THE JOURNAL OF FINANCE • VOL. LIV, NO. 3 • JUNE 1999

The Going-Public Decision and the Development of Financial Markets

AVANIDHAR SUBRAHMANYAM and SHERIDAN TITMAN*

ABSTRACT

This paper explores the linkages between stock price efficiency, the choice between private and public financing, and the development of capital markets in emerging economies. Generally, the advantage of public financing is high if costly information is diverse and cheap to acquire, and if investors receive valuable information without cost. The value of public firms generally depends on public market size, which implies that there can be a positive externality associated with going public, so that an inferior equilibrium can exist where too few firms go public. The model is consistent with empirical observations on financial market development.

FIRMS FUND THEIR INVESTMENT EXPENDITURES from a variety of sources. Mature U.S. corporations, for example, obtain the bulk of their new equity capital from retained earnings and allocate capital to various business units using what Williamson (1975) describes as an internal capital market. Other firms, however, depend much more on the public capital markets to fund investment. An extreme example of this is Thermo Electron Corporation, which has created and taken public more than 20 different new businesses. Thermo Electron's financing strategy is in sharp contrast to the strategies of other companies that provide private financing to fledgling corporations; for example, Enron Corporation, a publicly traded company, provides private equity to energy firms that have chosen not to go public.

The relative mix of the different sources of capital varies considerably from country to country. In Germany and other continental European countries, companies rely much more on private capital and internally generated capital than do firms in the United States and the United Kingdom. The

*Subrahmanyam is from the Anderson Graduate School of Management, University of California at Los Angeles. Titman is from the College of Business Administration, University of Texas at Austin, and the National Bureau of Economic Research. We thank an anonymous referee, René Stulz (the editor), Anat Admati, Franklin Allen, Tony Bernardo, Bhagwan Chowdhry, Joshua Coval, James Dow, Mike Fishman, Domingo Joaquin, Hayne Leland, Raghuram Rajan, Jay Ritter, Mark Rubinstein, Rob Vishny, Ivo Welch, Bill Wilhelm, Andrew Winton, and participants in the 1997 Indiana University Symposium and the 1998 American Finance Association meetings, and in seminars at Arizona State, the University of California at Berkeley, the University of Pennsylvania, Northwestern University, New York University, Tinbergen Institute, Tulane University, the Stockholm School of Economics, Michigan State University, and the University of Michigan for useful comments and discussions.

relative mix of these financing sources has also changed over time. For instance, Comment and Jarrell (1995) report that since about 1979, firms in the United States have been selling and spinning off divisions, reducing the importance of internal capital markets, and increasing the importance of public capital markets. Over the same time period initial public offerings (IPOs) have reached record levels.

This paper investigates the efficiency with which private and public markets allocate capital, paying particular attention to the role of information and liquidity. Specifically, we ask why public markets may provide the best source of financing for the high-tech companies started, for example, by Thermo Electron but private markets may be better for the energy companies funded by Enron. We also ask why the relative mix between private and public capital differs across countries.

We consider the financing decision of an entrepreneur with a technology that requires capital at the present time as well as in the future. The entrepreneur obtains the initial financing from either public markets (he can do an initial public offering) or private markets (he can sell stock to either a venture capitalist or a conglomerate). His choice between these alternatives is determined by the cost of the initial capital, which depends on liquidity considerations, and by how the choice affects future capital allocation choices.

Other researchers who have considered related topics have focused on incentive issues rather than directly on the information issues considered in this paper. For example, Williamson (1975) and Stein (1997) examine how managerial incentives affect the transfer of capital from the cash-rich divisions of a conglomerate to divisions that do not generate large amounts of cash but have good investment opportunities. In other related work, papers by Holmström and Tirole (1993) and Bolton and von Thadden (1998), both of which also consider liquidity, examine the incentive benefits associated with concentrated ownership and improved monitoring.[1]

The incentive issues described in earlier papers are likely to be important considerations in the going-public decision. For example, a small group of private shareholders may provide better monitoring than a dispersed public market. The importance of these incentive issues, however, is likely to depend on how information is generated and conveyed within an economy, which is the subject of our analysis. Indeed, as we discuss in Section VII, the broad thrust of our results continues to hold in a setting that accounts for these incentive issues.

Our analysis indicates that information considerations can favor either public or private financing depending on how investors obtain information. In a very simple setting where all individuals have equal access to the same costly information, the public markets are at a disadvantage relative to pri-

[1] See also Allen (1993), Dow and Gorton (1997), and Boot and Thakor (1997) for discussions relating to the advantages and disadvantages of bank-dominated versus market-dominated financial systems.

vate financiers. In this case, the information can be more efficiently collected and conveyed by a private financier because stock market analysts tend to duplicate each other's efforts and their strategic trades tend to obfuscate the information conveyed by the firm's stock price.

In reality, individuals obtain information in ways that are more complicated than the simple information technology described above; as a result, the information advantages and disadvantages of public and private markets are not so straightforward. First, when an investor pays to receive information, there is some uncertainty about what he will receive. Two investors expending the same resources on information collection are likely to receive correlated but different signals. As we will show, when investors receive different signals, the public markets can generate better information than can be generated by a private financier (or, equivalently, by the firm's managers themselves). This potentially more accurate information must, however, be weighed against the costs associated with having analysts duplicate each others efforts.

An additional aspect of information acquisition that we stress in this paper is the role of serendipity—that is, the extent to which stock market investors may, by chance, come across valuable information in their day-to-day activities. For example, in the course of managing the store's day-to-day operations, a manager for a retailer such as JC Penney may obtain valuable information about the demand for the clothing line of a fledgling garment manufacturer. Furthermore, an analyst examining one firm may discover relevant information about a different firm. Although information obtained serendipitously is likely to be noisy, when this diverse information is aggregated across many stock market investors, it can provide a useful signal that could not have been obtained if the firm were privately financed. The diversity of serendipitous information may also explain why different investors may interpret costly information differently.

Although private financing dominates public financing when a private financier can obtain more accurate information than would be generated in the public markets, the opposite is not necessarily true. In contrast to the information generated by the private financier, the information obtained by investors in the public markets can be a double-edged sword. On one hand, a more informative stock price can lead to better management decisions, which makes going public more attractive. On the other hand, however, markets are less liquid and the cost of capital is higher when investors are generating private information, which makes going public less attractive.[2]

[2] In our framework, liquidity considerations favor the private financier who can be viewed as either an institution (e.g., a conglomerate or a venture capitalist) with diversified holdings in many different investments, or a publicly traded financing company (e.g., the firm Enron mentioned above). The stock price of the private financier is thus less sensitive to private information, and so is more liquid than the entrepreneur's stock would be if it were publicly traded. See Gorton and Pennacchi (1993) and Subrahmanyam (1991).

Our analysis of the private versus public financing choice has implications about which firms engage in initial public offerings (IPOs), leveraged buyouts (LBOs), and corporate spinoffs. Additionally, our model provides potential explanations for why IPOs tend to cluster in industry groups, and why corporate spinoff activity and IPOs have increased dramatically over the past 20 years. We discuss these and other implications of our model in Section VI.

This framework for analyzing the going-public decision also provides important insights about the development of financial markets and how government actions that can have the effect of jump-starting an economy's stock market can improve economic efficiency. As we show, because both liquidity and the information generated in a stock market are determined by the number of stock market participants, whether a firm is better off being privately versus publicly financed is also determined by the size of the stock market. When the stock market consists of a relatively small number of firms, the information conveyed in the public markets is less accurate, which generally decreases the advantage of being publicly financed. As the stock market grows, the information conveyed by stock prices generally improves, which, in turn, increases the incentive for private firms to go public and for conglomerates to spin off independent business units. There is, however, an exception to this general rule. Because serendipitous information can sometimes crowd out costly information acquisition, increasing the size of the stock market can sometimes reduce the benefits of public financing.

By going public, firms can generate positive externalities by increasing the size and informational efficiency of the stock market. As a result of these externalities, there can be a path dependency in the development of financial markets. In particular, an economy can have two equilibria: a "bad" equilibrium in which most firms remain private and a "good" equilibrium with superior resource allocation and greater firm values and in which most firms are publicly traded. Firms choose not to go public in the bad equilibrium because they ignore the positive externality associated with having additional firms trading on the economy's stock exchange. Specifically, with more publicly traded stocks, it is more attractive for individuals to open brokerage accounts to become stock market investors. When the influence of serendipitous information on production choices is strong, these additional active investors improve the capital allocation process, making it more attractive for additional firms to go public. This, in turn, can create more incentive for individuals to become active investors, thus creating a snowballing effect that can move the economy from the bad equilibrium to the good equilibrium.

This snowballing effect can increase stock market values as well as the number of listings, which is consistent with Henry's (1997) empirical analysis of stock market liberalizations. One explanation for these increases is that liberalized stock markets provide investors with better diversification opportunities, which lower capital costs and thus increase stock prices (see, e.g., Stulz (1997)). Our model suggests that increased liberalization increases stock market values by increasing the informational efficiency and liquidity of the stock market.

This paper is organized as follows. Section I discusses the basic economic setting. Sections II and III discuss resource allocation in the public and private financing regimes, respectively. Section IV introduces liquidity costs and describes an entrepreneur's choice between public and private financing. Section V analyzes an information externality associated with the going-public decision; specifically, we demonstrate path dependency and multiple equilibria under certain conditions, and we discuss the role of the size of public markets in firms' decisions to go public. Section VI discusses empirical implications, Section VII discusses possible extensions to the model, and Section VIII concludes. Proofs and discussions of all lemmas and propositions appear in the Appendix.

I. The Economic Setting

A. The Entrepreneur

Consider an entrepreneur who has an established business and is developing a new product that will require additional capital. In other words, the firm has assets in place and a growth opportunity. In period 0 the entrepreneur raises equity capital that can be used either for his consumption or to fund the growth opportunity. The entrepreneur has two alternative sources of capital. The first is a stock market wherein publicly traded firms get funding directly from risk-neutral investors, and the second can be interpreted as either a conglomerate or a financial intermediary that we call the private financier. The choice between these alternatives is determined by the cost of obtaining capital from the alternative sources and by how these funding sources affect future investment choices.

We assume that the private financier is a well-diversified publicly financed company (such as the firm Enron, mentioned in the introduction), so that its "basket" of investments is not sensitive to private (or firm-specific) information. This implies that the private financier's publicly traded stock will be substantially more liquid than the entrepreneur's stock (see Gorton and Pennacchi (1993) and Subrahmanyam (1991)). Because the private financier's stock is more liquid, its cost of capital is lower and this lower cost can be passed on to the entrepreneur. To simplify our analysis, we assume that the private financier's cost of capital is zero, and we demonstrate that the cost of capital for the entrepreneur's less liquid public company is strictly positive.[3]

[3] In reality, because of certain benefits such as tax advantages, private financiers are often nontraded limited partnerships. The results in this paper are not critically dependent on our assumption that the private financier is publicly traded.

If public equity is issued, it will be traded in period 1, on a security market that is described below. Production choices are also made in period 1, and in period 2 the payoffs from the assets in place and the growth opportunity are realized. The period 2 payoff on the assets in place is given by $\bar{F} + \delta + \theta$, where $\bar{F}$ is the ex ante mean and δ and θ are two independent, zero–mean, normally distributed random variables.[4] The payoff from the growth opportunity depends on the amount of capital invested in it and is correlated with the payoff on the assets in place. Specifically, the growth opportunity pays off

$$\bar{G} + K(\delta + \theta) - 0.5K^2 \tag{1}$$

in period 2, where $\bar{G}$ is a positive constant and K is the amount of capital devoted to the project.

We assume that if the entrepreneur chooses public financing he issues financial instruments that will trade on the public security market. To simplify our analysis we assume that the entrepreneur initially issues public claims on the cash flow to the firm's assets in place rather than the whole firm (i.e., the assets in place plus the growth opportunity). This assumption has no substantive effect on the results because there is a deterministic relation in this model between the cash flows of the assets in place and the cash flows of the entire firm. However, because this relation is nonlinear, the cash flow of the total firm is nonnormal, which precludes a closed-form solution to the security market equilibrium in a model where a claim on the total firm's cash flow is sold. The important aspect to note is that the price of a claim on the firm's assets in place provides the same information about the optimal investment in the growth opportunity as would the price of the entire firm.

We assume that δ and θ are unknown to the entrepreneur in period 1 when he decides on how much capital to invest in the growth opportunity. He does, however, get imperfect information from the private financier about the payoff represented by equation (1) if he chooses private financing, or from the firm's stock price if he chooses to take the firm public. Based on this information he selects the level of K that maximizes the expected value of the growth opportunity. Thus, we assume that the incentives of the entrepreneur are perfectly aligned with those of the investors.

An important feature of this model, which we discuss in greater detail later, is that the expected value of the growth opportunity is an increasing function of the precision of the entrepreneur's information about δ and θ. An entrepreneur with better information makes better production decisions, thereby creating greater value. Hence, the decision to access public versus private markets depends in part on the precision of the information generated under the two alternatives.

The intuition behind our results requires only that there is a linkage between information contained in a firm's stock price and its real decisions. This linkage can arise for a number of reasons. One could assume, as we do,

[4] Allowing for nonzero means for δ and θ does not alter the qualitative nature of our results.

that stock prices convey valuable information to management. A slightly more complicated alternative, which we do not model, is that the management already knows the information, but the stock price is needed to provide an independent signal of the firm's future cash flows, which, in turn, allows firms with favorable future prospects to raise outside funds at a lower cost of capital. Alternatively, as in Holmström and Tirole (1993), information from stock prices may be used to monitor self-interested managers, forcing them to make the appropriate investment choices. Our main results should hold regardless of the specific mechanism by which information in stock prices influences investment choices. The important point is that firms make better decisions, and are thus more valuable, when their stock prices more accurately convey information about their prospects.

B. The Information Structure

As we mentioned in the introduction, information can be characterized by the cost of collecting it, the diversity of the information obtained by different individuals, and the degree of serendipity involved in the acquisition process. To simplify our exposition we assume that investors can become informed in two ways that differ along the above dimensions. First, they can expend time and effort collecting information about δ, which can be construed, for example, as information about the efficiency of the firm's production process. If the entrepreneur takes his firm public there will be an endogenous number M of investors collecting this costly information. However, if the firm is financed privately, this information will be collected by the private financier. We assume that each agent has to incur a cost c to obtain a private signal. In order to contrast the cases of perfectly correlated and diverse costly signals, we assume that the signal acquired by agent i has both common and unique noise terms. Thus, each costly signal is represented by a random variable $\delta + \xi + \epsilon_i$, where ϵ_i is i.i.d. across the agents who acquire costly information.

We assume that information about the second component of value, θ, is obtained serendipitously, that is, by luck and without cost.[5] This information might, for example, represent the aggregate demand for a firm's product, and thus can be related to how well the products are liked by its customers. If the entrepreneur does take his firm public, there will exist a large number of active investors who can potentially receive serendipitous information of this sort. A certain percentage of these investors actually do receive relevant serendipitous information and they buy or sell shares in the stock based on the information they receive.[6]

[5] In footnote 11, we discuss the case in which serendipitous information is correlated with costly information, and argue that the thrust of our results would not change substantively in this scenario.

[6] Since the investors are risk neutral, those investors who do not obtain information about the stock do not buy or sell its shares (see, e.g., Admati and Pfleiderer (1988)) and thus can be omitted from the analysis.

To account for the notion that serendipitous information is likely to be diverse, we assume that N traders receive a serendipitous information signal of the form $\theta + \eta_j, j = 1,\ldots,N$, where η_j is i.i.d. across the serendipitously informed traders.[7] The private financier, however, being only one (or a few) individual(s), is likely to have access to very little serendipitous information.[8] To keep our analysis simple we assume that the private financier does not observe serendipitous information.

At first glance one might expect serendipitous information to have very little effect on resource allocation because the information received by individuals is likely to be imprecise and the unconditional probability of any given investor receiving serendipitous information is likely to be small. With a very large population of stock market investors, however, the aggregate impact of serendipitous information on price efficiency can be substantial even if only a small proportion of the population receives such information.

One way to gauge the relative importance of the serendipitous information generated in a stock market is to examine the behavior of stock prices in the months following IPOs. When firms go public, a great deal of costly information is generated by underwriters, analysts, and auditors. Despite this close scrutiny, however, investment bankers find it quite difficult to accurately price firms at their initial public offering. Firms' stock prices are generally very volatile following their IPOs, suggesting that information that was not available to the underwriters is incorporated into stock prices during this period. Since there is very little new "costly information" generated immediately after the offering, we would attribute these price changes to what we call serendipitous information. Consistent with our analysis in the following section, Jegadeesh, Weinstein, and Welch (1994) find that the post-issue stock price performance strongly affects the amount of capital raised by the firm in the year following the IPO, which indicates that this information does affect investment choices.

Of course the precision of serendipitous information signals could vary greatly. In a more general setting with exogenous transaction costs, investors might choose not to trade on weak serendipitous information signals. This observation suggests that trading on serendipitous information is likely to be more important for firms with greater product demand uncertainty,

[7] It is possible to add a correlated error term to the serendipitous signal, but doing so complicates the analysis without adding much additional intuition.

A potentially important characteristic of this serendipitous information is that because of its diffuse nature, the information is not generally verifiable. One can envision a model with an agency relation between managers and shareholders where the nonverifiability of serendipitous information would play a key role in the going public decision. We believe that much of the analysis in this paper would carry over to such a model.

[8] In reality, private financiers may receive some serendipitous information. For example, Fama (1985) suggests that banks receive valuable information that flows from the various services they provide to borrowers (such as checking accounts and letters of credit). Allowing the private financier access to some serendipitous information makes private financing more attractive and our analysis less tractable, but does not fundamentally alter our results.

such as a fledgling garment manufacturer or a fledgling cosmetics firm. We also expect serendipitous information to be more relevant for industries whose products have a nationwide market (e.g., national department store and restaurant chains, and garment and automobile manufacturers). Such industries have a wide customer base and thus more investors are likely to receive diverse serendipitous information from different geographical regions.

II. Public Financing

We assume that firms are initially financed by a private financier whose shares are held by a large set, of measure A, of homogeneous, risk-neutral uninformed investors. The investors receive random but identically distributed liquidity demand shocks in period 1. If an individual firm goes public, a subset α of investors contributes capital by purchasing shares in the firm. Throughout the paper we assume that the measure of investors supplying capital to an individual firm that goes public is small relative to A so that the migration of this subset to the individual firm has no effect on the private financier's stock price.

In equilibrium, the risk-neutral uninformed investors must be indifferent between holding shares in the private financier's stock and the individual firm's stock. Hence, the expected return on the individual firm's stock must be higher than the expected return on the private financier's stock because the former is less liquid. In particular, due to informed trading, there is an adverse price impact when shares are liquidated in the secondary market for the individual firm's stock. For this reason, the total capital contributed by the investors who purchase shares in the firm is smaller than the unconditional expected value of the firm by an amount L, which is the liquidity cost incurred by the entrepreneur. We endogenize L when we explicitly model the secondary market in the next subsection. To ensure that the price investors are willing to pay for the shares remains strictly positive, we assume throughout the paper that the exogenous parameter $\bar{F}$ is large enough relative to the other exogenous parameters that $\bar{F} - L > 0$. As long as L is finite, which is the case in our model so long as the model's exogenous parameters are finite, it is always possible to find a threshold $\bar{F}^*$ such that for all $\bar{F} > \bar{F}^*$ the above inequality holds.

A. The Equilibrium in the Securities Market

We now analyze the process by which information is incorporated into the value of publicly traded stock. In this preliminary analysis the investment choices of firms are taken to be fixed. The next subsection extends the model to analyze the process by which information in the financial markets influences corporate investment choices.

Following Holmström and Tirole (1993), we assume that the total liquidity demand of the initial shareholders in period 1 is a zero-mean, normally distributed random variable, z. Thus, the net liquidity trade in period 1 is z.

Prices are set by competitive risk-neutral marketmakers who expect to earn zero profits conditional on their information set. All random variables are independently normally distributed with zero mean. Throughout the paper, we assume that the model parameters are such that at least one agent purchases and trades on costly information.

As in Admati and Pfleiderer (1988), Kyle (1985), and Subrahmanyam (1991), we assume that each trader i who possesses costly information submits an order of the form $\kappa(\delta + \xi + \epsilon_i)$, whereas the order of a serendipitously informed trader j is of the form $\nu(\theta + \eta_j)$. Marketmakers observe only the total (net) order flow from the informed and liquidity traders, and because they are competitive and risk-neutral, the price P satisfies the relation $P = \bar{F} + E(\delta + \theta | Q)$, where Q is the total order flow. We assume that marketmakers set a price schedule of the form $P = \bar{F} + \zeta Q$, where P denotes the price and Q denotes the net order flow. Using standard techniques, we obtain the following lemma. In this lemma, and throughout the paper, v_X denotes the variance of the random variable X. Further, v_ϵ and v_η denote the common variances of the uncorrelated error terms in the costly and serendipitous signals, respectively.

LEMMA 1: *In equilibrium, the value of* ζ *is given by*

$$\zeta = v_z^{-1/2}(T_M + T_N)^{1/2}, \tag{2}$$

where

$$T_M \equiv \frac{M v_\delta^2 (v_\delta + v_\xi + v_\epsilon)}{[(M+1)(v_\delta + v_\xi) + 2v_\epsilon]^2} \tag{3}$$

and

$$T_N \equiv \frac{N v_\theta^2 (v_\theta + v_\eta)}{[(N+1)v_\theta + 2v_\eta]^2}. \tag{4}$$

Note that T_M and T_N respectively capture the effects of traders with costly and serendipitous information on the market liquidity parameter ζ. These quantities are increasing in the information variances v_δ and v_θ because as the variance of information increases, the information becomes more valuable, which, in turn, makes the market less liquid. Also note that T_M is decreasing in M if and only if

$$M > \frac{v_\delta + v_\xi + 2v_\epsilon}{v_\delta + v_\xi}, \tag{5}$$

and T_N is decreasing in N if and only if

$$N > \frac{v_\theta + 2v_\eta}{v_\theta}. \tag{6}$$

Condition (5) indicates that if $v_\epsilon = 0$ then T_M is decreasing in M for $M \geq 1$; an analogous result holds for T_N when $v_\eta = 0$. Intuitively, if traders with a particular type of information observe perfectly correlated signals, increasing their number leads to intensified competition, thus lowering ζ. This will not necessarily be the case when information is imperfectly correlated across investors. Thus, if information is diverse, increasing the number of informed traders increases competition between these traders, but also increases the pool of information, which tends to increase ζ. If the number of the informed is sufficiently high so that equation (5) or (6) is satisfied, the competition effect dominates the information effect and ζ is decreasing in the number of informed.

The unconditional expected profits of the traders with costly information (for a given ζ) can be calculated as

$$\pi_c = E[\kappa(\delta + \epsilon)(\bar{F} + \delta + \theta - P)] = \frac{v_\delta^2(v_\delta + v_\xi + v_\epsilon)v_z^{1/2}}{(T_M + T_N)^{1/2}[(v_\delta + v_\xi)(M + 1) + 2v_\epsilon]^2}. \quad (7)$$

Similarly, the unconditional expected profits of the traders with serendipitous information are

$$\pi_s = E[\nu(\theta + \eta_i)(\bar{F} + \delta + \theta - P)] = \frac{v_\theta^2(v_\theta + v_\eta)v_z^{1/2}}{(T_M + T_N)^{1/2}[(N + 1)v_\theta + 2v_\eta]^2}. \quad (8)$$

The number of costly informed traders M then satisfies

$$\frac{v_\delta^2 v_z^{1/2}}{(T_M + T_N)^{1/2}(M + 1)^2(v_\delta + v_\epsilon)} = c. \quad (9)$$

Throughout the paper we ignore the integer problem and denote the number of informed traders implied by equating the expected profits to c as $M(c)$, or, for convenience, simply M. It is easy to show that the first derivative of this implicit function is negative. Note also that M depends on a variety of exogenous parameters such as the variances of costly and serendipitous information, v_δ and v_θ, and the number of serendipitously informed traders, N. In the next two sections, we analyze the effect of changing N on market liquidity and resource allocation.

B. The Effect of Serendipitous Information on Costly Information Acquisition

As just mentioned, for sufficiently large N an increase in the number of investors with serendipitous information increases liquidity. Thus, holding all else constant, increased participation by investors who might receive information serendipitously leads to a more efficient stock market. However, because the number of investors acquiring costly information is endogenous, an analysis of the effect of serendipitous information on costly information acquisition is needed before we can draw conclusions about resource allocation.

Whether increasing the number of serendipitously informed traders increases the profits of traders with costly information depends on the initial number of serendipitously informed traders. Note from equation (7) that the effect of serendipitous information on the profits of traders with costly information is captured by T_N. If N is small and the signals are not highly correlated (so that equation (6) does not hold), increasing N leads to an increase in T_N, which decreases market liquidity and consequently leads to a decrease in M. When equation (6) does hold, however, increasing the number of investors receiving serendipitous information increases the amount of costly information acquisition. This observation leads to the following proposition.

PROPOSITION 1: *An increase in N will increase market liquidity (lower ζ), and thus will increase the number of traders with costly information, M, if and only if N is large enough that equation (6) holds.*

The preceding discussion thus demonstrates that increasing the number of serendipitously informed traders can either increase or crowd out costly informed traders depending on whether the initial number of serendipitously informed traders is small or large.

C. Resource Allocation with Public Financing

The information content of a firm's stock price is important in our analysis because the information influences the amount invested in the firm's growth opportunity. To illustrate the relation between stock prices and investment choices let μ_δ and μ_θ denote the means of δ and θ, conditional on the information set of the entrepreneur. From equation (1), the entrepreneur selects the level of input K to maximize the conditional mean of the payoff from the growth opportunity:

$$\bar{G} + K(\mu_\delta + \mu_\theta) - 0.5K^2. \tag{10}$$

The first-order condition from this maximization problem yields[9]

$$K = \mu_\delta + \mu_\theta. \tag{11}$$

Substituting for K from equation (11) into equation (10), the optimized terminal value of the growth opportunity, denoted TV, is

$$TV = \bar{G} + (\mu_\delta + \mu_\theta)(\theta + \delta) - \frac{(\mu_\delta + \mu_\theta)^2}{2}. \tag{12}$$

[9] The formulation of the growth opportunity payoff in equation (1) allows the amount of capital to be negative. This feature, however, is of little economic consequence. It is possible to have alternative formulations in which the probability of the allocated capital being negative can be made arbitrarily small.

Note that $\mu_\delta + \mu_\theta$ is simply given by $P - \bar{F}$, the conditional expected value of $\delta + \theta$, because marketmakers set prices to be the expected values conditional on prices, which are the only variables observed by the entrepreneur. In our equilibrium, $P - \bar{F}$ is a linear function of the normally distributed random variables that appear in the expression for Q, the total order flow. Thus, writing $P - \bar{F}$ as

$$k_1\delta + k_2\theta + w, \tag{13}$$

where $k_1 = M\zeta\kappa$, $k_2 = N\zeta\nu$, and $w = M\kappa\zeta\epsilon + \kappa\zeta\sum_{i=1}^{M}\epsilon_i + \zeta\nu\zeta\sum_{i=1}^{N}\eta_i + \zeta z$, the right-hand side of equation (12) becomes

$$\bar{G} + (k_1\delta + k_2\theta + w)(\theta + \delta) - \frac{(k_1\delta + k_2\theta + w)^2}{2}. \tag{14}$$

The unconditional expectation of the terminal value is therefore given by

$$\bar{G} + \frac{v_\delta(2k_1 - k_1^2) + v_\theta(2k_2 - k_2^2) - v_w}{2}. \tag{15}$$

Substituting for κ, ν, and ζ from the proof of Lemma 1 (see the Appendix) into the expressions for k_1, k_2, and w, we find that the unconditional mean of the payoff from the growth opportunity, denoted EV, is

$$EV = \bar{G} + \frac{Mv_\delta^2}{2[(v_\delta + v_\xi)(M+1) + 2v_\epsilon]} + \frac{Nv_\theta^2}{2[(N+1)v_\theta + 2v_\eta]}, \tag{16}$$

which can be rewritten in our notation as

$$EV = \bar{G} + \frac{T_M[(M+1)(v_\delta + v_\xi) + 2v_\epsilon]}{2(v_\delta + v_\xi + v_\epsilon)} + \frac{T_N[(N+1)v_\theta + 2v_\eta]}{2(v_\theta + v_\eta)}. \tag{17}$$

Equation (17) provides a convenient expression that captures the effect of the information contained in the equilibrium stock price on the corporate investment decision. Note that the expression on the right-hand side of equation (17) also represents the maximum amount that primary market investors will be willing to pay for claims on the growth opportunity. A higher value for EV thus means that the entrepreneur can raise more capital in the primary market for claims on the growth opportunity. Note that for given values of M and N, EV is increasing in v_δ and v_θ, implying that for a given level of informed trading the expected terminal value of the growth opportunity is higher when information is more valuable. Also, because the right-hand side of equation (17) is increasing in M (from equation (7)), lowering the cost of information, c, increases the expected terminal value of the growth opportunity.

The effect of serendipitous information on costly information acquisition and resource allocation is illustrated by the following proposition.

PROPOSITION 2:

1. *If costly signals are perfectly correlated across investors* ($v_\epsilon = 0$), *then although an increase in the number of serendipitously informed traders decreases the number of traders with costly information, the net effect of these changes on the expected terminal value of the growth opportunity is always positive, regardless of whether equation (6) holds.*
2. *Suppose that costly information is diverse. Then, if equation (6) holds, the expected terminal value is increasing in the number of serendipitously informed traders, N. If equation (6) does not hold, then increasing the number of serendipitously informed traders decreases M, the number of traders with costly information, and thus has an ambiguous effect on the expected terminal value.*

Proposition 2 indicates that although crowding out can lead to poorer investment decisions when costly information is diverse, this phenomenon does not occur when such information is perfectly correlated across investors. In the latter case, the benefit of increased serendipitous information always dominates the deleterious effect of a smaller number of investors with costly information. Since it can easily be shown from equation (17) that EV is concave in M, the crowding out effect is more likely to reduce expected terminal values when the cost of diverse information is large because in this case M will be small and the decreases in M will have large effects on resource allocation.

As an aside, our result that serendipitous information can crowd out costly information acquisition should be contrasted with Fishman and Hagerty (1992), who demonstrate that the introduction of a *single* insider always reduces the number of outside analysts and can, therefore, decrease informational efficiency. Essentially, we show that adding more insiders (interpreted here as serendipitously informed traders) in some cases increases liquidity and encourages the production of information by outside analysts, thus making market prices more efficient. Hence, insider trading laws that reduce but do not completely eliminate insider trading may have harmful effects on both liquidity and informational efficiency.

III. Private Financing

We assume that if the entrepreneur chooses private financing, he sells his entire firm to a competitive, risk-neutral private financier who pays the expected value of the firm's payoff from its assets in place and its growth opportunity less the cost that the private financier spends acquiring information. Since it is assumed that there is no moral hazard, the expected value of the growth opportunity under private financing (the analog of equation (17)) can be obtained by substituting $\mu_\delta = E(\delta | \delta + \xi + \epsilon_i)$ and $\mu_\theta = 0$ into equation (12), and taking the unconditional expectation of the resulting expression. This exercise yields

$$EV = \bar{G} + \frac{v_\delta^2}{2(v_\delta + v_\xi + v_\epsilon)}. \tag{18}$$

Note that the total value of the firm is derived from its assets in place as well as its growth opportunity. The entrepreneur chooses private financing if this alternative leads to a larger firm value than public financing, and chooses public financing otherwise. The trade-offs governing the entrepreneur's choice are developed in the next section.

IV. A Comparison of Public and Private Financing

When an entrepreneur raises capital, the transfers that take place in public markets between informed investors and liquidity traders come into play because they affect the amount of money that can be raised in the public stock offering. To complete our analysis of the trade-offs between public and private financing, these liquidity considerations must be addressed.

In our framework, the ex ante value of the firm under public financing is given by $\bar{F}$ (the ex ante mean of the assets in place), plus the expected payoff on the growth opportunity, less liquidity costs. Recall that the anticipated aggregate liquidity demand of uninformed investors who subscribe to the initial offering is z. The liquidity cost incurred by the entrepreneur is then the ex ante expected loss of these investors in the secondary market and is given by $E[(P - F)z] = \zeta v_z$, where ζ is the liquidity parameter in the secondary market. Thus, $\bar{F}$ plus the right-hand side of equation (17) less ζv_z represents the value of the firm with public financing, and $\bar{F}$ plus the right-hand side of equation (18) less the cost of the private financier's signal represents the value of the firm with private financing. The entrepreneur's financing choice is based on comparing the firm values under the two alternatives. This choice can be described by the following proposition.

PROPOSITION 3: *The entrepreneur chooses public financing if*

$$\frac{T_M[(M+1)(v_\delta + v_\xi) + 2v_\epsilon]}{2(v_\delta + v_\xi + v_\epsilon)} + \frac{T_N[(N+1)v_\theta + 2v_\eta]}{2(v_\theta + v_\eta)} - v_z^{1/2}(T_M + T_N)^{1/2}$$
$$> \frac{v_\delta^2}{2(v_\delta + v_\xi + v_\epsilon)} - c, \tag{19}$$

and chooses private financing if the reverse is true.

To provide further intuition on the trade-offs between public and private financing, consider first the special case where $N = 0$ and costly information is perfectly correlated across agents ($v_\epsilon = 0$). In this case, since the market-maker earns zero expected profits and there are no serendipitously informed traders, the aggregate liquidity trader losses equal the total profits of costly informed traders, which, in equilibrium, equal Mc (recall that we are ignoring the integer problem). Thus, equation (19) reduces to

$$\frac{Mv_\delta^2}{2(M+1)(v_\delta + v_\xi)} - Mc > \frac{v_\delta^2}{2(v_\delta + v_\xi)} - c, \tag{20}$$

which is never true, so that in this case, the entrepreneur chooses private financing. There are two reasons for this result. First, strategic behavior causes the first term on the left-hand side to always be smaller than the first term on the right-hand side. Second, the total cost of information (Mc) is higher in the public financing case than in the private financing case, which reflects the notion that stock market investors tend to duplicate efforts in information production.

Now consider the case in which the correlated error term disappears ($v_\xi = 0$)and the uncorrelated term, v_ϵ, is strictly positive. In this case, it can be shown that for sufficiently large M (alternatively, a sufficiently low c), the inequality (19) holds even when $N = 0$. The reason is that the stock market aggregates a large number of costly diverse signals. In the limit, as the cost of information becomes very small, the stock market reveals the information about δ very precisely, so that public financing dominates private financing. This can easily be shown by noting that when $v_\xi = 0$, as $c \to 0$, so that $M \to \infty$, the first expression on the left-hand side of equation (19) goes to $v_\delta/2$. This implies that for c arbitrarily small and $N = 0$, public financing is preferred, since in this case equation (19) reduces to $1 > [v_\delta/(v_\delta + v_\epsilon)]$, which is true. This discussion indicates that a key determinant of the preference for public versus private financing is whether costly private information is diverse or strongly correlated across agents.

Our discussion assumes that the private financier has access to only a single signal. If instead the entrepreneur is allowed access to a very large number of costly diverse signals, he prefers private financing in the absence of serendipitous information because that choice enables him to avoid the liquidity costs due to duplication of effort and strategic behavior by informed traders. Our assumption that the private financier observes only one signal is in the spirit of Grossman and Stiglitz's (1980) study in which investors have access to only one signal at a fixed cost. The notion is that information processing costs and time limitations cause extreme convexity in the relation between the number of signals and the costs necessary to acquire them. The possibility of the private financier directly hiring many analysts does not seem realistic either, because of the difficulties involved in attempting to verify the credibilities of a large number of agents (Hirshleifer (1971)).

Table I

An Example of Crowding Out

The numbers of serendipitously informed traders and traders with costly information are respectively denoted by N and M, and Δp denotes the difference between firm values under public and private financing. Parameter values are as follows: the variance of costly information $v_\delta = 1.5$, the uncorrelated noise variance in costly information $v_\epsilon = 3.5$, the common noise variance in costly information $v_\xi = 0.23$, the variance of serendipitous information $v_\theta = 1.2$, the noise variance in serendipitous information $v_\eta = 10$, the variance of liquidity shocks $v_z = 20$, and the cost of information $c = 0.08$.

N	M	Δp
0	19.44	0.019
1	18.24	0.001
2	17.29	−0.011
3	16.66	−0.016
4	16.21	−0.015
5	15.89	−0.011
6	15.64	−0.005
7	15.46	0.003
10	15.11	0.028
20	14.90	0.117
50	15.59	0.284

A. Crowding Out

The preceding discussion indicates that when costly information is perfectly correlated across agents, firms do not go public in the absence of serendipitous information. It is not the case, however, that the benefits of going public unambiguously increase when the number of investors receiving serendipitous information increases. If N is initially small, and if the information obtained serendipitously is sufficiently noisy, equation (6) does not hold, and increasing N decreases liquidity and thereby leads to a decrease in M (from Proposition 2), which can further reduce liquidity (from equation (2)). Additionally, the decrease in M that can arise from an increase in N can have an adverse effect on resource allocation when costly information is diverse (Proposition 2). Since liquidity costs decrease in M at a successively smaller rate as M increases and expected terminal values are concave in M (see equations (2) and (17), the crowding out effect is more important when the cost of information is large—that is, when M is small.

Table I provides a numerical example that illustrates how the number of investors receiving serendipitous information affects the decision to go public. In this example, the entrepreneur wants to take the firm public when either $N \leq 1$ or $N \geq 7$. For $2 \leq N \leq 6$, the entrepreneur prefers private financing. When N is small, an increase in N causes M to decrease sharply and this decrease in costly information acquisition offsets the advantages of increasing the amount of serendipitous information, thereby reducing the relative attractiveness of public financing. For larger values of N the sensitivity of M to N successively decreases.[10] In these cases, the benefit of an increase in N dominates the deleterious effects of the resulting decrease in M, and the attractiveness of public financing relative to private financing increases. Of course, crowding out applies only for the parameter space in which equation (6) is not satisfied ($N \leq 18$ in the numerical example). Otherwise, further increases in N enhance liquidity and stimulate the collection of more costly information, which unambiguously increases the benefits of public financing.

Numerical simulations, not reported for brevity, indicate that the tendency for increases in N to crowd out traders with costly information and to reduce the attractiveness of going public is stronger in the following cases: (i) the smaller is v_θ, (ii) the larger is v_η, and (iii) the larger is the cost of information, c. Small values of v_θ or large values of v_η generally imply that the benefits of serendipitous information on firm values are small, so that the deleterious effect of a decrease in M dominates. Further, if c is large, M tends to be small, and because liquidity and the expected value of the growth opportunity are both concave in M, decreases in M have a large deleterious effect on firm values.[11]

B. Illustration of the Trade-offs between Public and Private Financing

This subsection describes additional simulations that provide further insights into the trade-offs between public and private financing. Figure 1, Panel A, plots the difference between firm values under public and private financing with respect to a variety of exogenous parameters and shows that the tendency to go public is generally stronger as any of N, v_θ, or v_ϵ is larger and as c is smaller.[12] For this set of parameter values, crowding out does not obtain, so that larger values of N make going public more attractive. Further, larger values of v_θ imply that serendipitous information is more valuable, which increases the benefit of going public (note that the benefit of going public is convex in v_θ). Similarly, if information is cheap to acquire there is a greater benefit to going public because the duplication of effort

[10] The effect of N on M is captured by T_N. It can easily be shown that if equation (6) is satisfied, increases in N have progressively smaller effects on T_N.

[11] We have assumed that the costly signal is independent of the serendipitous signal. A more complicated setup is one in which traders with costly information observe two components: one that is correlated with serendipitous information and one that is not. In this case, traders with costly information will face stronger competition when serendipitously informed traders are introduced. This effect would increase the tendency of serendipitously informed traders to crowd out costly informed traders, which would make public financing unattractive under a broader range of parameters than in the case of uncorrelated costly and serendipitous information that we analyze, but would leave our intuition and analysis otherwise unaffected.

[12] The simulations use the base parameter values $v_\delta = 2$, $v_\xi = 0.1$, $v_\epsilon = 2$, $v_\theta = 2$, $v_\eta = 3$, $c = 0.1$, and $v_z = 1$. The endogenous variable M is treated as continuous, rather than discrete. In both Panels A and B of Figure 1, we restrict ourselves to parameter spaces under which firm values under both public and private financing are positive.

problem is less severe. Finally, a larger value of v_ϵ implies that there is a greater benefit to having diverse information aggregated by the public market, which also makes going public attractive.

We conduct extensive numerical simulations changing every parameter from zero to 10 and find that though the nature of the comparative statics for v_θ and c is generally robust to parameter value choices, this is not the case for the results involving the other two variables, N and v_ϵ. In particular, as pointed out in Table I, the benefit of going public may not be monotonic in N because of crowding out. Also, increasing v_ϵ can have an ambiguous effect on the benefit of going public. First, the benefit of having diverse information aggregated by the public market is higher when v_ϵ is higher; however, as v_ϵ increases, M decreases because fewer investors find it worthwhile to collect more noisy information. Finally, increasing v_ϵ also affects ζ, and, for a given M, this effect is positive for low v_ϵ and negative for high v_ϵ (see equation (2)).[13]

The above effects are illustrated in Figure 1, Panel B. The parameter values used for this figure are qualitatively similar to those used for Panel A, except that serendipitous information is more diverse (so that we obtain crowding out), and information acquisition is made more sensitive to the exogenous parameters by choosing a high value of v_z.[14] Note that in this case, though the benefit to going public is still monotonic in v_θ and c, it is not monotonic in N and v_ϵ. Thus, as in Table I, for small N the adverse effects of crowding out dominate, and for large N the benefit of greater serendipitous information dominates. Also, the firm goes public for an intermediate level of v_ϵ but not for extreme levels; this result obtains because of an interaction of the three effects discussed above.[15]

C. Limiting Results

The preceding subsection discusses a variety of comparative statics associated with the benefit to going public for specific parameter value ranges. We now provide some limiting results on the going-public decision.

[13] The intuition for this effect is that increasing v_ϵ decreases the intensity of competition between informed traders (because their information becomes more diverse) and also reduces adverse selection (because each individual piece of information becomes more noisy). These opposing effects determine the sign of the comparative static.

[14] The specific base parameter values for Figure 1, Panel B, are $v_\delta = 2$, $v_\xi = 0.08$, $v_\epsilon = 2.7$, $v_\theta = 1$, $v_\eta = 10$, $c = 0.095$, and $v_z = 10$. Again, the endogenous variable M is treated as continuous, rather than discrete.

[15] A similar nonmonotonicity result associated with the variance in correlated noise, v_ξ, can also be obtained. The trade-offs here are simply that increasing v_ξ increases liquidity but also leads to inferior resource allocation. The net effect of increasing v_ξ can therefore be positive or negative. Demonstration of this possibility is omitted for brevity. We also find that increasing the noise variance in serendipitous information, v_η, generally lowers the benefit to public financing by making serendipitous information less valuable.

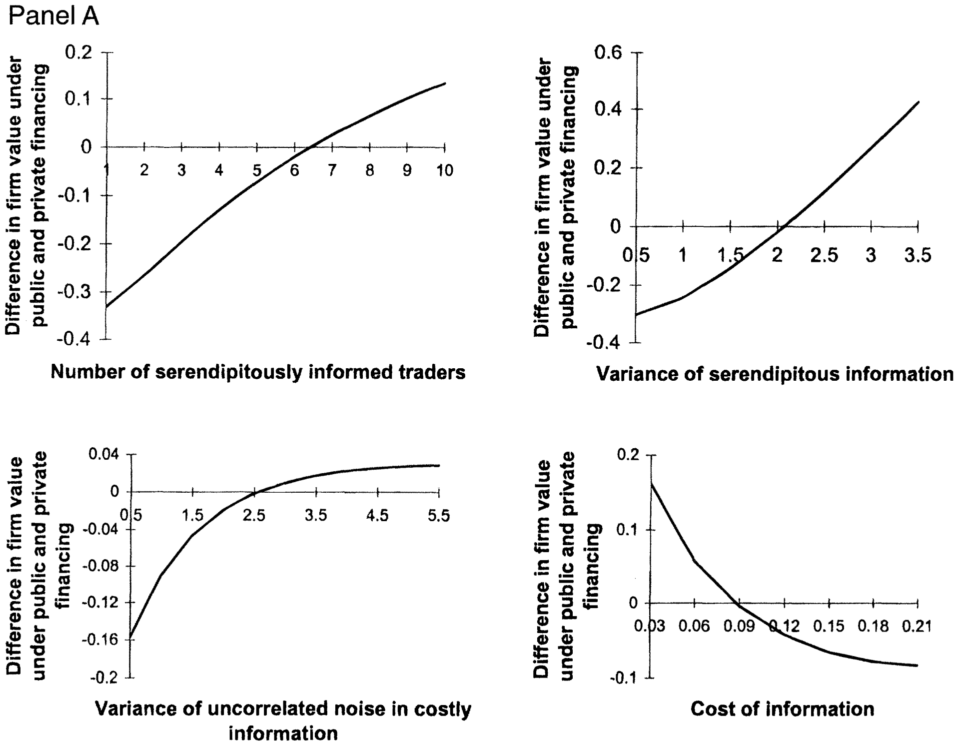

Figure 1. Trade-offs in public versus private financing. The parameter values for Panel A (Panel B) are as follows: the variance of costly information $v_\delta = 2$ (2), the uncorrelated noise variance in costly information $v_\epsilon = 2$ (2.7), the common noise variance in costly information $v_\xi = 0.1$ (0.08), the variance of serendipitous information $v_\theta = 2$ (1), the noise variance in serendipitous information $v_\eta = 3$ (10), the variance of liquidity shocks $v_z = 1$ (10.7), and the cost of information $c = 0.1$ (0.095).

PROPOSITION 4: *The entrepreneur prefers public financing to private financing in either of these sets of limits: (i) $N \to \infty$ and $c \to 0$, (ii) for $N > 0$, $v_\theta \to \infty$.*

Thus public financing is preferred as the number of serendipitously informed traders grows without bound and the cost of information acquisition becomes vanishingly small, or if the variance of serendipitous information becomes unboundedly large (so that serendipitous information becomes unboundedly valuable). In Section VI, we use the results of this section to develop some empirical implications of our analysis.

V. Information Externalities and the Decision to Go Public

This section considers externalities associated with information production that affect the choice between public and private financing. As we show, these externalities can have important influences on the development path

Panel B

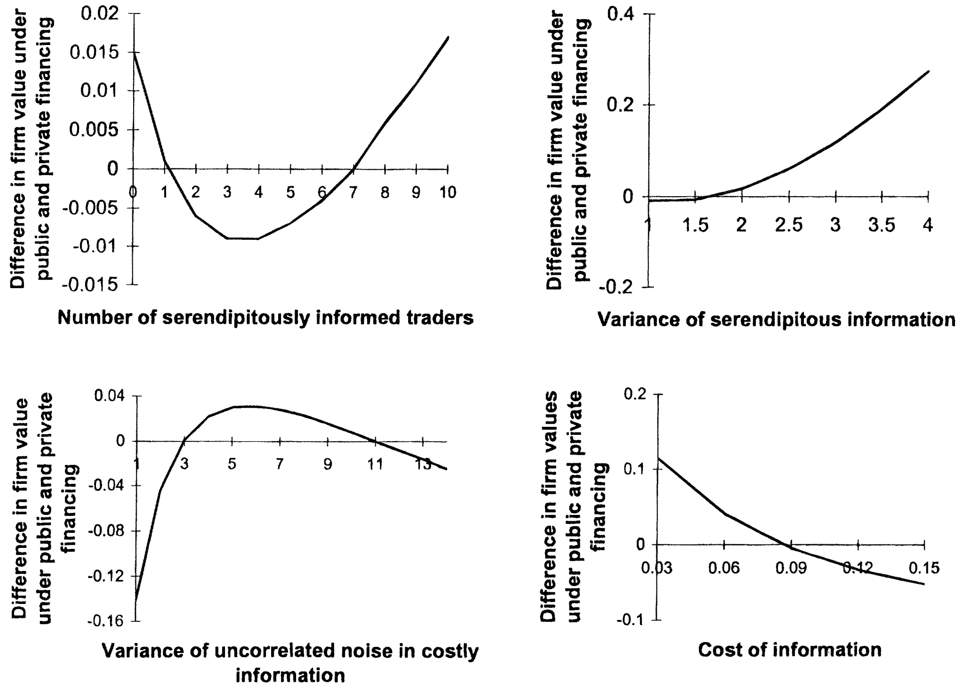

Figure 1. Continued.

of an economy's financial markets. Specifically, we ask whether an economy in which most firms are initially privately financed will independently make the transition to an economy in which most firms are publicly traded when doing so generates superior resource allocation and greater firm values. We show that this need not be the case. Under some conditions an economy will have multiple equilibria: a "good" equilibrium where most firms are publicly traded, and a "bad" equilibrium where firms are primarily privately financed. When an economy finds itself in the bad equilibrium, perhaps because the private financing regime was initially optimal, economic forces will not move the economy toward the good equilibrium where firms are publicly traded.

We extend the basic model of the previous section to allow for multiple firms and endogenize the number of active investors who can potentially receive serendipitous information. We postulate that active investors are each required to pay an ex ante setup cost to invest in the stock market; these costs correspond, for example, to learning about the institutional features of the stock market and setting up brokerage accounts. Thus, in order to recoup the cost of becoming an active investor, individuals must anticipate the possibility of obtaining information that allows them to make trading profits. We assume that as the number of public firms increases, the opportunities to profit from serendipitous information also increase. This captures the notion that an informed investor can profit only from information that relates to publicly traded companies. Hence, the incentive to become an active investor is increasing in the number of firms that are traded publicly, which in turn implies that there is an externality associated with going public.

A. Positive Externalities

The analysis in the previous sections demonstrates that the advantage of going public increases with the number of active investors, which implies that there is also an externality associated with becoming an active investor. Because of these two externalities, a coordination failure can arise. In other words, there can be an equilibrium with few active investors, where it is individually rational for most firms to choose private financing, even when there exists an alternative equilibrium with higher firm values, which consists of more active investors and more publicly financed firms.

To illustrate this possibility, consider two firms with payoffs $\bar{F} + \delta_l + \theta_l$, $l = 1,2$, and growth opportunity payoffs given by the analog of equation (1) with the appropriate subscripts. The variables δ_1 and δ_2 are independent and identically distributed with zero mean and variance v_δ, and the variables θ_1 and θ_2 are independent of δ_1 and δ_2 and are also independent with a zero mean and a common variance v_θ.

The entrepreneurs corresponding to each of these two firms choose the financing alternative that maximizes their expected wealth, taking the strategy of the other entrepreneur as given. If one firm goes public, then, as before, a set α of competitive, uninformed investors with liquidity needs buys shares in this firm. We further assume that if both firms go public, an additional set of uninformed investors, again of size α, contributes capital to the second firm.[16] The aggregate liquidity demands of each of these sets are mutually independent, normally distributed with zero mean and a common variance v_z.

We suppose that ex ante each potential trader with serendipitous information has to pay a cost of C' to become an active investor. Each trader j with costly information about firm l observes a signal $\delta_l + \xi_l + \epsilon_{jl}$, where ξ_l, $l = 1,2$ are independent of all other random variables and have a common variance v_ξ, and that ϵ_{jl}, for all i and j, are independent and identically normally distributed variables with mean zero and variance v_ϵ. We initially assume, for simplicity, that the number of traders with costly information is exogenous and that the private financier costlessly receives a signal $\delta_l + \xi_l + \epsilon_{jl}$. We later consider the case with costly information about δ_l where

[16] It is reasonable to assume that the measure of the second set is equal to that of the first because the firms' cash flows are identically distributed.

the number of costly informed traders is determined endogenously. Since the two firms are symmetric, we denote the number of traders with costly information in each of the firms with a common symbol M.

With a probability of 1/2, an active investor k receives a serendipitous signal $\theta_1 + \eta_{k1}$ about firm 1 and with a probability of 1/2, a serendipitous signal $\theta_2 + \eta_{k2}$ about firm 2. Since receiving these signals are independent events, the trader will receive a signal about both firms with a probability of 1/4, he will receive a signal about exactly one firm with a probability of 1/2, and he will receive no signal with a probability of 1/4. We assume that η_{ki}, for all i and k, are independent and identically normally distributed variables with mean zero and variance v_η. We also make the assumption that if $\hat{N}$ investors choose to become stock market investors, the number of serendipitous signals in the markets is consistent with the probabilities above, so that $\hat{N}/4$ individuals receive information about both firms, $\hat{N}/4$ receive no signals, and half of the remaining $\hat{N}/2$ investors get a signal about firm 1 and the other half get a signal about firm 2. (We recognize the integer problem, but ignore it because it hinders the exposition. An alternative is to simply assume that the numbers above are rounded off to the next smallest integer.)

Given the above assumptions, it is straightforward to calculate the number of individuals who become active traders and receive serendipitous information as a function of the cost C'. Let $\hat{N}/2 = N$ (for convenience). If both firms choose public financing, then, from equation (8), the number of individuals who become active traders and receive serendipitous information is given by the number N, which satisfies

$$\frac{v_\theta^2 v_z^{1/2}(v_\theta + v_\eta)}{(T_M + T_N)^{1/2}[(N+1)v_\theta + 2v_\eta]^2} = C', \tag{21}$$

If exactly one firm chooses public financing, then the number of traders with serendipitous information, N, satisfies

$$\frac{v_\theta^2 v_z^{1/2}(v_\theta + v_\eta)}{2(T_M + T_N)^{1/2}[(N+1)v_\theta + 2v_\eta]^2} = C'. \tag{22}$$

If firm 1 observes that firm 2 is being publicly financed, its value can be calculated given the number N that satisfies equation (21). If firm 2 is privately financed, however, then firm 1 must calculate its value as a public firm given the number N that satisfies equation (22). Since the $N = N_1$ that satisfies equation (22) is lower than the $N = N_2$ that satisfies equation (21), the terminal value mean of firm 1, as a public entity, is lower if firm 2 is privately financed—that is, $EV(N_1) < EV(N_2)$, and vice versa. As we show below, this relation will not always hold when the number of investors receiving costly information is endogenous.

Let L_1 and L_2 denote the liquidity costs incurred by a public firm when one and two firms go public, respectively. The value of each of the firms under private financing, EV_b, is the same regardless of whether the other firm is privately or publicly financed. Thus, if $EV(N_1) - L_1 < EV_b < EV(N_2) - L_2$; that is, if

$$\frac{T_M[(M+1)(v_\delta + v_\xi) + 2v_\epsilon]}{2(v_\delta + v_\xi + v_\epsilon)} + \frac{T_{N_1}[(N_1+1)v_\theta + 2v_\eta]}{2(v_\theta + v_\eta)} - v_z^{1/2}(T_M + T_{N_1})^{1/2}$$
$$< \frac{v_\delta^2}{2(v_\delta + v_\xi + v_\epsilon)} - c < \frac{T_M[(M+1)(v_\delta + v_\xi) + 2v_\epsilon]}{2(v_\delta + v_\xi + v_\epsilon)}$$
$$+ \frac{T_{N_2}[(N_2+1)v_\theta + 2v_\eta]}{2(v_\theta + v_\eta)} - v_z^{1/2}(T_M + T_{N_2})^{1/2}, \tag{23}$$

then there exist two Nash equilibria, one in which both firms remain private and another in which both firms go public. It is straightforward to show that both inequalities in equation (23) hold simultaneously for a wide range of parameters. For example, consider the case where v_ϵ is small. In this case, from equation (20), the first inequality will hold if C' is sufficiently high so that N_1 is sufficiently low, and because $N_2 > N_1$, it is easy to find parameter values such that the second inequality is satisfied as well. Note that when both equilibria obtain, firm values are higher in the all-public equilibrium.

The preceding discussion assumes that the number of costly informed traders, M, is fixed. If the inequalities (5), (6), and (23) are satisfied for $N = N_1$ and the equilibrium M corresponding to $N = N_1$, then endogenizing M increases the last expression in (23) further, thus increasing firm values in the all-public equilibrium. To see this, assume as before that information about δ_l (i.e., $\delta_l + \xi_l + \epsilon_{jl}$) can be acquired at a cost of c. Now suppose both firms go public. This leads to an increase in N to, say, N_2, which, from equation (9), leads to a further increase in M, which, in turn, stimulates a further increase in N_2, thereby lowering liquidity costs, L_2, increasing the expected value of the growth opportunity, $EV(N_2)$, and therefore increasing firm values. The preceding discussion can be summarized by the following proposition.

PROPOSITION 5: *When the conditions (5), (6), and (23) hold for $N = N_1$ and the equilibrium M corresponding to $N = N_1$, then there exist two Nash equilibria. In the first equilibrium, both firms choose private financing and in the second equilibrium, both firms choose to go public. Firm values are higher in the equilibrium where both firms go public.*

B. Implications for Financial Market Development

Our analysis has implications for the development of financial markets in emerging economies. To elaborate, we note first that an all-private equilibrium will exist only if the costs of becoming an active investor and acquiring information are sufficiently large. Indeed, it can easily be shown that there exist strictly positive numbers C'^* and c^* such that if $C' < C'^*$ and $c < c^*$, the first inequality in equation (23) will not be satisfied, so that the all-private equilibrium will not exist. This suggests that the coordination problem is more likely to obtain in emerging economies where the setup costs of active investing and accessing information about firms are high. Turning now to the second inequality in equation (23), note that this inequality will be satisfied (i.e., an all-public equilibrium will exist), if N_2 is sufficiently large. From equation (21) it follows that N_2 will be high if the cost of becoming an active investor and the cost of information acquisition are small. The above arguments thus imply that reducing the barriers associated with becoming active investors and lowering information costs—for example, by reducing brokerage commissions and improving disclosure requirements to enhance the ease with which information about firms can be uncovered—can stimulate a snowballing effect whereby more firms find it in their interests to go public, which in turn makes markets more liquid and efficient, which in turn makes it more attractive for additional firms to go public, and so on.

C. Negative Externalities

Proposition 5 addresses the case in which N_1 is large enough that equation (6) is satisfied. If this is not the case, increasing the number of serendipitously informed traders will crowd out traders with costly information. In this situation, the second inequality of equation (23) is less likely to hold with $N = N_2$, so the tendency for multiple equilibria to obtain is reduced. Indeed, rather than a positive externality associated with going public, there can be a negative externality associated with going public, implying that in this case, there can be too many firms going public.[17] In general, this is more likely to occur when serendipitous information is useful for valuing the firms' assets in place, but is not useful for valuing their growth opportunities.

D. The Role of Market Size

Up to this point we have illustrated the importance of externalities within the context of a model with only two firms. This subsection illustrates how public markets can become more attractive as the size of the market grows. To do this, we present numerical simulations for the straightforward extension of our model to the case of multiple firms. Thus, we now assume that

[17] Formally, this happens when the second inequality in equation (23) is satisfied for $N = N_2$ and the equilibrium value of M, but the last expression in equation (23) is less than the first expression, for the equilibrium N_2 and M in each case. As the analysis in the previous section suggests, this is more likely to be the case when costly information is diverse. It is easy to construct numerical examples demonstrating this possibility.

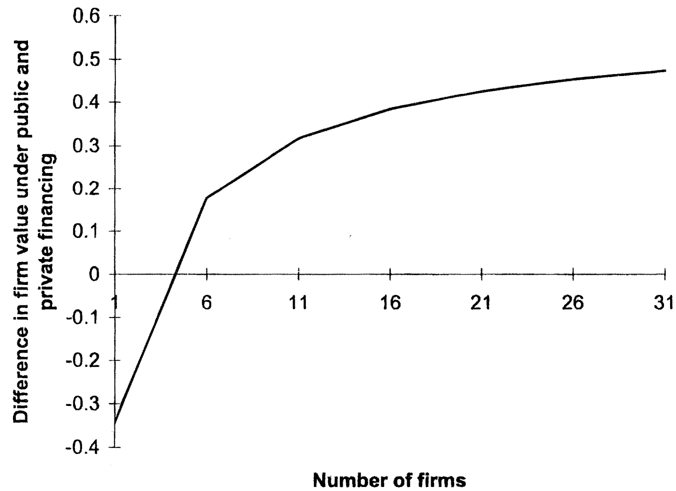

Figure 2. The benefit to public financing as a function of market size. The parameter values are the same as those for Figure 1, Panel A, except that the number of potential serendipitously informed traders is endogenous and the cost of becoming an active investor $C' = 0.3$.

there is an arbitrary number of firms with independent and identically distributed payoffs of the form described in the previous section. Costly and serendipitous signals also are of the same form as in the two-firm case.[18]

Figure 2 plots the difference between the values of a firm under public and private financing as a function of the number of other firms trading publicly.[19] For simplicity, it is assumed that the probability of getting serendipitous information on any one firm is constant at 1/2. For the case considered in the figure, the all-private equilibrium always exists, and it can be seen that the benefit of going public is increasing in the number of firms. This happens by way of increases in the number of active investors and, in turn, in the number of traders with costly information. We have verified that the above result is quite robust; it follows from the feature that the opportunities to profit from serendipitous information are increasing in the number of firms.

E. Global Markets and Home Bias

As equity markets globalize, one might argue that it is considerably less likely that an economy can be in a bad equilibrium with too few public firms. In theory, a German firm can benefit from active U.S. investors who are free

[18] Formally, analysis of this extension implies solving the case where the subscript l extends from 1 to B, where B is the number of firms, and where all other assumptions remain the same as in the previous subsection.

[19] The parameter values are the same as those documented in footnote 12, with the additional assumption that $C' = 0.3$.

to invest anywhere in the world and, therefore, ceteris paribus, should be no less likely to go public than its U.S. counterparts. This will not be the case, however, if investors are more likely to receive serendipitous information about domestic stocks than about international stocks, or if foreign investors are only likely to receive serendipitous information about a subset of domestic stocks.

Consistent with these notions, Brennan and Cao (1997) argue that the "home bias" in portfolio choice occurs because domestic investors are more knowledgeable about domestic stocks. Similarly, Kang and Stulz (1997) show that foreign equity ownership in Japanese firms is concentrated not in the national market portfolio, but, for example, in large firms and in firms that export more, suggesting that foreign investors are more likely to invest in stocks about which they are more likely to receive serendipitous information. Thus, international public markets (e.g., the Global Depositary Receipt market) may be most useful for companies with a large international presence (e.g., those with international brand recognition or that export a large proportion of their production), and domestic equity financing or private financing may be more appropriate for firms whose products are more localized.

F. Scale Economies in Information Acquisition

Finally, it is worth noting that there are other aspects of information collection that can add to the coordination problem. For example, it is likely that there are fixed costs of information acquisition (e.g., setting up the infrastructure for security analysis in terms of software, modeling, etc.) that are independent of the number of firms. If information acquisition has fixed and variable components, then if few firms are publicly traded the fixed costs per firm would be larger, which in turn would imply that fewer investors would purchase costly information. In this scenario, adding new publicly traded firms has a positive externality because it increases the number of investors acquiring information about existing publicly traded firms. One could again have multiple equilibria, one in which few firms go public and another in which many firms go public.

VI. Empirical Implications

Our analysis has a number of important implications about how firms are financed and how markets develop. To develop some of these implications, we need to consider the types of information which are more likely to be received by investors in the course of their everyday activities. We believe that information about the demand for a firm's products is more likely to be obtained in this manner, but that information about how the firm is managed is more likely to be generated through costly analysis. Given this assumption, and the results in Section IV, the model suggests the following:

- As the market for firms' products expands and future demand uncertainty increases, public financing becomes more attractive. In fact, Pagano, Panetta, and Zingales (1998) find that increases in sales tend to increase firms' tendencies to go public.[20] Our analysis further suggests that attributes which capture the importance of serendipitous information can play a useful role in predicting which firms go public. Such attributes can include industry dummies designed to capture variation in demand uncertainty (proxied by the model parameter v_θ) across industries. For example, one might suspect that serendipitous information plays a more important role in new industries (e.g., those involved in the Internet) where costly information is less available.

- When there is a large complementarity of nascent firms' products with other industries, there should be more serendipitous information (from analysts who are following other industries), making public financing attractive. This cross-sectional link between product complementarity and the tendency to go public is a testable implication that is partially supported by the observed clustering of IPOs by industry groups.
- When firms require internal restructuring, the kind of information that can be obtained from a private financier through costly investigation becomes relatively more important and serendipitous information becomes relatively less important, making the public markets relatively less attractive. This implication is consistent with the observation that firms often go private in leveraged buyouts prior to internal reorganizations and then go public after the reorganization is completed.
- Another implication is related to the observation that public stock markets have become broader and more liquid since the May 1975 drop in U.S. brokerage commissions and the October 1986 "Big Bang" in London. Our model suggests that as public markets become more liquid and informationally efficient, they will become relatively more attractive sources of capital.[21] Two phenomena are consistent with this implication. First, the number of IPOs has increased substantially as the public markets have become more liquid (see, e.g., Brav (1996)). Second, since the late 1970s, large diversified conglomerates have been spinning off divisions, becoming more focused (Comment and Jarrell (1995)).[22]

[20] An alternative explanation for Pagano et al.'s (1998) results is simply that firms with greater sales revenue are simply larger firms which can go public at a lower relative cost because of the large fixed costs associated with going public. Our analysis, however, suggests independently testable implications; see the remaining material in the discussion of this item.

[21] Increased informational efficiency of the public markets may also reduce adverse selection problems associated with initial public offerings and thereby stimulate going-public activity.

[22] See also Forest (1995) and Cusatis, Miles, and Woolridge (1993). Bhide (1990) suggests that the May 1975 drop in stock market commissions made conglomerates relatively less attractive. Matsusaka (1993) concludes that the stock market responded favorably to conglomerate mergers in the 1960s when the stock market was relatively illiquid, but responded negatively to similar acquisitions in the 1980s when the market was more liquid. Lang and Stulz (1994) find that diversification hurt firm values in the 1980s. Servaes (1996) finds that the market discounted conglomerates considerably more in the 1980s than it did in the 1970s, which is consistent with our arguments. He also finds, however, that conglomerates were discounted relative to less diversified firms in the 1960s, which is inconsistent with our model. See also the more recent paper by Hubbard and Palia (1999).

Further testable implications follow from the path-dependency discussed in the previous section, and are consistent with empirical observations about financial markets in developing economies.

- Countries with different histories but similar economies may have stock markets that differ substantially in size. The previously discussed differences between the U.S. and German financial systems are consistent with this implication.
- When the stock market in a particular economy reaches a critical mass, the market can in essence "snowball," with new firms listing on the stock market, making the market more liquid and efficient, which in turn induces more firms to go public. This testable implication is consistent with the recent emerging-markets phenomenon of very rapid growth in the stock markets of some developing countries. Our analysis suggests that relatively small government actions that stimulate the stock market can have a major effect by initiating the snowballing effect. For example, Perotti and Oijen (1995) document that a large fraction of the increased capitalization of the recent emerging stock markets have come from privatized state-run enterprises. They note that the São Paulo stock market jumped 13 percent on the April 1995 announcement by José Serra, minister of economic planning of Brazil, that the government would "sell everything that's fit to sell."

VII. Discussion and Possible Extensions

Since our model is quite stylized it raises a number of issues that warrant further discussion. Specifically, in order to illustrate our results in the most straightforward manner possible, we have assumed that the private financier's stock is perfectly liquid, the private financier does not receive serendipitous information, managers act in the interests of shareholders, and investors are risk neutral. We argue in this section that the main thrusts of our arguments are likely to hold when these assumptions are relaxed.

A. Incentive and Holdup Problems

By focusing on informational issues we have not considered important incentive issues that also enter into an entrepreneur's choice between public and private financing. When incentive problems are relevant, the private financier, who can avoid the free-rider problems that arise when there are many small shareholders, may be able to better monitor management. We also have not considered the problem of monitoring the private financier who is supposed to be monitoring the individual entrepreneurs that are being financed. Diamond (1984), however, suggests that monitoring a financial intermediary is not as much of a problem because it is easier to detect whether or not the manager of a well-diversified intermediary is shirking, because the returns he generates are much less noisy.

When serendipitous information is relevant, Diamond's delegated monitoring solution to the agency problem may not be the best approach since the private financier is, in this case, at an informational disadvantage. As mentioned earlier, even if the private financier could observe this serendipitous information, since this information tends not to be verifiable, it cannot be used in contracts. Being publicly traded may thus provide a better solution to the agency problem since contracts can be contingent on stock price performance that is verifiable. Along somewhat different lines, Rajan (1992) and Burkart, Gromb, and Panunzi (1997) point out that if a private financier is the only person with access to information about a firm, there is a potential holdup problem that can result in inefficient investment. Having an informative stock price will mitigate this problem even when investors acquire information that is identical to the information acquired by the private financier. Our results on path-dependency and the role of serendipitous information will continue to hold in both of the above settings. Specifically, because a firm's incentives to go public depend on the potential information content of its stock price, there are positive externalities associated with going public and becoming an active investor that, in turn, imply a path dependency in the development of a country's financial markets.

B. Investor Risk Preferences

In order to simplify our analysis and abstract away from the risk-sharing benefits of public markets we have assumed that investors are risk neutral. We believe, however, that stock markets play important allocative roles, in part because they communicate information about investor risk preferences. For example, the manager of a biotechnology firm may have much better information than outside investors about the firm's future cash flows, but may not know the rate at which the market will capitalize those cash flows. Thus, he might look at the stock price and, for example, pass up a scale-increasing project with very favorable expected cash flows because the firm's low stock price indicates that the market puts a very high discount rate on those flows. This type of serendipitous information is consistent with the general notion of free information that gets incorporated into market prices. Modeling the noisy revelation of uncertain investor preferences by the stock price is an exercise that would be isomorphic to (but more complicated than) ours, and the economic insights thus obtained would be similar.

VIII. Conclusion

Information can be characterized by how it is obtained (serendipitously versus through costly analysis), the cost of obtaining it, and its diversity (the extent to which the information obtained by different individuals differs). Although there is a substantial literature that considers how different types of information affect asset prices, there has been very little work on how the various types of information interact in a setting where there is more than one source of information. Exploring these different characterizations of information and how they interact provides important insights about how firms are financed and about how financial markets develop, which is the subject of this paper.

Some of our more significant results are as follows:

- Public financing is preferred when serendipitous information is important for resource allocation and/or the number of serendipitously informed traders is large, but when information relevant to resource allocation is very costly to obtain, private financing is preferred.
- The benefit from going public depends on the size of public markets—that is, the number of firms already trading publicly. The benefit from going public is greater in a large, liquid public market.
- If the costs of becoming an active investor and of acquiring information are large, there can exist multiple equilibria because firms and investors ignore how these choices affect the liquidity and informational efficiency of the overall market. There can exist a "bad equilibrium" in which many firms remain private, and a "good equilibrium" in which most firms are publicly traded.
- When stock markets liberalize, the expansion in investor base can create a snowballing effect by stimulating more firms to go public, which encourages more agents to become stock market investors, and so on.

Information that is received by stock market investors without costly effort (i.e., serendipitous information) is more likely to relate to issues outside of the firm, such as whether its products are generally liked by its customers and whether competitors are developing competing products. In contrast, learning about the likely success of an internal reorganization is less likely to occur by chance and may require costly effort to obtain. Our model, therefore, suggests that firms go public when they are introducing new products and firms go private when they are planning to implement internal reorganizations.

The model presented in this paper also provides a useful framework for assessing the relative efficiency of the financial systems in countries such as Germany, where the stock market is small and relatively inactive, and countries like the United States and the United Kingdom with very active stock markets. In Germany the number of investors is far smaller and there is likely to be much less serendipitous information incorporated into stock prices. The relative efficiency of a German versus a U.S. system would thus depend on the relative importance of individual investor-generated and analyst-generated information. Again, if assessing management requires costly analysis, but information about new technologies is often obtained by investors in their day-to-day activities, we might expect German firms to be more efficiently managed, but U.S. financial markets may better allocate capital to new technologies.

A comparison of the two financial systems should be of interest since the best system will not necessarily evolve in the absence of outside intervention. Recent empirical research, which examines how an economy's stock market affects the overall economic development of less-developed countries, suggests that a move from a bad equilibrium with a small stock market to a good equilibrium with a larger stock market may significantly affect economic growth rates.[23] Our analysis suggests that the move to the all-public equilibrium can be influenced by reducing both the costs faced by agents in learning about the stock market and becoming active investors and the cost of information acquisition, for example by reducing brokerage commissions and improving disclosure requirements.

Our model should be contrasted with other recent explanations for both the decision to go public and path dependencies in financial market development. In particular, Chemmanur and Fulghieri (1997) and Pagano (1993) present models in which the main advantage of going public is that public financing is cheaper than private financing because public investors can diversify their portfolios. Pagano argues that if diversification is an important motive for going public, one might observe bad equilbria where most firms remain private. This equilibrium is sustainable since, in the absence of other publicly traded firms, entrepreneurs find that it is not worthwhile "cashing out" by going public because they have few good outside investment alternatives.

We believe that these diversification-based explanations are less plausible than our information-based explanation because the diversification arguments ignore the fact that the providers of private capital can themselves be public firms. Thus, if the venture capitalist in Chemmanur and Fulghieri (1997) is itself a public firm, its cost of capital should be no higher than that of any other public firms, implying that there should not be a reduction in capital costs when the firms they manage go public. Additionally, a public venture capital firm (or bank) would itself provide a diversified investment vehicle for entrepreneurs wishing to go public, so we do not believe that the coordination problem suggested by Pagano (1993) is likely to be as severe as the coordination problem described here. Furthermore, the Pagano model cannot explain why so few firms go public in countries like Germany, where investors have the opportunity to diversify internationally. (In fact, Pagano et al. (1998) find little empirical support for the diversification argument.)

As discussed in Section VI, our analysis provides several testable implications and is consistent with a number of recent observations relating to IPOs, spinoffs, and the rapid growth of stock markets in emerging economies. In future research, however, one might consider generalizing the model along two dimensions, as described below.

First, there is the possibility that analysts receive information serendipitously about one company when doing research about a second company. This could increase the external benefits associated with taking a firm public because additional public firms provide analysts with more incentive to

[23] Atje and Jovanovich (1993), Levine and Zervos (1998), and Rajan and Zingales (1998) provide evidence suggesting that the size of the stock market (e.g., traded value/GDP or market capitalization) and stock market liquidity (e.g., turnover) are leading indicators of economic performance.

evaluate existing firms. For example, the apparent clustering of IPOs in given industries might be explained by the externalities created by the analysts evaluating the initial IPOs in the industry. However, the existence of other publicly traded firms in the same industry provides an incentive for new firms to free ride off the prices of existing firms, which discourages these firms from going public. An analysis of these trade-offs appears to be a promising line of research.

One might also consider allowing firms to obtain private and public financing simultaneously, thereby getting the maximum benefit from serendipitous as well as costly information. In this setting, firms will still decide against public financing if the cost cannot be justified by the additional information generated by investors receiving serendipitous information. The analysis, however, might have interesting implications about the optimal mix between private and public financing.

Appendix

Proof of Lemma 1: Let the order of a particular trader with costly information be denoted by x. Then this informed trader maximizes

$$E[x\{\bar{F} + \delta + \theta - (\bar{F} + \zeta Q)\} | \delta + \xi + \epsilon_i]. \tag{A1}$$

It is straightforward to show that the only possible equilibrium in our class is the one in which all investors with a particular type of information use symmetric strategies. Assuming that the other $M - 1$ traders with costly information use strategies of the form $\bar{\kappa}(\delta + \xi + \epsilon_i)$, and that the N traders with serendipitous information use strategies of the form $\nu(\theta + \eta_i)$, the trader's objective, equation (A1), becomes

$$\max_x E\left[x\left(\delta + \theta - \zeta\left(x + (M-1)\bar{\kappa}(\delta + \xi) + \kappa \sum_{i=1}^{M} \epsilon_i + N\nu\theta + \nu \sum_{i=1}^{N} \eta_i + z\right)\right)\middle| \delta + \epsilon\right]. \tag{A2}$$

Maximizing the above objective, we find that the trader's optimal order x is given by $\kappa(\delta + \xi + \epsilon_i)$, where

$$\kappa = \frac{v_\delta - \zeta(M-1)\bar{\kappa}(v_\delta + v_\xi)}{2\zeta(v_\delta + v_\xi + v_\epsilon)}. \tag{A3}$$

Solving for the symmetric Nash equilibrium by setting $\bar{\kappa} = \kappa$, we have

$$\kappa = \frac{v_\delta}{(M+1)(v_\delta + v_\xi + v_\epsilon)\zeta}. \tag{A4}$$

Similarly, let a trader i with serendipitous information conjecture that each of the traders with costly information uses a strategy of the form $\kappa(\delta + \epsilon)$, and each of the other traders with serendipitous information uses strategies of the form $\nu(\theta + \eta_j)$, with $j \neq i$. Denoting the trader i's order by y, his objective then becomes

$$\max_y E\left[y \left\{ \bar{F} + \delta + \theta - \left(\bar{F} + \zeta \left(y + M\kappa(\delta + \epsilon) + (N-1)\bar{\nu}\theta + \bar{\nu} \sum_{j \neq i} \eta_j + z \right) \right) \right\} \middle| \theta + \eta_i \right]. \tag{A5}$$

Maximizing the above objective, we find that the trader's order can be written as $y = \nu(\theta + \eta_i)$, where

$$\nu = \frac{v_\theta[1 - \zeta(N-1)\bar{\nu}]}{2\zeta(v_\theta + v_\eta)}. \tag{A6}$$

Again, setting $\bar{\nu} = \nu$ to solve for the symmetric Nash equilibrium, we have

$$\nu = \frac{v_\theta}{\zeta[v_\theta(N+1) + 2v_\eta]}. \tag{A7}$$

Finally, since $P = \zeta Q = E(\delta + \theta | Q)$, ζ is the coefficient in the regression of $\delta + \theta$ on Q, so that $\zeta = \text{cov}(\delta + \theta, Q)/\text{var}(Q)$. Substituting

$$Q = M\kappa(\delta + \epsilon) + N\nu\theta + \sum_{i=1}^{N} \eta_i + z \tag{A8}$$

into the above expression for ζ and, in turn, substituting for κ from equation (A4) and ν from equation (A7) yields a quadratic equation for ζ. As a positive ζ is required to satisfy the second-order condition for the informed traders, we take the positive root of this equation, which is given by

$$\zeta = v_z^{-1/2} \left[\frac{Mv_\delta^2(v_\delta + v_\xi + v_\epsilon)}{[(M+1)(v_\delta + v_\xi) + 2v_\epsilon]^2} + \frac{Nv_\theta^2(v_\theta + v_\eta)}{[(N+1)v_\theta + 2v_\eta]^2} \right]^{1/2}, \tag{A9}$$

and is identical to equation (2). ■

Proof of Proposition 1: If equation (6) does not hold, increasing N increases T_N and therefore reduces the profits of the traders with costly information (from equation (7)). This leads to a decrease in N. If equation (6) does hold, the reverse is true. ■

Proof of Proposition 2: Consider first the case of perfectly correlated costly signals ($v_\epsilon = 0$). In this case, the total derivative of EV_d with respect to N can be written as $dEV_d/dN = (\partial EV_d/\partial M)(dM/dN) + \partial EV_d/\partial N$. From equations (7) and (17), dEV/dN equals

$$\frac{v_\theta^2(v_\theta + 2v_\eta)}{((N+1)v_\theta + 2v_\eta)^2} + \frac{G}{H}, \tag{A10}$$

where

$$G \equiv v_\delta^2 v_\theta^2(v_\theta + v_\eta)((N-1)v_\theta - 2v_\eta)(M+1), \tag{A11}$$

and

$$\begin{aligned} H \equiv {} & (4M^2Nv_\theta^2(v_\theta + v_\eta)(v_\delta + v_\xi) \\ & + M(3N^2v_\delta^2 v_\theta^2 + 2Nv_\theta(3v_\delta^2 v_\eta + (v_\delta + v_\eta)(3v_\delta^2 + 4v_\delta v_\theta + 4v_\xi v_\theta)) \\ & + 3v_\delta^2(v_\theta + 2v_\eta)^2 + N^2v_\delta^2 v_\theta^2 + 2Nv_\theta(v_\delta^2 v_\eta + (v_\theta + v_\eta)(v_\delta^2 + 2v_\delta v_\eta + 2v_\xi v_\eta)) \\ & + v_\delta^2(v_\theta + 2v_\eta)^2))((N+1)v_\theta + 2v_\eta). \end{aligned} \tag{A12}$$

The above derivative is always positive. To see this, note that the numerator of the expression obtained by adding the two fractions in equation (A10) determines the sign of the derivative. This numerator is positive for $M = 0$ and is increasing in M.

Consider next the case of diverse costly signals with uncorrelated error terms ($v_\xi = 0$). In this case, calculating dM/dN from equation (7), we find that dEV_d/dN equals

$$\frac{v_\theta^2(v_\theta + 2v_\eta)}{((N+1)v_\theta + 2v_\eta)^2} + \frac{G'}{H'},$$

where

$$G' \equiv v_\delta v_\theta^2(v_\theta + v_\eta)(v_\delta + 2v_\epsilon)(Nv_\theta - (v_\theta + 2v_\eta))((M+1)v_\delta + 2v_\epsilon), \tag{A13}$$

and

$$\begin{aligned} H' \equiv {} & (4M^2Nv_\delta^2 v_\theta^2(v_\theta + v_\eta) \\ & + Mv_\delta(3N^2v_\delta v_\theta^2(v_\delta + v_\epsilon) + 2Nv_\theta(3v_\delta^2(v_\theta + 2v_\eta) + v_\delta(3v_\epsilon(v_\theta + 2v_\eta) \\ & + 4v_\theta(v_\theta + v_\eta)) + 8v_\epsilon v_\theta(v_\theta + v_\eta)) + 3v_\delta(v_\theta + 2v_\eta)^2(v_\delta + v_\epsilon)) \\ & + (v_\delta + 2v_\epsilon)(N^2v_\delta v_\theta^2(v_\delta + v_\epsilon) + 2Nv_\theta(v_\delta^2(2v_\eta + v_\theta) + v_\delta(v_\epsilon(2v_\eta + v_\theta) \\ & + 2v_\theta(v_\theta + v_\eta)) + 4v_\epsilon v_\theta(v_\epsilon + v_\theta))v_\delta(v_\theta + 2v_\eta)^3(v_\delta + v_\epsilon)))((N+1)v_\theta + 2v_\eta). \end{aligned} \tag{A14}$$

It is easy to show that the above derivative is of ambiguous sign. For example, when $c = 0.032$, $N = 0$, $v_\delta = 0.1$, $v_\epsilon = v_z = 1$, and $v_\theta = 10$, equation (6) is not satisfied, and the above derivative is negative if $v_\eta = 10$ but positive if $v_\eta = 20$. ■

Proof of Proposition 3: In the public financing regime, $\bar{F}$ plus the right-hand side of equation (17) less the liquidity costs represents the capital raised from the set of investors who subscribe to claims on the firm. In the private financier regime, the private financier contributes capital equal to $\bar{F}$ plus the right-hand side of equation(18). Thus, if the right-hand side of equation (17) less the liquidity costs is greater than the right-hand side of equation (18), the entrepreneur's expected wealth is higher in the stock market regime and vice versa. ■

Proof of Proposition 4: First note that as $N \to \infty$, $T_N \to 0$ and the second term on the left-hand side of equation (19) goes to $v_\theta/2$. Further, as $c \to 0$, from equation (7), $M \to \infty$, so that $T_M \to 0$. Additionally, as $M \to \infty$, the first term on the left-hand side of equation (19) goes to $v_\delta^2/[2(v_\delta + v_\xi)]$. All this implies that as $N \to \infty$ and $c \to 0$, equation (19) goes to

$$\frac{v_\delta^2}{2(v_\delta + v_\xi)} + \frac{v_\theta}{2} > \frac{v_\delta^2}{2(v_\delta + v_\xi + v_\epsilon)}, \tag{A15}$$

which is true.

Consider now the case in which $v_\theta \to \infty$. In this case $T_N \to \infty$, and, from equation (7), $M \to 0$, so that $T_M \to 0$, and the first term on the left-hand side of equation (19) also goes to zero. The left-hand side of equation (19) can thus be written as

$$\lim_{v_\theta \to \infty} \frac{N v_\theta^2}{(N+1)v_\theta + 2v_\eta} - \frac{v_\theta \sqrt{N v_z (v_\theta + v_\eta)}}{(N+1)v_\theta + 2v_\eta}, \tag{A16}$$

which can be rewritten as

$$\lim_{v_\theta \to \infty} \frac{\sqrt{N}}{N + 1 + \dfrac{2v_\eta}{v_\theta}} [\sqrt{N} v_\theta - \sqrt{v_\theta + v_\eta}]. \tag{A17}$$

It is evident that as long as $N > 0$, the term in brackets above goes to plus infinity whereas the term that multiplies this term limits to a finite number. Thus, as $v_\theta \to \infty$, the left-hand side of equation (19) limits to plus infinity, whereas the right-hand side (which does not depend on v_θ) remains a finite number. Thus, public financing is preferred in the limit as $v_\theta \to \infty$. ■

Proof of Proposition 5: The first part of equation (23) (at the equilibrium M) indicates that $EV(N_1) - L_1 < EV_b$, so that it is not an equilibrium for one firm to choose a stock market and the other firm to choose a private financier, because the firm choosing a stock market has an incentive to switch to private financing. It is, however, an equilibrium for both firms to choose private financing. Now consider a situation in which the second part of equation (23) holds at the M corresponding to $N = N_1$. Then, if the conditions of equations (5) and (6) hold as well, when N increases to N_2, liquidity costs decrease and expected terminal values increase, so that $EV(N_2) - L_2 > EV_b$. Thus, in this case, it is also an equilibrium for both firms to go public, because once they have done so, neither firm has an incentive to switch to private financing. In this situation, the date 0 values of both firms are higher in the equilibrium in which both firms go public than in the one in which they both choose public financing. ■

REFERENCES

Admati, Anat R., and Paul Pfleiderer, 1988, Selling and trading of information in financial markets, *American Economic Review* 78, 96–103.

Allen, Franklin, 1993, Stock markets and resource allocation; in Colin Mayer and Xavier Vives, eds.: *Capital Markets and Financial Intermediation* (Cambridge University Press, Cambridge, Mass.)

Atje, Raymond, and Boyan Jovanovich, 1993, Stock markets and development, *European Economic Review* 37, 632–640.

Bhide, Amar, 1990, Reversing corporate diversification, *Journal of Applied Corporate Finance* 3, 70–81.

Bolton, Patrick, and Ernst-Ludwig von Thadden, 1998, Blocks, liquidity, and corporate control, *Journal of Finance* 53, 1–26.

Boot, Arnoud, and Anjan Thakor, 1997, Financial system architecture, *Review of Financial Studies* 10, 693–733.

Brav, Alon, 1996, Inferences in long-horizon event studies: A re-evaluation of the existing evidence, Working paper, University of Chicago.

Brennan, Michael, and Henry Cao, 1997, International portfolio investment flows, *Journal of Finance* 52, 1851–1880.

Burkart, Mike, Denis Gromb, and Fausto Panunzi, 1997, Large shareholders, monitoring, and the value of the firm, *Quarterly Journal of Economics* 112, 693–728.

Chemmanur, Thomas, and Paolo Fulghieri, 1997, A theory of going public, *Review of Financial Studies*, forthcoming.

Comment, Robert, and Gregory Jarrell, 1995, Corporate focus and firm performance, *Journal of Financial Economics* 37, 67–87.

Cusatis, Patrick J., James A. Miles, and J. Randall Woolridge, 1993, Restructuring through spinoffs: The stock market evidence, *Journal of Financial Economics* 33, 293–311.

Diamond, Douglas W., 1984, Financial intermediation and delegated monitoring, *Review of Economic Studies* 51, 393–414.

Dow, James, and Gary Gorton, 1997, Stock market efficiency and economic efficiency: Is there a connection?, *Journal of Finance* 51, 1087–1129.

Fama, Eugene, 1985, What's different about banks?, *Journal of Monetary Economics* 85, 29–39.

Fishman, Michael, and Kathleen Hagerty, 1992, Insider trading and the efficiency of stock prices, *Rand Journal of Economics* 23, 106–122.

Forest, Stephanie A., 1995, The whirlwind breaking up companies, *Business Week* (August 14), 44.

Gorton, Gary, and George Pennacchi, 1993, Security baskets and index-linked securities, *Journal of Business* 66, 1–23.

Grossman, Sanford J., and Joseph E. Stiglitz, 1980, On the impossibility of informationally inefficient markets, *American Economic Review* 70, 393–408.

Henry, Paul B., 1997, Stock market liberalization, economic reform, and emerging equity market prices, Working paper, Massachusetts Institute of Technology.

Hirshleifer, Jack, 1971, The private and social value of information and the reward to inventive activity, *American Economic Review* 61, 561–574.

Holmström, Bengt, and Jean Tirole, 1993, Market liquidity and performance monitoring, *Journal of Political Economy* 101, 678–709.

Hubbard, R. Glenn, and Darius Palia, 1999, A re-examination of the conglomerate merger wave in the 1960s: An internal capital market view, *Journal of Finance*, this issue.

Jegadeesh, Narasimhan, Mark Weinstein, and Ivo Welch, 1994, An empirical investigation of IPO returns and subsequent equity offerings, *Journal of Financial Economics* 34, 153–175.

Kang, Jun-Koo, and René Stulz, 1997, Why is there a home bias? An analysis of foreign portfolio equity ownership in Japan, *Journal of Financial Economics* 46, 3–20.

Kyle, Albert S., 1985, Continuous auctions and insider trading, *Econometrica* 57, 1315–1335.

Lang, Larry, and René Stulz, 1994, Tobin's q, corporate diversification, and firm performance, *Journal of Political Economy* 102, 1248–1280.

Levine, Ross, and Sara Zervos, 1998, Stock markets, banks, and economic growth, *American Economic Review* 88, 537–558.

Matsusaka, John G., 1993, Takeover motives during the conglomerate merger wave, *Rand Journal of Economics* 24, 357–379.

Pagano, Marco, 1993, The flotation of companies on the stock market: A coordination failure model, *European Economic Review* 37, 1101–1125.

Pagano, Marco, Fabio Panetta, and Luigi Zingales, 1998, Why do companies go public? An empirical analysis, *Journal of Finance* 53, 27–64.

Perotti, Enrico, and Pieter von Oijen, 1995, Privatization and stock market development in emerging capital markets, Working paper, University of Amsterdam.

Rajan, Raghuram, 1992, Insiders and outsiders: The choice between informed and arm's length debt, *Journal of Finance* 47, 1367–1400.

Rajan, Raghuram, and Luigi Zingales, 1998, Financial dependence and growth, *American Economic Review*, forthcoming.

Servaes, Henri, 1996, The value of diversification during conglomerate merger waves, *Journal of Finance* 51, 1201–1225.

Stein, Jeremy, 1997, Internal capital markets and the competition for corporate resources, *Journal of Finance* 52, 111–133.

Stulz, René, 1997, International portfolio flows and security markets, Working paper, Ohio State University.

Subrahmanyam, Avanidhar, 1991, A theory of trading in stock index futures, *Review of Financial Studies* 4, 17–51.

Williamson, Oliver, 1975, *Markets and Hierarchies: Analysis and Antitrust Implications* (Collier Macmillan Publishers, Inc., New York, N.Y.).

LINKED CITATIONS

You have printed the following article:

The Going-Public Decision and the Development of Financial Markets
Avanidhar Subrahmanyam; Sheridan Titman
The Journal of Finance, Vol. 54, No. 3. (Jun., 1999), pp. 1045-1082.
Stable URL:
http://links.jstor.org/sici?sici=0022-1082%28199906%2954%3A3%3C1045%3ATGDATD%3E2.0.CO%3B2-C

[Footnotes]

[1] **Stock Market Efficiency and Economic Efficiency: Is There a Connection?**
James Dow; Gary Gorton
The Journal of Finance, Vol. 52, No. 3, Papers and Proceedings Fifty-Seventh Annual Meeting, American Finance Association, New Orleans, Louisiana January 4-6, 1997. (Jul., 1997), pp. 1087-1129.
Stable URL:
http://links.jstor.org/sici?sici=0022-1082%28199707%2952%3A3%3C1087%3ASMEAEE%3E2.0.CO%3B2-%23

[1] **Financial System Architecture**
Arnold W. A. Boot; Anjan V. Thakor
The Review of Financial Studies, Vol. 10, No. 3. (Autumn, 1997), pp. 693-733.
Stable URL:
http://links.jstor.org/sici?sici=0893-9454%28199723%2910%3A3%3C693%3AFSA%3E2.0.CO%3B2-4

[2] **Security Baskets and Index-Linked Securities**
Gary B. Gorton; George G. Pennacchi
The Journal of Business, Vol. 66, No. 1. (Jan., 1993), pp. 1-27.
Stable URL:
http://links.jstor.org/sici?sici=0021-9398%28199301%2966%3A1%3C1%3ASBAIS%3E2.0.CO%3B2-0

NOTE: *The reference numbering from the original has been maintained in this citation list.*

LINKED CITATIONS

[2] **A Theory of Trading in Stock Index Futures**

Avanidhar Subrahmanyam

The Review of Financial Studies, Vol. 4, No. 1. (1991), pp. 17-51.

Stable URL:

http://links.jstor.org/sici?sici=0893-9454%281991%294%3A1%3C17%3AATOTIS%3E2.0.CO%3B2-2

[6] **Selling and Trading on Information in Financial Markets**

Anat R. Admati; Paul Pfleiderer

The American Economic Review, Vol. 78, No. 2, Papers and Proceedings of the One-Hundredth Annual Meeting of the American Economic Association. (May, 1988), pp. 96-103.

Stable URL:

http://links.jstor.org/sici?sici=0002-8282%28198805%2978%3A2%3C96%3ASATOII%3E2.0.CO%3B2-H

[20] **Why Do Companies Go Public? An Empirical Analysis**

Marco Pagano; Fabio Panetta; Luigi Zingales

The Journal of Finance, Vol. 53, No. 1. (Feb., 1998), pp. 27-64.

Stable URL:

http://links.jstor.org/sici?sici=0022-1082%28199802%2953%3A1%3C27%3AWDCGPA%3E2.0.CO%3B2-Z

[22] **Takeover Motives during the Conglomerate Merger Wave**

John G. Matsusaka

The RAND Journal of Economics, Vol. 24, No. 3. (Autumn, 1993), pp. 357-379.

Stable URL:

http://links.jstor.org/sici?sici=0741-6261%28199323%2924%3A3%3C357%3ATMDTCM%3E2.0.CO%3B2-1

[22] **Tobin's q, Corporate Diversification, and Firm Performance**

Larry H. P. Lang; René M. Stulz

The Journal of Political Economy, Vol. 102, No. 6. (Dec., 1994), pp. 1248-1280.

Stable URL:

http://links.jstor.org/sici?sici=0022-3808%28199412%29102%3A6%3C1248%3ATCDAFP%3E2.0.CO%3B2-J

[22] **The Value of Diversification During the Conglomerate Merger Wave**

Henri Servaes

The Journal of Finance, Vol. 51, No. 4. (Sep., 1996), pp. 1201-1225.

Stable URL:

http://links.jstor.org/sici?sici=0022-1082%28199609%2951%3A4%3C1201%3ATVODDT%3E2.0.CO%3B2-9

NOTE: *The reference numbering from the original has been maintained in this citation list.*

LINKED CITATIONS

[22] **A Reexamination of the Conglomerate Merger Wave in the 1960s: An Internal Capital Markets View**
R. Glenn Hubbard; Darius Palia
The Journal of Finance, Vol. 54, No. 3. (Jun., 1999), pp. 1131-1152.
Stable URL:
http://links.jstor.org/sici?sici=0022-1082%28199906%2954%3A3%3C1131%3AAROTCM%3E2.0.CO%3B2-0

[23] **Stock Markets, Banks, and Economic Growth**
Ross Levine; Sara Zervos
The American Economic Review, Vol. 88, No. 3. (Jun., 1998), pp. 537-558.
Stable URL:
http://links.jstor.org/sici?sici=0002-8282%28199806%2988%3A3%3C537%3ASMBAEG%3E2.0.CO%3B2-9

[23] **Financial Dependence and Growth**
Raghuram G. Rajan; Luigi Zingales
The American Economic Review, Vol. 88, No. 3. (Jun., 1998), pp. 559-586.
Stable URL:
http://links.jstor.org/sici?sici=0002-8282%28199806%2988%3A3%3C559%3AFDAG%3E2.0.CO%3B2-C

References

Selling and Trading on Information in Financial Markets
Anat R. Admati; Paul Pfleiderer
The American Economic Review, Vol. 78, No. 2, Papers and Proceedings of the One-Hundredth Annual Meeting of the American Economic Association. (May, 1988), pp. 96-103.
Stable URL:
http://links.jstor.org/sici?sici=0002-8282%28198805%2978%3A2%3C96%3ASATOII%3E2.0.CO%3B2-H

Blocks, Liquidity, and Corporate Control
Patrick Bolton; Ernst-Ludwig Von Thadden
The Journal of Finance, Vol. 53, No. 1. (Feb., 1998), pp. 1-25.
Stable URL:
http://links.jstor.org/sici?sici=0022-1082%28199802%2953%3A1%3C1%3ABLACC%3E2.0.CO%3B2-N

NOTE: *The reference numbering from the original has been maintained in this citation list.*

LINKED CITATIONS

Financial System Architecture
Arnold W. A. Boot; Anjan V. Thakor
The Review of Financial Studies, Vol. 10, No. 3. (Autumn, 1997), pp. 693-733.
Stable URL:
http://links.jstor.org/sici?sici=0893-9454%28199723%2910%3A3%3C693%3AFSA%3E2.0.CO%3B2-4

International Portfolio Investment Flows
Michael J. Brennan; H. Henry Cao
The Journal of Finance, Vol. 52, No. 5. (Dec., 1997), pp. 1851-1880.
Stable URL:
http://links.jstor.org/sici?sici=0022-1082%28199712%2952%3A5%3C1851%3AIPIF%3E2.0.CO%3B2-3

Large Shareholders, Monitoring, and the Value of the Firm
Mike Burkart; Denis Gromb; Fausto Panunzi
The Quarterly Journal of Economics, Vol. 112, No. 3. (Aug., 1997), pp. 693-728.
Stable URL:
http://links.jstor.org/sici?sici=0033-5533%28199708%29112%3A3%3C693%3ALSMATV%3E2.0.CO%3B2-G

Financial Intermediation and Delegated Monitoring
Douglas W. Diamond
The Review of Economic Studies, Vol. 51, No. 3. (Jul., 1984), pp. 393-414.
Stable URL:
http://links.jstor.org/sici?sici=0034-6527%28198407%2951%3A3%3C393%3AFIADM%3E2.0.CO%3B2-1

Stock Market Efficiency and Economic Efficiency: Is There a Connection?
James Dow; Gary Gorton
The Journal of Finance, Vol. 52, No. 3, Papers and Proceedings Fifty-Seventh Annual Meeting, American Finance Association, New Orleans, Louisiana January 4-6, 1997. (Jul., 1997), pp. 1087-1129.
Stable URL:
http://links.jstor.org/sici?sici=0022-1082%28199707%2952%3A3%3C1087%3ASMEAEE%3E2.0.CO%3B2-%23

Insider Trading and the Efficiency of Stock Prices
Michael J. Fishman; Kathleen M. Hagerty
The RAND Journal of Economics, Vol. 23, No. 1. (Spring, 1992), pp. 106-122.
Stable URL:
http://links.jstor.org/sici?sici=0741-6261%28199221%2923%3A1%3C106%3AITATEO%3E2.0.CO%3B2-G

NOTE: *The reference numbering from the original has been maintained in this citation list.*

LINKED CITATIONS

Security Baskets and Index-Linked Securities
Gary B. Gorton; George G. Pennacchi
The Journal of Business, Vol. 66, No. 1. (Jan., 1993), pp. 1-27.
Stable URL:
http://links.jstor.org/sici?sici=0021-9398%28199301%2966%3A1%3C1%3ASBAIS%3E2.0.CO%3B2-0

On the Impossibility of Informationally Efficient Markets
Sanford J. Grossman; Joseph E. Stiglitz
The American Economic Review, Vol. 70, No. 3. (Jun., 1980), pp. 393-408.
Stable URL:
http://links.jstor.org/sici?sici=0002-8282%28198006%2970%3A3%3C393%3AOTIOIE%3E2.0.CO%3B2-6

The Private and Social Value of Information and the Reward to Inventive Activity
Jack Hirshleifer
The American Economic Review, Vol. 61, No. 4. (Sep., 1971), pp. 561-574.
Stable URL:
http://links.jstor.org/sici?sici=0002-8282%28197109%2961%3A4%3C561%3ATPASVO%3E2.0.CO%3B2-2

Market Liquidity and Performance Monitoring
Bengt Holmström; Jean Tirole
The Journal of Political Economy, Vol. 101, No. 4. (Aug., 1993), pp. 678-709.
Stable URL:
http://links.jstor.org/sici?sici=0022-3808%28199308%29101%3A4%3C678%3AMLAPM%3E2.0.CO%3B2-F

A Reexamination of the Conglomerate Merger Wave in the 1960s: An Internal Capital Markets View
R. Glenn Hubbard; Darius Palia
The Journal of Finance, Vol. 54, No. 3. (Jun., 1999), pp. 1131-1152.
Stable URL:
http://links.jstor.org/sici?sici=0022-1082%28199906%2954%3A3%3C1131%3AAROTCM%3E2.0.CO%3B2-0

Continuous Auctions and Insider Trading
Albert S. Kyle
Econometrica, Vol. 53, No. 6. (Nov., 1985), pp. 1315-1335.
Stable URL:
http://links.jstor.org/sici?sici=0012-9682%28198511%2953%3A6%3C1315%3ACAAIT%3E2.0.CO%3B2-8

NOTE: *The reference numbering from the original has been maintained in this citation list.*

LINKED CITATIONS

Tobin's q, Corporate Diversification, and Firm Performance
Larry H. P. Lang; René M. Stulz
The Journal of Political Economy, Vol. 102, No. 6. (Dec., 1994), pp. 1248-1280.
Stable URL:
http://links.jstor.org/sici?sici=0022-3808%28199412%29102%3A6%3C1248%3ATCDAFP%3E2.0.CO%3B2-J

Stock Markets, Banks, and Economic Growth
Ross Levine; Sara Zervos
The American Economic Review, Vol. 88, No. 3. (Jun., 1998), pp. 537-558.
Stable URL:
http://links.jstor.org/sici?sici=0002-8282%28199806%2988%3A3%3C537%3ASMBAEG%3E2.0.CO%3B2-9

Takeover Motives during the Conglomerate Merger Wave
John G. Matsusaka
The RAND Journal of Economics, Vol. 24, No. 3. (Autumn, 1993), pp. 357-379.
Stable URL:
http://links.jstor.org/sici?sici=0741-6261%28199323%2924%3A3%3C357%3ATMDTCM%3E2.0.CO%3B2-1

Why Do Companies Go Public? An Empirical Analysis
Marco Pagano; Fabio Panetta; Luigi Zingales
The Journal of Finance, Vol. 53, No. 1. (Feb., 1998), pp. 27-64.
Stable URL:
http://links.jstor.org/sici?sici=0022-1082%28199802%2953%3A1%3C27%3AWDCGPA%3E2.0.CO%3B2-Z

Insiders and Outsiders: The Choice between Informed and Arm's-Length Debt
Raghuram G. Rajan
The Journal of Finance, Vol. 47, No. 4. (Sep., 1992), pp. 1367-1400.
Stable URL:
http://links.jstor.org/sici?sici=0022-1082%28199209%2947%3A4%3C1367%3AIAOTCB%3E2.0.CO%3B2-F

Financial Dependence and Growth
Raghuram G. Rajan; Luigi Zingales
The American Economic Review, Vol. 88, No. 3. (Jun., 1998), pp. 559-586.
Stable URL:
http://links.jstor.org/sici?sici=0002-8282%28199806%2988%3A3%3C559%3AFDAG%3E2.0.CO%3B2-C

NOTE: *The reference numbering from the original has been maintained in this citation list.*

LINKED CITATIONS

The Value of Diversification During the Conglomerate Merger Wave
Henri Servaes
The Journal of Finance, Vol. 51, No. 4. (Sep., 1996), pp. 1201-1225.
Stable URL:
http://links.jstor.org/sici?sici=0022-1082%28199609%2951%3A4%3C1201%3ATVODDT%3E2.0.CO%3B2-9

Internal Capital Markets and the Competition for Corporate Resources
Jeremy C. Stein
The Journal of Finance, Vol. 52, No. 1. (Mar., 1997), pp. 111-133.
Stable URL:
http://links.jstor.org/sici?sici=0022-1082%28199703%2952%3A1%3C111%3AICMATC%3E2.0.CO%3B2-R

A Theory of Trading in Stock Index Futures
Avanidhar Subrahmanyam
The Review of Financial Studies, Vol. 4, No. 1. (1991), pp. 17-51.
Stable URL:
http://links.jstor.org/sici?sici=0893-9454%281991%294%3A1%3C17%3AATOTIS%3E2.0.CO%3B2-2