</sup> An implication of this is that the entrepreneur should not collect additional information after the decision on project investment has been made. This is because there would be no benefit from obtaining the additional information, but there would be an increase in the entrepreneur's signalling costs since his information has become more precise.

If it is reasonable to assume that the precision of the entrepreneur's private information is inversely related to the inherent riskiness of the firm's cash flows, then the comparative static result obtained in (15) implies that, given the nature of the entrepreneur's information, the less risky the firm the higher will be the quality of the auditor chosen. This is consistent with casual evidence which suggests that the clients of the more prestigious auditors are generally less risky.

This model can also be used to investigate the effect of an increase in the minimum acceptable level of auditor quality,  $q_{\min}$ . First, it can be immediately seen that an increase in  $q_{\min}$  will cause some entrepreneurs (those with the least favorable information on their firms' value) to drop out of the new issues market; their projects will no longer be profitable given the increased cost of taking their firms public. In addition, an increase in  $q_{\min}$  will cause the entire equilibrium signalling schedule to shift downward. This can be seen by differentiating (11) with respect to  $q_{\min}$  and using the expression for  $z$  as given

<sup>7</sup>In addition, because an increase in the precision of the entrepreneur's information results in the information having a greater impact on his firm's market price, the choice of a higher level of precision would adversely affect him ex-ante by increasing the variance of the price that he will receive for his shares.

by (12),

$$\begin{aligned} \partial f(q^*)/\partial q_{\min} &= -c'(q_{\min})(q_{\min} + h)/(1 - \alpha)h \\ &\quad - a(1 + \alpha)/2h(q_{\min} + h) + c'(q_{\min}) \\ &\quad + a(1 - \alpha^2)/2(q_{\min} + h)^2. \end{aligned} \quad (16)$$

With  $h$  and  $q_{\min}$  positive,  $\partial f(q^*)/\partial q_{\min} < 0$ . Each of the remaining entrepreneurs must therefore increase their expenditures on the auditing services. An increase in the minimum acceptable quality level of auditing services then has the effect of decreasing the value, to all entrepreneurs, of their investment projects.

A few additional comparative statics of this equilibrium are worth noting. First, since the entrepreneur is subject to greater risk for higher levels of  $q$  (as discussed above), the signalling schedule is a function of his level of risk aversion. As can be seen from (11) and (12) an increase in the risk aversion parameter,  $a$ , increases  $f(q^*)$  for all  $q^*$  and so decreases the quality level which the entrepreneur chooses. The signalling schedule is also affected by the shareholding level of the entrepreneur, in two opposing ways. On the one hand, if the entrepreneur retains a higher percentage of the shares, the marginal benefit he derives from choosing a higher-quality level, and receiving a higher market valuation for the shares sold, is lower. This effect works in the direction of increasing  $f(q^*)$  for all  $q^*$ , lowering the optimal quality level chosen. On the other hand, if the entrepreneur retains more shares, he is less subject to the uncertainty associated with the price he receives for his shares. This effect works in the direction of decreasing  $f(q^*)$  for all  $q^*$ , raising the optimal-quality level chosen. As can be seen from (11) and (12) (after some manipulation) the first effect dominates the second in that  $f(q^*)$  increases for all  $q^*$ . The greater the entrepreneur's shareholding level, the lower will be the quality level chosen by him.

## 5. Suggestions for future research

A possible extension of this analysis would be to have the entrepreneur's shareholding level determined endogenously. Then his shareholdings as well as his auditor quality choice could convey information to investors. In such a model it would be possible to explore the entrepreneur's trade-offs in his choice between these two signals. Increasing his shareholdings would increase the risk of his portfolio while increasing auditor quality would increase the auditing costs as well as the risk that the entrepreneur would face over the market price to be received for his shares. The entrepreneur must balance these risks and costs in deciding on his optimal shareholding level and the optimal auditor

quality. Although a complete analysis of this problem would be difficult, it would be of interest to determine whether or not the principal result of this paper, that auditor quality is an increasing function of the favorableness of the entrepreneur's information, and the principal result of Leland and Pyle (1977), that the entrepreneur's shareholdings are a positive function of the favorableness of his information, continue to hold in this more complex setting.

If both shareholdings and auditor quality were endogenously determined it might also be possible to expand the model to allow for two aspects of the entrepreneur's information (such as the mean and variance of his posterior distribution), rather than just one, to initially be unknown to investors. The entrepreneur's choices for shareholdings and auditor quality might, together, be able to reveal both attributes. [If a solution to such a two-signal problem exists, the method of solution would be along the lines of Hughes (1986).]

Another possible extension to this analysis would be to allow the entrepreneur to withdraw his shares from the market and abandon his investment project if the information provided by the auditor is sufficiently unfavorable. In this case, the auditor's information would have added value to the entrepreneur since it would be useful in his investment decision. While a formal analysis of this extension would be difficult technically, it is expected that, because of the information's added value, the optimal level of auditor quality would increase for all entrepreneurs.

It may also be possible to apply the model developed here to examine the choice of auditor for an existing firm's annual audit. This will be the case if the firm's manager is compensated at least in part on the basis of the firm's market value so that he has an incentive to reveal favorable information. A strict application of the model, however, would imply frequent auditor changes, as the manager's private information changes from year to year. But, given that there may be significant costs associated with switching auditors, the manager might be deterred from such frequent changes. It is more likely, then, that an auditor switch would be made only if it would result in a large positive impact on investors' expectations.

## **6. Summary and conclusion**

When a firm's owners decide to take their firm public they must choose an auditor to help in preparing the firm's financial statements. The auditor, in the course of doing so, supplies information to investors which is useful for valuing the firm. The analysis presented here demonstrates that not only is this information important for valuation purposes but that also the quality of the auditor chosen provides information useful to investors; the higher the quality level chosen, the greater will be investors' assessment of the firm's value.

Furthermore, as noted at the beginning of this paper this analysis can also be applied to the choice of the quality of any outsider who can provide

information about the firm. In particular it can be used to explain the choice of investment banker. Under this interpretation the chosen quality of the investment banker can also be said to provide information useful to investors, with the higher the quality level chosen, the greater the investors' valuation of the firm.

Auditor and investment banker quality, however, are not the only choice variables that can provide information to investors. The entrepreneur's shareholdings [Leland and Pyle (1977) and Hughes (1986)], his direct disclosure about firm value [Bhattacharya and Ritter (1983) and Hughes (1986)], the firm's debt level [Ross (1977)], and its dividend policy [Bhattacharya (1979, 1980)] have all been suggested as signals of firm value. In reality, it is expected that auditor and investment banker quality along with each of these financial variables provide some, but not complete, information about value.

Since all of these variables have been suggested as possible signals, an empirical test of the results presented here would ideally involve using proxies for auditor and investment banker quality along with measures of these other financial variables. However, while the model presented here suggests that for these tests auditor and investment banker quality be measured along a continuum, developing such measures would be very difficult. A more practical alternative for these tests is to partition both the auditors and the investment bankers into two quality levels (big eight versus non-big eight auditors and major versus non-major investment bankers). Recent research along these lines has been conducted by Simunic and Stein (1984). Among other results they find that, consistent with the analysis in this paper, there is a positive relation between a firm's market value and the quality of the auditor and investment banker chosen by the firm's owners.<sup>8</sup> Additional empirical work of this type will help to provide more insights into the importance of the auditor and investment banker choice relative to other informational signals suggested in the literature.

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<sup>8</sup>They also find weak support for a negative relation between the owner's shareholdings and auditor quality, a result also consistent with the analysis here.

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