STOCK MARKETS AND RESOURCE ALLOCATION

by

Franklin Allen

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RODNEY L. WHITE CENTER FOR FINANCIAL RESEARCH
The Wharton School
University of Pennsylvania
Philadelphia, PA 19104-6367

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Franklin Allen*

University of Pennsylvania

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Abstract

In some countries, such as the U.S. and U.K., stock markets have played an important role in the allocation of resources while in others, such as France, Germany and Japan, only banks have played an important role. This paper investigates the relative advantages that stock markets and banks have in providing finance for industry. It is argued that stock markets are desirable when investors disagree on the optimal policies a firm should pursue because they allow diversity of opinion to be taken account of; this type of situation is likely in new industries or those with an oligopolistic or monopolistic structure. Banks, on the other hand, are desirable when there is wide agreement on optimal policies as in most competitive industries.

1. Introduction

As Western European countries integrate their economies and Eastern European countries move away from Communism, both are reassessing their economic and financial institutions. One of the most important choices they face concerns the emphasis they should place on stock markets (including equity, bond and other markets) as opposed to banks for providing finance to their industries.

Although both stock markets and banks have existed in most advanced countries for many years, the relative importance of the two has varied. Stock market-based financial systems have been associated with the nineteenth century U.K. when it was the first country to go through the Industrial Revolution and the twentieth century U.S. when it was the first country to go through the Post-Industrial Revolution. Bank-based financial systems have been associated with France, Germany and Japan.

In the second half of the nineteenth century the stock market played an important role in the financing of industry in the U.K. According to Michie (1987), roughly one quarter of capital formation was raised through the London stock exchange in 1853; by 1913 this had grown to one third.[1] Table 1 gives a detailed breakdown of the distribution of securities by industry between 1853 and 1913. It can be seen that railways were the most important category apart from government debt. Urban services, financial services and commercial and industrial firms were all significant and constituted most of the remainder. Agriculture was a very minor component and consisted entirely of overseas investments.

In the first half of the twentieth century, the role of the London Stock Exchange in raising funds for industry declined and it was in the U.S. that stock markets came to have the

greatest relative importance. Table 2 shows the stocks listed on the NYSE at the end of 1949. It can be seen that manufacturing industries dominated and that agriculture was again unimportant.

Mayer (1988) has examined the importance of various sources of funds for financing investment in a number of major industrialized countries in more recent years. His comparison between France, Germany, Japan, the U.K. and the U.S. using data from the period 1970-1985, is shown in Figure 1. The most important source of funds was retained earnings; stock markets were relatively unimportant. The exception is the U.S. where significant amounts were raised in the bond markets.

A more direct comparison of the relative importance of banks and stock markets is given in Figure 2 which is from Frankel and Montgomery (1991). It can be seen that the U.S. is dramatically different from the other countries in terms of the proportion of funds raised with securities, a category which includes both stocks and bonds. Apart from 1985-1989 when companies were borrowing to repurchase shares, securities have been much more important in the U.S.

Why do these stark differences in the role of banks and stock markets between the U.S. and other countries arise? In order to answer this question, it is necessary to start by contrasting banks and stock markets. As suggested by Hellwig (1990), the main distinction is between the structure of the financial institutions rather than the financial instruments they issue. There are countries where banks lend using debt and equity and countries where bonds and shares are traded in stock markets. The important difference between the two institutions is that banks individually negotiate contracts with borrowers and it is rare for a borrower to deal with more

than a few banks; in stock markets there are a large number of anonymous lenders who take the contract form specified by the borrower or an intermediary as given. In the U.S. this difference between stock markets and banks is particularly evident. The stock markets have many participants and are very competitive. In other countries, the difference is not as clearcut. In Germany, for example, the stock market is not as competitive and firms can seek financing from several different banks. However, as the globalization of financial markets continues, the number of participants in most major stock markets is growing and the markets are becoming more competitive while bank loans are still negotiated individually.

What are some of the advantages and disadvantages that have been suggested for banks and stock markets? It has been argued that banks perform a number of roles. These include the following.

- Banks act as delegated monitors of firms (Diamond (1984).
- In contrast to stock markets, they allow long-term relationships and commitments (Mayer (1988), Shleifer and Summers (1988), Berkovitch and Greenbaum (1990) and Boot, Thakor and Udell (1987, 1991)).

Diamond's (1984) notion is that the management of a firm needs to be "monitored" to ensure they act in the interest of the investors providing finance to the firm. This monitoring only needs to be done by one party; duplication does not result in improved monitoring. If finance is provided through a stock market, diverse ownership means that securityholders may waste resources by costly repetition of monitoring. They cannot combine to hire somebody to monitor because of a free rider problem; each would want others to bear the costs of monitoring the monitor. Diamonds suggests that a bank lending to corporations allows the advantages of

a single monitor to be captured and solves the problem of monitoring the monitor. By holding a large portfolio of loans to different firms, the bank can guarantee to its depositors that it is undertaking the monitoring and thus overcomes the free rider problem; if it did not monitor it would be unable to make the promised payment to the depositors.

Mayer (1988) and Shleifer and Summers (1988) have pointed to the importance of long-term relationships. They suggest that because of incomplete contracting possibilities it is desirable for firms to make long-term implicit contracts with their workers, suppliers and other groups they do business with. These long-term relationships allow significant ex ante gains to be made. For example, workers and suppliers may be willing to acquire firm-specific capital whereas without an implicit contract they would not be willing to do so. Ex post, a firm may be required to make payments to fulfil its implicit contracts which it is not legally obligated to. For a firm that is listed on a stock exchange, there is an incentive for somebody to take it over and cease making the payments required under the implicit contract. Recognizing this possibility, workers and others will be wary of entering into implicit contracts and ex ante gains will be lost. In contrast, one of the advantages of bank-oriented financial structures is that this problem is not so serious. Banks will encourage long-term relationships in order to be able to share in the ex ante gains; ex post they will want to keep the implicit contracts from a desire to maintain their long-term reputation. Their position and incentives are very different from those of stock market raiders. Similarly, Berkovitch and Greenbaum (1990) and Boot, Thakor and Udell (1987, 1991) have stressed the importance of banks' ability to make credible long-term commitments.

Bank loans have many other desirable characteristics which arise from the fact that they are provided on an individual basis. For example, bank loans can be renegotiated more easily than securities sold in stock markets (Wilson (1991)). There are also better incentives for various types of information about borrowers to be gathered than with stock markets (Sharpe (1990)). A comprehensive survey of these and other recent theories of banking is provided in Bhattacharya and Thakor (1992).

A number of advantages of stock markets have been stressed in the literature. These include the following.

- Stock markets allow efficient risk sharing (e.g., Diamond (1967)).
- They provide incentives to gather information which becomes reflected in stock prices. These prices provide signals for the efficient allocation of investment (Grossman (1976; 1978), Grossman and Stiglitz (1980) and Diamond and Verrecchia (1981)).
- Information in stock market prices allows effective managerial incentive schemes (Diamond and Verrecchia (1982), Holmstrom and Tirole (1990)).

Diamond (1967) and others have suggested that one of the important advantages of stock markets is that they allow efficient risk sharing between investors. However, the absence of agriculture from stock markets is somewhat surprising if risk sharing is one of their major roles. Although futures markets exist to spread some of the risk in agriculture, the residual uncertainty is still considerable and is larger than in many industries that figure prominently on the stock market. Also, in comparing the U.S. with other countries there does not appear to be any evidence that risk is shared better in the U.S. In France, Germany and Japan the portfolios held

by banks and other financial institutions appear to spread risk across the population as effectively as in the U.S.

The number of firms analysts gather information about differs significantly in different countries. Table 3 shows the number of firms covered by financial analysts by country. It can be seen that in France and Germany, in particular, very little information is gathered and stock prices are unlikely to reflect much information. At the other extreme, many firms in the U.S. are covered by analysts so stock prices are likely to incorporate more information. Grossman (1976; 1978), Grossman and Stiglitz (1980) and Diamond and Verrecchia (1981) have suggested models where investors have diverse information and stock prices aggregate this information. This allows stock prices to provide efficient signals for the allocation of resources. Diamond and Verrecchia (1982) and Holmstrom and Tirole (1990) have extended this idea to suggest that the information in stock prices allows effective managerial incentive schemes to be provided. Similarly to risk sharing, however, it does not appear that the U.S. has had a significant advantage over other countries in terms of the efficiency of investment allocation or the provision of managerial incentives. In this view, an advantage of bank-oriented systems is the absence of wasteful expenditures involved when analysts gather information.

It would appear that stock-market based systems have few advantages and a number of disadvantages when compared with bank-based systems. This suggests bank-based systems are superior. The purpose of the current paper is to argue that the standard arguments presented above do not capture all the benefits of stock markets and, depending on the circumstances, stock markets can play an important role. It is suggested in Section 2 that from the classical economists onwards the typical starting point of analysis has been that the production technology

is well known and the essential resource allocation problems considered have been static in nature. With competitive industries like agriculture, repetition ensures a consensus will soon be reached and this assumption is appropriate. However, in industrial economies with oligopolistic or monopolistic industries the actions managers of large corporations should take are far from clear. The problems they face are extraordinarily complex and there will be a divergence of opinions on what a firm should do. Although there may be some sharing of information, the complexity of the problems involved means that a consensus on how firms should be run will not be reached; it is simply too time consuming and costly to transfer all the relevant information. In this type of situation the crucial issue in allocating resources is one of checking whether the strategies the management undertakes are sensible ones. The great advantage of a stock market is that it provides incentives for large numbers of investors to check what the firm is doing. These arguments are developed more fully in Section 3.

Given this checking role for the stock market, what is the role of banks? The crucial difference between this framework and those of Diamond (1984) and Mayer (1988) is that repetition of the decision making process is valuable. The weakness of banks is that they only allow checking to occur relatively few times; if there is one bank lending, checking occurs just once. It is argued in Section 4 that banks are institutions which will be advantageous when there is a consensus on the actions that management should take and the problem is to ensure that they actually take them as in Diamond (1984). This suggests that in industries where the optimal actions of management are widely agreed upon banking will predominate; thus banking will be important in competitive industries such as agriculture. However, in industries where there is

wide disagreement on optimal policies, stock markets will be important; these include those industries dominated by large corporations and those with high technology.

The idea that the stock market provides a checking role also has implications for government ownership. The extreme case of government ownership was in the former communist countries. One of the defects of centrally planned systems is that there are no checks in the sense of decisions being replicated. Thus managers might have information about the effects of various actions which are far from the truth but this may not become apparent for a considerable time. In a number of non-communist countries there has also been substantial government ownership of firms, particularly those which have natural monopolies. The only checks on these firms are those provided by politicians which again rarely involve replication of decisions. In contrast a quotation on the stock market means that analysts have a constant incentive to consider how the firm is being run and what alternative strategies there are. These arguments suggest that private ownership of firms may be preferable to government ownership even when firms have natural monopolies. They are considered more fully in Section 5. Section 6 contains concluding remarks.

The approach taken in this paper is related to that in Sah and Stiglitz (1985; 1986). They consider the optimal structure of firms given that people make mistakes in screening projects. In contrast, the issue addressed here is the optimal structure of financial institutions given that people have different views on how firms should be run. However, both approaches are concerned with the allocation of resources when the traditional assumption that production functions are known to all is dispensed with.

2. Traditional Analyses

Starting with the classical economists, the traditional view of the firm in economics has been that it combines a vector of inputs, such as various types of capital and labour, to produce a vector of outputs. The role of the owners or managers of the firm is to choose the vector of inputs to maximize profits given the technological relationship between inputs and outputs.

This approach to modelling the firm, which assumes that its production function is well known, was appropriate for economies prior to the Industrial Revolution. The industries in these economies had a number of features which made the assumption of a known technology reasonable.

- The industries were competitive with many producers.
- Production cycles were relatively short.
- Technology was constant.

The classic example of an industry with these characteristics was agriculture. There were many farmers, production occurred in a matter of months and was repeated every year and technology only changed slowly. In this type of situation, assuming the production function was well known was appropriate. Many producers and the short production cycle meant that a wide range of actions would be tried and their consequences discovered. Movement between farms and direct observation ensured that this knowledge became widely spread and there was wide agreement throughout the industry on the technology. Similar arguments will apply in other competitive industries.

At this point it is helpful to develop these ideas more formally. Suppose a firm is run by a manager who may or may not be the owner. For large corporations "the manager" should

be thought of as the management team that runs the firm. The manager can choose various courses of action α for the firm. These courses of action are multi-dimensional and may include a wide range of things. Examples would include how much to invest in equipment, research and development, what personnel policies to pursue and so on. Manager i's opinions of the effectiveness of the various possible actions will be determined by his or her information set η_i. This is again multi-dimensional. It includes the information that the manager has about the particular firm that is being managed, his or her education, any relevant political views and so forth. The manager's perception of the value of the firm depends on this information set and the course of action undertaken. The value of the firm as perceived by manager i given a course of action α is

$$V_i = V(\alpha, \eta_i). \tag{1}$$

The true information set is denoted η_T. Each individual manager's view of the information set is initially a function of η_T and a vector of random disturbances ϵ_i:

$$\eta_i = \eta_T + \epsilon_i \tag{2}$$

where $E\epsilon_i = 0$ and the ϵ_i are independent.

The relationship between firm value and the manager's information and actions is represented in Figure 3 for the special case where α has one dimension. It is important to stress that in practice α will have many dimensions. The optimal course of action as perceived by manager i is α_i^* whereas the optimal course of action is in fact α_T^*. The value of the firm as perceived by the manager is $V(\alpha_i^*, \eta_i)$ but the true value is $V(\alpha_i^*, \eta_T)$.

An important issue is how managers acquire the information that determines their opinions. This is a long, complex process. Part of it is during their education, part of it is the

information they acquire to make actual decisions about the running of the firm. The amount of information involved is so large that it can only be directly transferred at great cost.

For firms in competitive industries where the production cycle is brief, it will soon be the case that the effect of actions will be empirically established. Empirical information will come to dominate and there will be a consensus on the relationship between actions and value:

$$V(\alpha_i, \eta_h) = V(\alpha_i, \eta_r) \quad \text{for all i.} \tag{3}$$

The convergence of information sets will come about in a variety of ways including through the education system, trial and error, the movement of personnel between firms and the direct observation of competing firms.

In this view, one of the advantages of competitive industries with many firms is that the information which is the basis of management decisions is widely agreed upon and has been verified numerous times. Thus in competitive industries with the features listed initially it is natural to assume the production technology is known to everybody.

This was essentially the view of the production process taken by the classical economists and it provided very useful insights into the role of the price system in allocating resources efficiently. In this type of economy there is little role for a stock market and indeed the classical economists rarely mentioned its existence. For example, even though Ricardo had made a fortune on the stock market before turning to economics, he ascribed it no special place in his economic theories.[2]

The static theory of resource allocation culminated with the Arrow-Debreu model and the fundamental theorems of welfare economics. Provided markets are complete an efficient allocation of resources can be attained. An important component of markets being complete is

that the appropriate financial markets are available to consumers. Equity and bond markets may perform this role but there is no need that they do so; any other types of financial security that complete the market can perform this function. Apart from this possible role in sharing risk, the stock market is also not important in the Arrow-Debreu theory.

3. The Checking Role of the Stock Market

In modern economies there are a number of factors which mean the assumption that the relationship between actions and outcomes is widely agreed upon is problematic in many industries. These include the following.

- Increasing returns to scale result in there only being a few firms in an industry.
- There is often a long time between the adoption of policies and the time that their success or failure is realized.
- Technological change is important and rapid.

An example of an industry which displays these characteristics in varying degrees is biotechnology.

These factors contrast sharply with those underlying industries before the Industrial Revolution listed above. In some industries, instead of there being many firms there are now only a few; instead of production cycles being short, they can be up to several decades in length; instead of technological change being unimportant, it often changes rapidly.

All this suggests that in many cases there will be very little consensus about the effects of managerial actions. Even after expending considerable effort gathering information, the complexity of running modern corporations means that there will not be a uniform view of the

best actions to undertake. It is important to stress that it is not just a difference in the data that is collected that is important here. Even if people collected the same information about the industry, they might interpret it differently because of differences in education, personal experiences and background. The range of relevant information is so large that in practice it cannot be shared between people. The length of time taken to complete projects and the fact that the technology changes means that few actual data points will be gathered. In the absence of a large sample of data points on the effect of various policies it is likely that differences in views of the production function will persist. This divergence of opinions is an important feature of many industries.

How do these differences in opinion relate to standard Bayesian decision theory? In an important contribution, Aumann (1976) showed that if two people have the same priors for a given event and their posteriors are common knowledge then they cannot agree to disagree. Geanakoplos and Polemarchakis (1982) demonstrated that if the two agents receive different information then by communicating their posteriors back and forth they will converge to a common posterior. McKelvey and Page (1986) extended these results to n individuals and showed that public announcement of posteriors was not necessary for convergence; public announcement of other aggregate statistics can have the same effect. The crucial point here is that if the information that each person observes is sufficiently complex, the number of iterations required to obtain convergence will be large. The process of making public announcements and updating priors is not costless and takes time. In addition, the underlying technology is continually changing. In practice, therefore, agents will update only a limited amount and will agree to disagree.

The fact that each manager's information set is the true one plus a disturbance (as in (2)) and these disturbances are independent means that the more values of η_i that are obtained the better is the aggregate information set. This is why competitive industries do well in this framework; there are multiple "draws" and in the long run a consensus as to the true production function is reached. In oligopolistic and monopolistic industries this will not be the case, there will only be a limited number of views and each will have a certain amount of idiosyncratic noise.

In this type of situation the resource allocation problem becomes one of trying to ensure that the information sets that managers of firms make decisions on are as close to the true one as possible. One way to do this is to increase the number of firms so that the industry becomes more competitive in the sense that there are more draws of η_i. However, if there are significant returns to scale this will not be a very good way of obtaining checking. Another way to achieve checking is to set up a stock market. In a stock market with many investors there is an incentive for many people to estimate η_i.

In a series of papers Grossman (1976; 1978) has argued that if some agents are better informed than others about the value of a financial asset, then the price of that asset aggregates the information possessed by all the traders. In terms of the literature on agreeing to disagree, McKelvey and Page (1986) showed that provided markets are complete public revelation of the asset price is sufficient for there to be consensus on the asset return distribution.

Grossman and Stiglitz (1980) pointed out that if acquiring information is costly there is a paradox in the complete markets framework. If the price reflects all investors' information there is no incentive to expend resources to gather information and nobody will do so.

However, if nobody collects information there is an incentive to expend resources and profitably trade on it. Grossman and Stiglitz's solution to this paradox is to argue that there may be a number of variables which are unobservable to participants so that markets are incomplete and this limits the ability of the uninformed to deduce the information of the informed from the price. In this case those that gather costly information can recover the costs of doing so. Uninformed investors deduce some information from price but they do not end up with the same posteriors as the informed. In general, the more variables that are unobservable, the less information that can be deduced from price and the greater the difference in posteriors between the informed and uninformed.

When there are many different dimensions of information that are relevant for determining optimal actions as there are here a stock price will transfer very little of it. The stock price may be a relatively accurate signal of $V(\alpha_i^*, \eta_T)$ where α_i^* is the current set of actions proposed by management. However, given the large dimension of η_h that is postulated here and the lack of knowledge about the structure of the economy, the stock price may reveal a very limited amount about η_T itself. For example, the stock price of General Motors may be a reasonable estimate of the value of General Motors given current management policies. At the same time the stock price may reveal relatively little about others' views of optimal strategies for General Motors.

If there are many small investors it will typically not be worthwhile for each individual investor to undertake the necessary research. However, even in this case the existence of an information market as considered in Admati and Pfleiderer (1986; 1990) and Allen (1990) may mean that a number of groups will go through the process of estimating η_h. In the U.S. many

financial analysts are employed and the information they create is sold to investors in a number of ways. Hence there is a wide range of circumstances where the stock price comes to reflect $V(\alpha_i^*, \eta_T)$.[3]

In summary, it has been argued that:

- the stock price tends to reflect the true value of the firm given current management policies $V(\alpha_i^*, \eta_T)$;
- the stock price does not provide much information about the optimal policies a firm should pursue α_T^*.

The first result means that the stock price can help allocate resources efficiently. The second result underlines the importance of other means of transferring the information about policies for running the firm. We consider these in turn.

Stock Prices and Resource Allocation

Stock prices affect resource allocation in a number of ways. A firm initially raises money in the stock market through an initial public offering. With IPO's the offering will fail if the market ascribes a value to the firm which is less than the start up cost. Hence in this case there is a direct allocational effect of checking by investors.

There has been a large literature in recent years on IPO's. Ibbotson (1976) and others have documented the fact that IPO's are underpriced: their stock price on average rises about 15 percent during the first day of trading.[4] For some time this was regarded as a puzzle. However, Rock (1986) presented a model where underpricing comes about because some investors collect information and value the firm. This means that uninformed investors face an

adverse selection problem. The informed investors will identify which stocks are worth more than the issue price and will order a large amount. As a result the uninformed will be rationed when buying the stock is profitable. In contrast, when a stock has an issue price above its value the informed will not demand any and the uninformed will receive their full allocation. It follows from this that in order for the uninformed to be willing to participate there must be underpricing on average.

An alternative explanation of the IPO underpricing phenomenon is based on the assumption that the owners of firms are better informed about its value than investors in the market. Allen and Faulhaber (1989), Grinblatt and Hwang (1989) and Welch (1989) have suggested that in this case underpricing can act as a signal. Good firms signal they are good by underpricing their IPO's and this subsequently enables them to raise capital on better terms than they would if they did not signal.

The important distinction between these two types of model is whether it is the firm itself that has the best information about its value or whether it is the market that has the best information. Michaely and Shaw (1992) consider data from firms with IPO's in the period 1984-1988 to test between these two hypotheses. Their results do not support the signaling hypothesis but instead suggest that the market has superior information about the value of the firm. Jegadeesh, Weinstein and Welch (1991) also investigate this issue using IPO's between 1980-1986; their results also suggest that the market has better information about the value of the firm.

At first sight it appears unlikely that the market could have better information than the managers of a firm undergoing an IPO. However, the important point here is that even though

the firm may be better informed about its prospects than any single investor, in the aggregate the market may be better informed than the firm. Initial public offerings thus provide an example where checking by investors ensures that resources are allocated to viable firms. If the firms' managers have information that is sufficiently different from the truth, the stock market mechanism ensures that they will not be allocated resources. What is important here is that there is multiple checking by investors. In aggregate their information ensures an efficient allocation of resources. When there is a large degree of underpricing, investors will have a strong incentive to become informed. Hence, the information that is collected initially will tend to be relatively good.

Once a firm has gone public its equity trades on the stock market. As long as it is publicly quoted, investors have an incentive to value it. This involves continually evaluating η_i and deducing $V(\alpha_i^*, \eta_i)$. The stock price again reflects the average valuation of investors. In this case, however, the allocational effect is not the same as in initial public offerings. As Mayer's (1988) findings indicate, even companies in the U.S. resort to the capital market to raise money relatively infrequently and instead prefer to rely on internal finance.

There are a number of points here. The first is that as long as a firm is making reasonable earnings it will not have to rely on raising funds in the market. In terms of the analysis of this paper, provided managers' information is sufficiently close to the truth, η_T, they will be able to generate earnings and need not be extensively checked by the market. Should it be the case that η_i is very different from η_T then the firm will not be successful; its earnings will not be sufficient to finance its needs and it will have to resort to the outside markets. In this case its stock market valuation is important in the same way as in an IPO; only firms which

investors on average think has a value greater than its costs will receive funds. Again the checking function of the stock market ensures an efficient allocation of resources.

An important determinant of the effectiveness of the stock market as a check on firms' activities is the financial policies they pursue. Firms that use a significant amount of debt and pay out a large portion of their earnings will have to continually raise finance and the average valuation of investors reflected in the stock price will be an important determinant of the level of resources allocated to the firm. This is clearly related to Jensen's (1986) free cash flow theory. However, here resources are wasted because managers have bad information whereas in Jensen's theory managers pursue their own ends.

Why is it that investors do not always insist on keeping firms on a short rein so that the firms continually have to return to the market? So far no distinction has been made about the ease with which the managers and investors can acquire values of η_i. In many cases once a firm is in operation the manager may be able to acquire information which is more accurate than outside investors and it may be optimal to give the manager a relatively long rein. Thus for firms such as IBM and Kodak where research and development are important components of the firm's long term viability and investors have very limited access to the results of the firm's R&D program, this is likely to be the case. Investors may be prepared to give the managers a lot of freedom which corresponds to firms adopting fairly conservative debt and dividend policies. For other firms where the technology is relatively well known, such as utilities, it may be optimal to restrict the actions of managers and force them to return to the capital market relatively frequently. In this case high debt and payout ratios are optimal. This type of theory of

corporate financial policies may provide some insights into why taxes appear to have such little influence on corporate financial policies.

It has been argued that the stock market helps allocate resources efficiently because it provides incentives for investors to gather information and check what the managers of firms do is sensible. The process of going through this exercise multiple times ensures that stock prices reflect values accurately. The effect on the allocation of resources in the case of IPO's is immediate. For stocks that are traded in the secondary market the effect may be important even though the firms raise funds in the markets relatively infrequently. In this view the primary purpose of corporate financial policy is to determine the extent to which firms can rely exclusively on their perception of η_i. There remains the issue of how information is directly transferred; this is considered next.

The Direct Transfer of Information and The Market for Corporate Control

It was argued above that in competitive industries a consensus on η_T is reached over time through a transfer of information by various mechanisms. In noncompetitive industries subject to technological change, the stock market ensures that only managers who have information that is sufficiently close to the consensus of the market will be allocated resources. Given the complexity of the information set η_T, the stock price allows relatively little of it to be deduced. Clearly, an important part of allocating resources efficiently in this type of situation will be to ensure some type of information transfer takes place. No doubt a certain amount of transfer will occur directly. Analysts will discuss what they think of various actions a firm could take and

the likely effectiveness of these. Some of these views will reach management and may affect their view of η_i.

Firms may also be willing to voluntarily engage in direct exchanges of information. Examples of this type of direct exchange are trade associations, cartels and research joint ventures. The literature on exchange of information through trade associations includes Novshek and Sonnenschein (1982), Clarke (1983), Vives (1984) and Gal-Or (1985). In the model of Novshek and Sonnenschein (1982) firms which have access to the same amount of private information are indifferent between revealing their information and not revealing it. In the papers of Clarke (1983) and Gal-Or (1985) sharing information is not optimal in equilibrium. However, Vives (1984) showed that if goods are substitutes and there is Bertrand competition or goods are complements and there is Cournot competition, sharing information is optimal.

There is also a literature on the formation of cartels and the exchange of information which includes Roberts (1985), Cramton and Palfrey (1990) and Kihlstrom and Vives (1989). Roberts (1985) considered a duopoly where costs could be high or low but were not publicly observable. He showed that if firms are sufficiently similar then information about costs will not be shared and collusion cannot be achieved unless there are sidepayments. Cramton and Palfrey (1990) generalize Roberts' analysis by considering a model with a continuum of firms and a finite number of types. They show that as the number of firms becomes large then even if there are sidepayments the exchange of information and the formation of a cartel will not occur. Kihlstrom and Vives (1989) consider a similar model to Cramton and Palfrey but with a continuum of firms and a finite number of types. In this case the adverse selection problem is less severe, information is exchanged and the monopoly outcome is enforceable.

Research joint ventures are another important way information is exchanged. Katz (1986) showed that firms have an incentive to share the costs and knowledge created by research projects. Bhattacharya, Glazer and Sappington (1990) analyze the optimal level of knowledge sharing and show how this can be implemented.

In addition to these methods for direct voluntary exchange of information there is another important mechanism for the direct transfer of information, namely the market for corporate control. Manne (1965) has argued that an important element of market economies is the ability of different management teams to compete for the control of assets. There are essentially three mechanisms for transferring control:

- proxy fights;
- direct purchase of shares;
- mergers.

These three mechanisms can be interpreted in terms of the framework suggested above. Suppose there is a raider R whose information set η_R is such that the optimal set of actions α_R^* is different from that pursued by the current management α_i^* and

$$V(\alpha_R^*, \eta_R) > MV \tag{4}$$

where MV is the market value of the firm. How can the raider take advantage of this apparent opportunity?

One possibility is a proxy fight. In this case in order to persuade the shareholders to vote with the raider so that the optimal policies α_R^* can be implemented it is necessary to transfer η_R to them and convince them it is better than their own information set. Unless the current management of the firm is adopting policies that are clearly suboptimal this will be difficult.

As argued above transferring an information set can be exceedingly complex. Even if there is agreement about the data gathered, differences in education may mean interpretations of the data differ which will make it necessary to share information about educational processes to obtain consensus. If there are a large number of shareholders it is likely that it will be impractical in most cases to successfully engage in a proxy fight. This is consistent with the evidence that proxy fights are in fact relatively rare.

A second possibility is a tender offer. Here there is no need to persuade the shareholders directly; a large enough offer will induce them to sell. In determining the amount that must be paid, it is the information set of the median holder η_M conditional on the offer that is important. The size of the offer the raider R will need to make will depend on

$$\text{Max } \{V(\alpha_i^*, \eta_M), V(\alpha_R^*, \eta_M)\}. \tag{5}$$

Shareholders will update their beliefs in response to the raider's offer. However, as before, given significant differences in information arising from differences in education and background, they may not update very much on the basis of this single piece of information. In this case the holdout problem identified by Grossman and Hart (1980) does not necessarily arise. Suppose $V(\alpha_i^*, \eta_M) > V(\alpha_R^*, \eta_M)$ so the median shareholder thinks the value of the firm will go down when the raider gets control. He or she will only require their reservation value $V(\alpha_i^*, \eta_M)$ in order to be willing to sell. There will only be a holdout problem if $V(\alpha_R^*, \eta_M) \geq V(\alpha_i^*, \eta_M)$ so the median holder has similar views to the raider. In this case the raider will need to pay the full price unless there are possibilities for dilution as in Grossman and Hart (1980). Takeovers will therefore be most profitable from the perspective of the raider if the

raider's views are different from those of the shareholders. It is therefore desirable that there be as little transfer of information as possible before the takeover occurs.

The third type of mechanism for transferring control is a merger. If the merger occurs after a tender offer then it is the tender offer that is the mechanism for transferring control. Hence the case of interest is where the merger is agreed to by both firms and there is no tender offer. In the framework here, one of the advantages of mergers can be the sharing of information about the effects of management actions. When η is very complex a merger may be the most effective way of sharing information and obtaining a superior information set on average.

Discussion

This section has suggested that one of the main roles of the stock market is to provide a way of checking that firms are well run when there are divergences of opinion on how firms should be run. In the case where a firm is publicly quoted there is a built in incentive for investors to assess what the management is doing. Thus firms where the managers obtain a "bad draw" are likely to be identified. The stock price comes to reflect the views of a wide range of different investors and hence is likely to be representative of the true value of the firm.

Even when the firm is not continually raising capital in the market but is financing its investments through retained earnings a stock market quotation is still important. It ensures continuous checking. Firms where the managers get a long way out of line with the consensus in the market will eventually be forced to relinquish control either because they cannot raise the necessary capital or because of a takeover attempt.

One important implication of the analysis above is that stock market quotation may be preferred to individual or family ownership. Although the incentive effects of private ownership are preferable to stock market ownership, the checking function associated with listing may allow a better allocation of resources overall.

4. Banks versus Stock Markets

In Diamond's (1984) theory of banks as delegated monitors, information about the management of the firm needs to be collected to ensure that they do not take suboptimal actions. If the equity of the firm is owned by many shareholders, none of them has the correct incentives to monitor the firm. They could combine to hire somebody to do this but that person would effectively be another manager. The essential problem is who it is that monitors the monitor. Diamond points out that if a bank undertakes to monitor a number of firms it can diversify the unique risk associated with each. By promising a certain return to its depositors, it can guarantee that it is undertaking the cost of monitoring the firms; if it did not, it would be unable to pay the promised return. This theory relies on the assumption that there is a consensus on the way the firm should be run and the probability distribution of returns on loans. If there was disagreement on the expected return on loans, depositors would not be able to properly evaluate whether the bank had done the required monitoring.

When there is no consensus on the way in which firms should be run as in the previous section, banks may not be as effective in allocating financial resources as stock markets. When banks evaluate loans to companies, they will produce an estimate of η in order to value the firm. They thus provide a check on the manager's estimate. The problem is that there is only one

check. In situations where there are diverse views on η this does not permit much of a consensus to be reached.

Implicit in this argument is the notion that the bank cannot simply hire more people and produce an information set which is equivalent to the stock market. In order to individually negotiate a loan with a borrower it would be necessary to aggregate the information. Ultimately there would be a loan officer in charge of the negotaition and his or her biases will affect the weights given and determine η_i. The subjective nature and complexity of the information that forms the basis of the negotiation cannot be aggregated simply. Of course, the bank could exactly replicate a stock market but if there are any fixed costs setting up an actual market would dominate this strategy.

One of the criticisms of Diamond's theory that has been made by Hellwig (1990) is that it predicts firms will only transact with one bank but in practice this is not usually the case. If there are differences in information sets, an increase in the number of banks the firm deals with may be advantageous for all. However, the problems associated with coordinating negotiations that are likely to occur as the number of banks increases mean that it will usually only be worth a few banks lending.

In summary, the essential difference between Diamond's theory and that suggested here is that multiple opinions are valuable. Banks do not give repeated evaluations in the same way that stock markets do and may be an inefficient way of allocating resources when there are large differences in views on production functions.

The two theories can thus be combined to explain why in some circumstances banks will be the optimal way of allocating resources and in others stock markets will be. Banks will be

a good way to provide financing in traditional industries such as agriculture where the technology is well known and there is a wide consensus on how things should be done. Here the bank can monitor firms effectively and take advantage of the scale economies in monitoring. In industries where there is little consensus on how the firms should be managed an allocation of resources through a stock market is desirable. The theory predicts stock market quotations will be observed among large corporations and in industries where there is continuous technological advance. Countries which will have a significant stock market will be those with a significant amount of technological innovation in the sense of developing entirely new industries and those with industries with a significant amount of concentration.

It was the U.K. which first underwent the Industrial Revolution in the nineteenth century with the development of the railways and other new industries which were to a large extent financed through the London Stock Exchange. Similarly, in the U.S. the New York Stock Exchange played a critical role in the development of the major twentieth century industries such as the automobile, aircraft, electronics and computer industries. Among current emerging industries such as biotechnology, stock markets are again major sources of finance.

In contrast, in nineteenth century Germany industrial development took place when the technologies were not as new and untried as in the U.K. Similarly, in the twentieth century Japan's most important achievements have mainly been in existing industries rather than in entirely new ones. In both these cases, the factors that favor stock market finance are less prevalent and those that favor bank finance are more prevalent than in the U.S. and U.K.

5. The Stock Market and Government Ownership

During the early part of the twentieth century there was an important debate among economists on whether planned socialist economies where the means of production were owned by the state could allocate resources efficiently. Lange and Lerner argued that there was no reason why such an economy could not achieve the same allocation of resources as a capitalist economy. This debate took as its starting point the traditional classical model discussed in Section 2 above where it was essentially assumed that there is a consensus on production functions. Thus, for example, Lange (1938) argues: "The administrators of a Socialist economy will have exactly the same knowledge or lack of knowledge, of the production functions as the Capitalist entrepreneurs have."

The defense of capitalism conducted by Robbins and von Hayek among others took the traditional framework of analysis as given. They argued that the practical difficulty of calculating the necessary prices would be the main problem with socialist systems. For example, Robbins (1934) argued that:

> On paper we can conceive this problem to be solved by a series of mathematical calculations. ... But in practice this solution is quite unworkable. It would necessitate the drawing up of millions of equations on the basis of millions of statistical data based on many more millions of individual computations. By the time the equations were solved, the information on which they were based would have become obsolete and they would need to be calculated anew. The suggestion that a practical solution of the problem of planning is possible on the basis of the Paretian equations simply indicates that those who put it forward have not grasped what these equations mean.

These arguments by and large followed the classical tradition of ignoring the stock market and it was assigned no special role in the debate. There was very little discussion of the basic assumptions of the static model. The question of private versus state ownership is not really

very important in this framework. Since the technology is known managers employed by the state can run firms as efficiently as managers employed by stockholders. Although most countries did not go as far as the Soviet block in terms of central planning, state ownership became a central plank of many Socialist parties. After the Second World War many of these parties attained power and large sectors of industry were nationalized. For example, in Britain the railways and the coal and steel industries were acquired by post-war Labour governments. Many third world countries such as India were also heavily influenced by Lange and Lerner's ideas and large sectors of industry came under state control.

The theory presented in Sections 3 and 4 suggests that public ownership will be inefficient because there is only one group that tries to estimate the relationship between firms' actions and outcomes. There is no checking by replication except that undertaken by the ministries in charge of the industries and politicians. There is no automatic incentive for doing this in the way that there is in a stock market economy. If managers have inaccurate information, their misperceptions can persist almost indefinitely. State-owned industries thus provide a stark contrast to those where the firms are listed on stock exchanges.

In many countries natural monopolies are directly owned by the state. Traditional theory has very little to say in terms of the efficacy of this compared to having a company which is owned by shareholders and regulated by the government. The theory of Section 3 suggests there is an important difference. With government ownership there is again no checking but with private ownership, stock market investors will constantly evaluate what the management of the firm is doing. It is interesting to note in this regard that many of the early listings on exchanges were monopolies. For example, in Britain the first joint stock companies were trading

monopolies such as the East India Company and other monopolies such as those providing water supplies. More recently in the U.S., regulated utilities comprise a large proportion of listed stocks. Of course, it is important to stress here that the desirability of ownership of natural monopolies will depend on the effectiveness of the government regulation and the disadvantages of this may offset the advantages associated with stock market listings.

6. Concluding Remarks

Divergence of opinions about how firms should be run is an important feature of many industries. Standard theories do not incorporate this factor in a satisfactory way. This paper has argued that stock markets can play an important role in industrialized economies when there is disagreement about production functions. Stock markets work relatively well when there is little consensus on how a firm should be run since they provide checks that the manager's view of the production function is a sensible one. They therefore work best in industries which are not very competitive or where there is a long period before the results of actions become apparent or where technology is constantly changing. The theory is thus consistent with the observation that the stock market was important in the U.K. during the nineteenth century when it was the first country to go through the Industrial Revolution. It is also consistent with the fact that the U.S. has relied heavily on stock markets in the twentieth century when it was the first country to go through the Post-Industrial Revolution. In contrast, it has been argued that banks are desirable institutions for allocating resources in situations where there is a consensus on the technology and the main problem is monitoring firms.

These conclusions have a number of implications for the development of financial institutions in Europe. For the advanced economies of Western Europe the implication is that active stock markets are important if developing new industries where there is no consensus on technology is desired. However, banks are clearly also very important and will remain so in the foreseeable future. The countries of Eastern Europe, on the other hand, face a different problem. They will be building basic industries where the technology is well known for some time to come. This indicates that they should concentrate on developing bank-based financial systems. Stock markets should be given relatively little emphasis for a number of years.

In most countries stock markets and banks are only one way in which funds for industry are raised. Self-financed owner-managed firms and informal networks are also crucial. It is important that in Western Europe these methods of finance be maintained and that in Eastern Europe these channels be actively encouraged and developed.

This paper has focused on the provision of funds for industry. Another important role of stock markets is the provision of funds for governments. To the extent this role is important, stock markets oriented to public finance should be developed.

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Notes

1. See Michie (1987) p. 110.

2. See Soule (1935) pp. 5-6.

3. In Allen (1990), analysts are provided with the correct incentives to truthfully reveal their information. This may not always be possible in practice. In such cases analysts may be compared to their peers. As a result they may tend to "herd" together and there will be an insufficient diversity of views relative to the truth. It is an empirical issue as to which is the correct description of information gathering in stock markets.

4. See Smith (1986) for a summary of the empirical evidence on underpricing.

Category	1853 %	1863 %	1873 %	1883 %	1893 %	1903 %	1913 %
Government							
Domestic	92.5	84.0	63.8	48.4	46.6	43.8	38.8
Foreign	7.5	16.0	36.2	51.6	53.4	56.2	61.2
Total	76.0	67.0	59.3	52.0	39.5	36.0	34.8
Railways							
Domestic	86.1	55.4	51.4	44.6	35.3	35.8	29.4
Foreign	13.9	44.6	48.6	55.4	64.7	64.2	70.6
Total	18.5	27.7	32.1	40.6	49.4	44.2	43.4
Urban Services							
Total	2.0	1.7	1.4	2.8	2.9	2.9	4.6
Financial Services							
Total	1.1	1.6	5.4	2.8	4.1	6.3	6.4
Commercial and industrial							
Total	1.8	1.7	1.4	1.2	3.5	9.9	9.6
Mining							
Domestic	—	19.6	16.9	2.9	0.9	—	—
Foreign	—	80.4	83.1	97.1	99.1	100.0	100.0
Total	0.6	0.3	0.3	0.6	0.7	0.6	1.0
Agriculture							
Total (All foreign)	—	—	0.1	—	—	0.1	0.3
Total (millions)	£1,215.2	£1,601.4	£2,269.1	£3,634.3	£4,899.2	£6,978.3	£9,550.3
Domestic	97.1	76.7	62.6	50.1	46.3	50.7	46.8
Foreign	8.5	23.3	37.4	49.9	53.7	49.3	53.2

Table 1

London Stock Exchange: Securities Quoted (Paid-Up Capital) (in Per Cent of Overall and Individual Totals), 1853–1913

(Source: Michie (1987), Table 2.4, p. 54)

Group	No. Issuers	Market Value
Aircraft	24	$ 733,622
Amusement	22	990,202
Automotive	69	5,597,060
Building Trade	29	1,150,761
Chemical	78	10,661,300
Electrical Equipment	20	2,105,845
Farm Machinery	8	956,488
Financial	32	1,667,982
Food Products & Beverages	70	4,646,688
Leather & Its Products	12	339,010
Machinery & Metals	103	2,612,936
Mining	40	1,958,759
Office Equipment	10	883,151
Paper & Publishing	35	1,198,242
Petroleum & Natural Gas	45	10,046,827
Railroad & R.R. Equipment	86	4,391,592
Real Estate	11	240,588
Retail Trade	73	4,729,705
Rubber	10	621,731
Shipbuilding & Operating	11	167,453
Steel & Iron	41	3,086,983
Textile	44	1,302,786
Tobacco	15	1,710,630
Utilities	94	11,696,454
Miscellaneous	17	623,017
U.S. Cos. Oper. Abd.	25	980,200

Table 2

All Stocks Listed on N.Y.S.E. as of the Close of Business December 31, 1949

Market Values are given in Thousands

(Source: Neill (1950), p. 323)

Country	Firms Covered by Financial Analysts
France	303
Germany	210
Japan	1,152
U.K.	1,183
U.S.	>4,600

Table 3

Number of Firms Covered by Financial Analysts by Country

(Source: Nelson's Directory of Investment Research 1992)

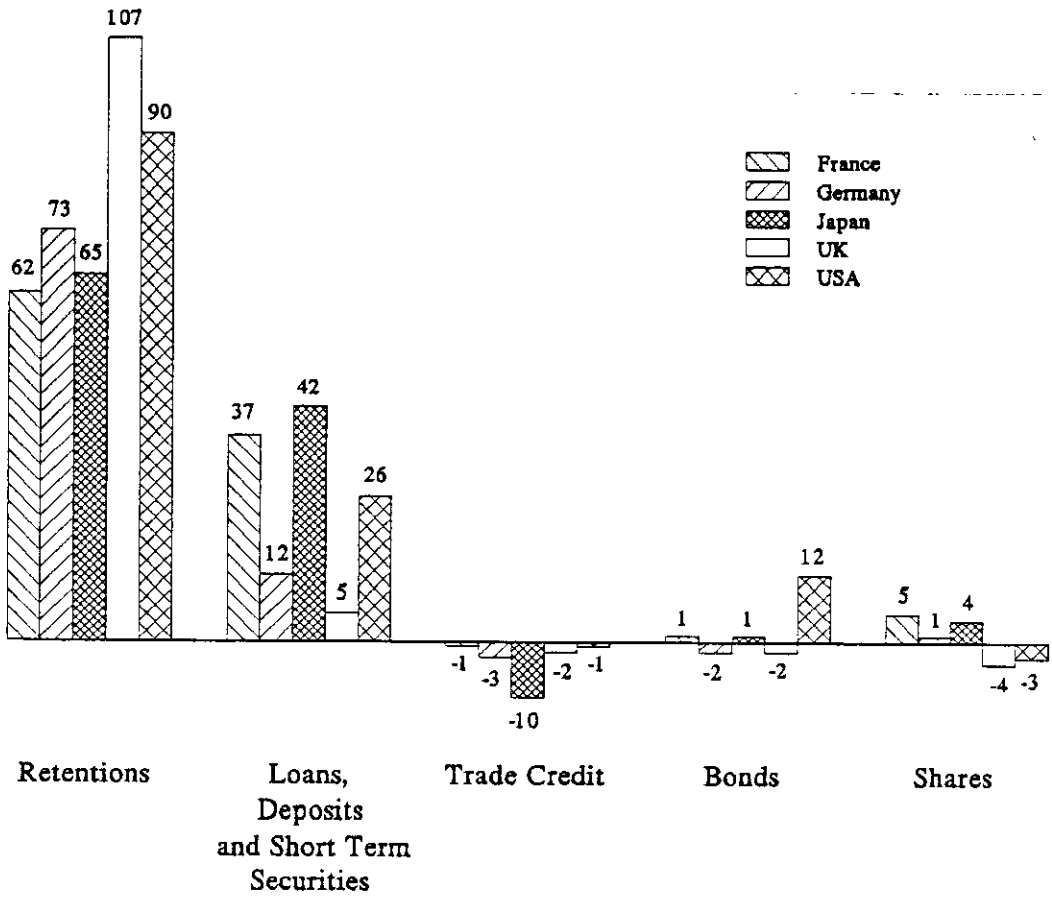

Figure 1

Net financing of private physical investment by enterprises in France, Germany, Japan, the U.K. and the U.S.A.

(Source: Mayer (1988), Figure 2, p. 1174)

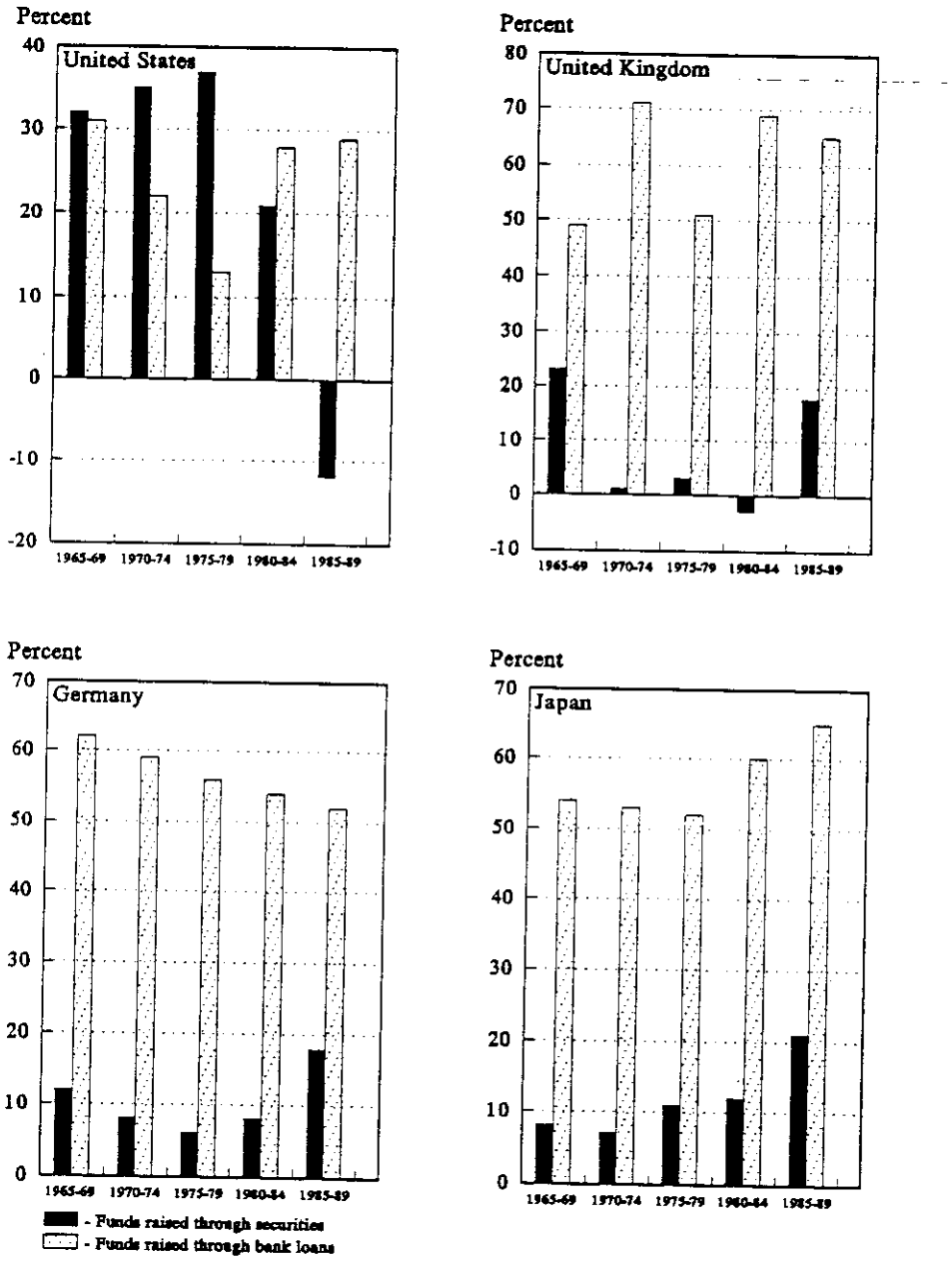

Figure 2

Percent of total business funds raised through securities and bank loans 1965-89

(Source: Frankel and Montgomery (1991), Figure 6, p. 267)

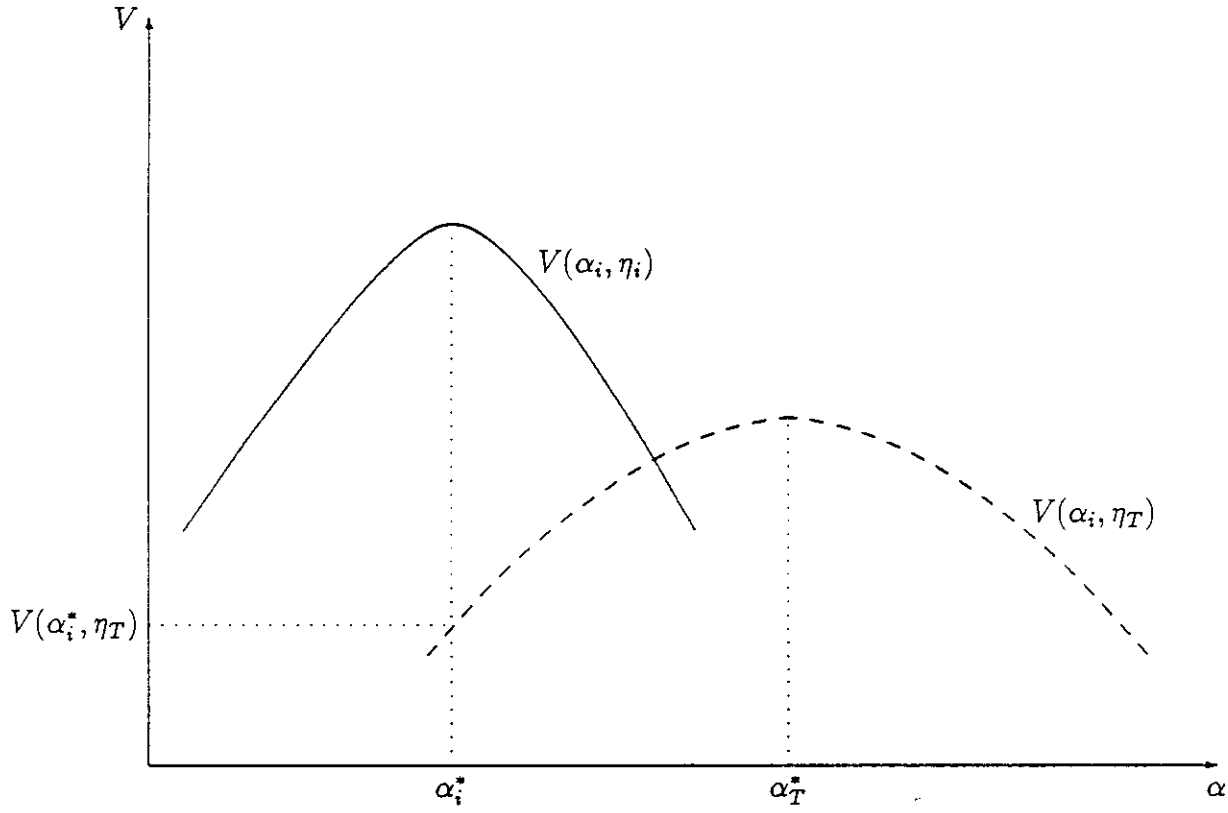

Figure 3

The relationship between value and actions