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Essays on Investment and Financing Decisions

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To the Graduate Council:

I am submitting herewith a dissertation written by George P. Tsetsekos entitled "Essays on Investment and Financing Decisions." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Business Administration.

George C. Philippatos, Major Professor

We have read this dissertation and recommend its acceptance:

Do-Young Choi, David Kidwell, Ronald Shrieves, Errol Glustoff

Accepted for the Council:

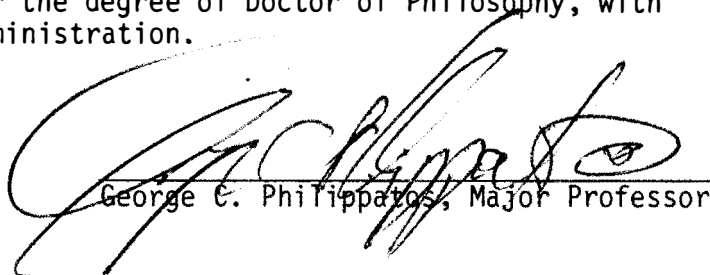
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Vice Provost and Dean of the Graduate School

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and recommend its acceptance:

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ESSAYS ON INVESTMENT AND FINANCING DECISIONS

A Dissertation

Presented for the

Doctor of Philosophy

Degree

The University of Tennessee, Knoxville

George P. Tsetsekos

June 1986

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This dissertation is the outcome of an unexpected educational excursion that I took after graduation from the NTUA. The excursion began in January 1980 with the unconditional help and encouragement of Dr. Peter Athanasopoulos; it continued with the intellectual cooperation offered by Professor Nicolas Gressis; and it ended in Knoxville, Tennessee, in 1984, with an enriching and professionally rewarding experience provided by Dr. George Philippatos. I have only good memories from this journey. Dr. Philippatos, to whom I acknowledge my indebtedness, made the end an unforgettable experience.

ABSTRACT

This dissertation contains three essays in the area of Business Finance which are related to the literature of asymmetric information and agency. Our purpose is to demonstrate that the presence of asymmetric information creates possible costly effects that adversely influence the performance and profitability of the firm.

The first essay deals with the value of slack (excess liquidity) and the investment decision under asymmetric information. It is shown that when managers and shareholders hold different information sets with respect to the quality of an investment opportunity, an optimum amount of slack can partially resolve an underinvestment problem. The employed framework emphasizes the existence of a penalty function which is assigned by capital market participants due to the uncertainty associated with the announcement of external financing.

In the second essay, we address issues of risk sharing between an agent and a principal. We examine the principal-agent relationship under the plausible condition of a multidivisional managerial effort. It is suggested that under realistic assumptions, information about the divisional performance produces sharing rules which are different from those derived under the condition of aggregated information.

The third essay deals with issues of agency costs and financial decisions at the divisional level of a multidivisional firm. It

is argued that the internal organizational structure places some constraints on the nature of the financial decisions made by the division manager. The internal regulatory environment forces the divisional manager to be risk averse and to avoid the adoption of risky projects. The costs associated with this managerial behavior, called managerial regulatory costs, represent a different dimension of agency costs.

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INTRODUCTION

Recent developments in Corporate Finance have examined the potential conflicts of interest between shareholders and managers that result from the separation of ownership and control. The agency theory has provided a functional framework within which issues of investment and financing decisions can be analyzed in a practical manner consistent with economic theory. Indeed, the agency theory has provided a strong economic rationale that explains corporate finance structures and other proportions associated with the complexities of modern financial arrangements.

Agency problems are related to informational asymmetry among the actors in the organization. An argument for the significance of asymmetric information in a firm is its pervasiveness in market transactions. Asymmetric information exists when two or more agents involved in a contract have different information sets. By information set we mean the spectrum of information that is relevant to the agents' decision making which includes elements such as endowments, preferences and beliefs. It is reasonable to assume that asymmetric information is present in almost any financial transaction. Most corporate activities are characterized by contractual arrangements involving contingent payoffs. Arguments of agency conflicts and informational asymmetry can successfully be employed in explaining corporate finance behavior.

This work contains three essays in the area of Business Finance which are related to the literature of asymmetric information

and agency. Our purpose is to demonstrate that the presence of asymmetric information creates possible costly effects that adversely influence the performance and profitability of the firm. It is our objective to describe the nature of the asymmetry of information, as well as the magnitude of the resulting inefficiency.

The first essay deals with the value of slack (excess liquidity) and the investment decision under asymmetric information. It is shown that when managers and shareholders hold different information sets with respect to the quality of an investment opportunity, an optimum amount of slack can partially resolve an underinvestment problem. The employed framework emphasizes the existence of a penalty function which is assigned by capital market participants due to the uncertainty associated with the announcement of external financing.

In the second essay, we address issues of risk sharing between an agent and a principal. We examine the principal-agent relationship under the plausible condition of a multidivisional managerial effort. It is suggested that under realistic assumptions, information about the divisional performance produces sharing rules which are different from those derived under the condition of aggregated information. Further, it is suggested that information about divisional effort is considered a valuable signal from the principal's point of view.

The third essay deals with issues of agency costs and financial decisions at the divisional level of a multidivisional firm. It

is argued that the internal organizational structure places some constraints on the nature of the financial decisions made by the division manager. The internal regulatory environment forces the divisional manager to be risk averse and to avoid the adoption of risky projects. The costs associated with this managerial behavior, called managerial regulatory costs, represent a different dimension of agency costs. While agency costs represent losses which result from the self-interest behavior of managers when they pursue personal goals at the expense of shareholders goals, managerial regulatory costs are the result of the behavior of divisional managers who respond to internal organizational forces.

Although all essays are examining related issues of agency and asymmetric information, the last two essays have a strong thematic continuity in that they examine the principal-agency relation from two different perspectives: the contracting-agency framework, and the risk-sharing agency framework.

PART I

THE VALUE OF SLACK AND THE INVESTMENT DECISION
UNDER ASYMMETRIC INFORMATION

I. INTRODUCTION

The textbook treatment of liquidity assumes that liquid balances are the direct result of the firm's operating cycle. With the exception of a few studies, excess liquidity (slack) is treated as an undesirable-costly account, presumably because the firm can invest excess liquid balances in profitable fixed assets. Slack resources are examined in a framework which emphasizes the perfect synchronization of funds resulting from current assets and current liabilities. However, such an approach is considered myopic because it isolates the valuation of liquid assets from the valuation of fixed assets. Indeed, this separation is unfortunate because it tends to focus attention on the analysis of only one part of the firm's real assets.

This essay deals with the role of excess liquid resources in the investment decision. Our intention is to analyze the use of slack for reasons other than those associated with the firm's operating cycle. We examine the value of slack in the context of asymmetric information between managers and shareholders. Problems of asymmetric information regarding new investments force shareholders to discount on an ex-ante basis the actual value of new profitable opportunities. To avoid undervaluation effects, managers can hold slack resources before the investment opportunity

appears on the horizon. Certainly, this approach has its own merits when there are not costs of holding slack. However, maintaining slack resources is an expensive proposition. Since there are costs and benefits of holding slack, our focus in this essay is on identifying the optimum amount of slack that the firm should allocate for future investment purposes.

Our framework emphasizes two elements: first, the nature of the asymmetry of information that appears to be the principal force for the accumulation of slack resources; and second, the impact of announcement effects of external financing on the firm's market value. The proposed model combines arguments of asymmetric information with tradeoff effects of external financing.

The remainder of this essay is divided into four sections. Section II introduces the concept of slack, defines slack as a special liquid asset, and highlights its possible uses. Also, in this section we review the literature that deals with the issues addressed in our model. In section III we introduce and discuss the assumptions of our model. The presentation of the model is followed by an in-depth analysis which clearly shows the benefits of holding slack. In section IV, we present the cost considerations of our model, and we derive the optimum amount of slack. Finally, in section V we offer some possible extensions of our work and recommendations for future research.

II. THE CONCEPT OF SLACK

A. A Definition

We define slack as the excess of liquid resources allocated over the minimum necessary level to accomplish the task of working capital management assigned to any organization. In this context, the unavailability of slack may be defined as an underallocation of liquid assets and can be seen as a form of capital rationing. Slack has the meaning of an asset of reserve liquidity that managers retain for a later occasion; it is unused but available if needed for any special purpose; it is a secure possession of a reservoir of liquid funds. Slack can either be considered as an idle resource or as an asset which is gainfully employed in the short term.

For expositional purposes we present a new view of the balance sheet. Under the conventional approach, the asset side of the balance sheet consists of fixed assets and working capital assets or current assets. The liability side consists of working capital liabilities and shareholder's equity. Working capital assets and liabilities represent the firm's financial needs which result from the firm's operating cycle. Unfortunately, these financial needs include elements which are influenced by both strategic and operating decisions. The conventional approach does not offer any distinction between financial needs resulting from operations, and financial needs arising from long term investment (liquidation) decisions. The following new way of viewing the

balance sheet addresses these needs. Under the new approach, the asset side of the balance sheet consists of three elements: (a) fixed assets (assets in place), (b) working capital requirements, which are directly related to the firm's operating cycle (production-distribution), and (c) slack, which consists of liquid resources not tied to the firm's operating cycle designated for future discretionary investments. The right hand-side of the balance sheet consists of shareholder's equity, long-term debt and required working capital liabilities. Figure 1 offers a graphical illustration of the conventional and new structure of the balance sheet. It is suggested that working capital requirements support assets in place and assist, using a synchronization process, in the smooth operation of the main line of business. On the other hand, it will be argued that slack is a financial asset whose existence is associated with the firm's future discretionary investment behavior.

Working capital accounts in surplus position and unused debt capacity are the two most widely used forms of slack.

B. Rationale for Holding Slack

Keynes (1936) suggested three motives for holding liquid balances. The transaction motive reflects the need for cash to meet payments for the factors of production, i.e., payments arising in the ordinary course of business or because of the nature of the firm's operating cycle. The precautionary motive refers to the maintenance of a cushion or buffer liquid balance which can be used in order to meet unexpected contingencies. Finally, the

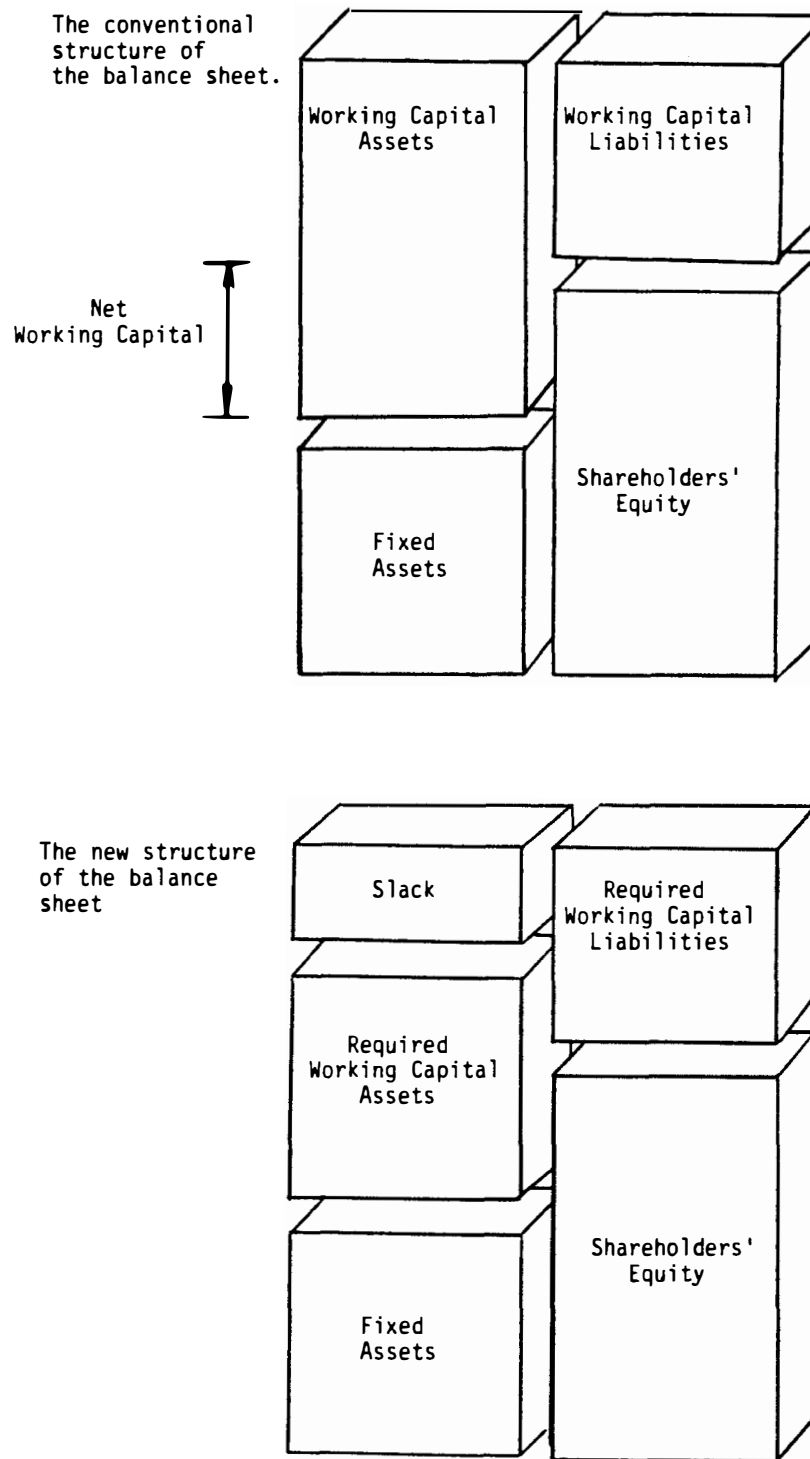


Figure 1. The Balance Sheet Redefined

speculative motive incorporates the notion of holding cash in order to take advantage of expected opportunities in the capital market. The objective here is to secure profits by being more knowledgeable than the market about what the future will bring.

According to our definition, firms cannot hold slack for transaction purposes. The demand of slack is not based on the desire for a good short-term synchronization of different flows of revenues and expenses. Slack cannot be conceived as an important residual which can be analyzed in the area of cash management. However, there is a wish on the part of management to maintain a satisfactory buffer level of funds which can be seen as an element of the precautionary or speculative demand for liquidity.

Managers want to maintain a buffer level of liquidity in an attempt to reduce costly asymmetric information problems that result from the issue of new securities. Although the financing of a project appears to be a straightforward process, fundamental changes in the economic environment and consequent transformations in the capital markets have complicated corporate financing arrangements. Long-term funds have often been either unavailable or perceived to be prohibitively expensive. Partially segmented capital markets and the existence of some market imperfections have made it increasingly difficult for corporations to sell long-term fixed rate debt and equity securities at prices that are fair to current shareholders.

An interesting situation arises when managers, who possess confidential information about new investments, decide to issue

risky claims to finance new projects. In this case, two conflicting objectives should be reconciled. First, managers should preserve the relative advantage which is derived from the implementation of the new projects as long as possible. This can be achieved only when important information remains confidential. Second, managers should maximize shareholders' wealth or the firm's market value. This implies that information relevant to the superiority of the new projects should be revealed to the market and, consequently, to competitors.

In an non-competitive environment, conveying information to the market place about new profitable opportunities is in the best interest of current shareholders and managers. However, in the presence of competition the revelation of confidential information becomes a complicated proposition. A possible solution to this problem suggests that managers can simply announce the existence of projects that create rents. However, this method of communication does not eliminate the possibility of moral hazard, i.e., that the information given is unreliable. Therefore, firms unable to reveal all the information to the market for reasons of competitive advantage will perceive that their claims are undervalued by investors.

We can reconcile the above statements by suggesting that slack has the potential capability of providing the firm a mechanism through which it can communicate relevant information to the market in a verifiable way. At the same time, this mechanism allows the

firm to maintain some confidentiality regarding new investments. It should be noted that the ability of slack to perform such a function depends upon several other conditions. If these conditions hold, then it can be said that the market is able to invert the managerial decision-making process and can interpret its underlying characteristics from the chosen financial package of the firm.

Therefore, managers of slack rich firms would be able to take advantage of unforeseen investment opportunities without being obligated to reveal confidential information. Alternatively, if the company does not have a reservoir of liquidity, either extra costs will occur, or the firm forgoes the realization of profits.

This implies that in some cases a firm without slack passes up valuable investment opportunities, i.e., opportunities which could make a positive net contribution to the market value of the firm. If a sudden need for funds arises, the firm will have to gather financing quickly at a supplementary cost due to the lack of preparation or a bad economic environment. Such a suboptimal investment policy is an agency cost induced by the unavailability of slack.

C. Literature Review

Research in the area of Finance treats excess liquidity solely as a component of working capital. The cost of maintaining a level of liquidity stems from the fact that the borrowing rate to finance working capital assets exceeds the lending rate. Under these

circumstances, there is a trade-off between the benefits associated with liquidity and the costs of maintaining it. Most of the work in this area has been directed towards optimizing the levels of cash and marketable securities, so that the firm does not carry any excess undesirable liquid resources. However, the optimization process is considered myopic for the following three reasons. First, the process is in complete isolation with regard to the optimization of other assets, and more importantly, from the overall valuation of the firm. Second, most of the work has treated current assets and fixed assets separately. This split is unfortunate and tends to focus attention on only one part of the balance sheet without considering the firm's overall valuation in a competitive environment. Third, various components of working capital, and in particular cash, have been divorced from the most fundamental decisions of investment and financing.

In addition to the previously mentioned reasons, modern financial theory, until recently, completely ignores liquidity. The two traditional models, CAPM and APT, by construction are not able to value liquidity. In a world of riskless borrowing and lending there is no reason for the firm to carry a stock of cash and, consequently, items of working capital are unnecessary and irrelevant to the firm's valuation. Further, the degree of liquidity is a matter of indifference to equityholders. If there are perfect capital markets investors can make diversification decisions by creating their own homemade leverage, in such a way as to satisfy

their utility for liquid funds. For a given investment strategy, liquidity is irrelevant to shareholders.

Despite the above-mentioned arguments about the irrelevance of slack, there are a few studies that have addressed the relationship of (excess) liquidity and other financial variables. Essentially, there are three groups of studies that address the following relationships:

- (a) Liquidity and debt level,
- (b) Liquidity and conflict resolution of different groups of shareholders, and
- (c) Liquidity and the problem of market value decline at the announcement of external financing.

Liquidity and Debt Level

Donaldson (1969,1971) argues that the firm will hold liquid resources in an attempt to avoid bankruptcy during times of financial crises. Managers will use less debt than anticipated because they want to maintain a cushion of unused funds that can be used on a precautionary purpose. This cushion gives the firm some financial mobility with which it can survive the crisis. Donaldson did not address the issue as to what is the appropriate level of liquid assets that a value maximizing entity should hold. Modigliani and Miller (1963) recognized the need for flexibility but assumed that it would come from unused debt capacity rather than liquid assets.

Bierman and Thomas (1972) attempted to find the optimum amount of debt that the firm should hold in order to maximize the

returns to stockholders. In an extension of this work, Bierman, Chorpas and Thomas (1973) introduced working capital as a buffer device against bankruptcy. Again, they found the optimal amount of debt for the firm to hold, such that the return to stockholders is optimized.

Liquidity and Agency Problems

Kalay (1982), addressing a different topic, in an attempt to resolve the wealth transfer problems that exist among shareholders and bondholders, looked at the direct and indirect constraints imposed on dividend payments. For a company with a limited supply of positive NPV projects, a commitment to pay dividends by maintaining some reservoir of funds is far more preferential than the case where the firm is involved in overinvesting (i.e., accepting projects with negative NPV). In this setting a reservoir of liquid funds reduces the likelihood of overinvesting and eliminates the conflicts of interest among stockholders and bondholders as they were described in the Jensen and Meckling (1976) framework. Kalay's empirical work uncovers the surprising result that firms hold positive reservoirs whose magnitudes are non-trivial for periods of more than ten years. Indirectly we have evidence for the significance of slack, although the explanation here is based on the control of conflicts among stockholders and bondholders. Nevertheless, the existence of these reservoirs is justified on a cost basis; it is more expensive for managers to overinvest and pay no dividend, than to keep slack with the intention of paying some future dividends.

Slack and Announcements of External Financing

In this section we present some papers which are related to our research effort. In the process of describing the major contributions of these papers, we also criticize some of the assumptions of the models presented.

Huberman (1984) developed a theory, namely the liquidity theory, that explains the observed negative correlation between the market value of the firm and its external financing activity. His theory is similar to the Keynesian theory of money demand for speculative purposes. Liquidity is defined as the cash availability which is derived from the need to have funds before the investment opportunity arises. There are two major sources of liquidity, (a) current cash flows, that is, retained earnings, and (b) external debt financing. The cost of holding liquidity is explained on the basis of either tax liabilities or agency considerations. To measure this cost, it was assumed that liquid funds are riskless assets that have returns lower than the risk-free rate. Huberman developed a dynamic programming problem which considers the continuous interaction among the firm's investment opportunities, its liquid position, and its cash flows (earnings). It was proven that the investments on liquid assets were related to the anticipated cash flows. It should be noted that the model is based on the assumptions that investment opportunities are certain and that only future earnings are uncertain, although some of this uncertainty is resolved ex-ante.

Huberman's model has an intuitive appeal, since his results confirm the negative correlation between the firm's value and external financing.

Huberman claims that his theory is based on arguments of liquidity. However, it is very difficult to see that his analysis is structured exclusively around liquidity arguments. For example, the cost of cash availability can be justified on assumptions of asymmetric information which leads to the agency problem and, therefore, to the conclusions cited by Huberman. Another limitation of the analysis is the non-stochastic nature of the investment decisions which drastically simplifies issues of liquidity management. In addition, the conjecture of the risk-free debt eliminates potential, although complex, signaling problems. Despite the above mentioned minor limitations, Huberman's analysis conveys a strong message: the firm's value, its liquidity position, and the investment decision are interrelated.

The most relevant work in the area of the importance of slack is the model of Myers and Majluf (1984). Using numerical analysis techniques, they proved that in a world of asymmetric information, managers can reject profitable investment opportunities without reducing current shareholders' wealth. This paradoxical action can be eliminated only when managers have accumulated slack resources before the investment opportunity appears. Clearly, the Myers and Majluf analysis considers the interaction of the financing and investment decision. A simultaneous announcement of investing/

financing of a project communicates unfavorable news to outsiders who view the decision to issue new shares as a dilution of their ownership of earnings. Even when debt claims are issued, the result of the decline in the firm's market value is obtained. The central cause of the problem is the asymmetry of information regarding the value of a real option that exists between managers and shareholders.

The Myers and Majluf (1984) analysis clearly shows the value of slack in an asymmetric information world. This result was obtained on the assumption that there are not costs of holding slack. Implicitly it was conjectured that the optimum level of slack is unlimited (infinite). That is, the authors adopted a rather unrealistic corner solution without bound as to the utilization of slack. However, as Huberman (1984) and others have indicated, there are costs associated with the maintenance of slack. Therefore, a complete analysis of the value of slack should incorporate both the costs and benefits derived by holding slack.

In addition, the Myers and Majluf (1984) model addresses in a restrictive way the investment opportunity. It is assumed that an investment opportunity requires a predetermined amount of capital. The investment opportunity has the "take it or leave it" feature. However, there are projects in which management can invest variable amounts of capital.

Clearly, the Myers and Majluf (1984) model was not designed with the intention to answer the above stated problems. Our purpose here is to demonstrate that even after making allowances for more

realistic assumptions, such as the cost of holding slack, the Myers and Majluf framework provides a rich environment in analyzing financial decisions under asymmetric information.

In this essay we develop a model that explicitly takes into account the costs and benefits of holding slack. In order to analyze the value of slack we used a framework which is similar to Myers and Majluf (1984). We choose to impose a cost structure for holding slack that is conceptually similar to the cost of liquidity developed by Huberman (1984). It is conjectured that slack arises in response to organizational and environmental problems and it can occur in ex-post efficient organizational forms, despite the presence of asymmetric information and moral hazard. Our model introduces a valuation mechanism that clearly recognizes the limitations of external borrowing. In the formulation of the problem we attempt to relate trade off effects of external financing with the value of growth opportunity. Finally, our analysis accepts the notion that investment in growth option is a continuous variable.

III. MODEL CONSIDERATIONS

A. Major Assumptions

- (A.1) There is one period framework with two dates 0,1.
- (A.2) The economy is populated by managers (who make investment-financing decisions), and shareholders (who own the stock of the firm).

- (A.3) There is asymmetry of information between managers and capital markets regarding the quality of the investment decision. Managers hold superior information regarding investment alternatives and other financial data. If managers identify an investment opportunity that creates an intertemporal advantage over competitors, they are confronted with two conflicting objectives: (a) To preserve the relative advantage as long as possible. This can be achieved only when important information remains confidential. (b) The management should maximize shareholders' wealth or the firm's market value. Managers should reveal to the market details about the nature of profitable opportunities. Then, market participants will respond to the new information by buying or selling firm's securities. In a competitive environment the existence of conflicting alternatives (a) and (b) makes the revelation of confidential information a complicated proposition.
- (A.4) There are two kinds of investment. Investment in assets in place (I^*) and investment in growth options ($I-I^*$). Assets in place represent current operating requirements whose maintenance requires an Investment I^* . The firm determines the level of I^* by using the NPV rule. The investment in growth options ($I-I^*$) is a continuous variable which is partially determined by the slack availability.

(A.5) The value of the assets in place is determined by the function $f(I)$. It is assumed that the function $f(I)$ has the classical properties $f'(I) > 0$ and $f''(I) \leq 0$, and it is a continuous and differentiable function. $f(I)$ is always a positive, however small. The value of the growth option is determined by the function $g(I-I^*)$ which is, without loss of generality, an increasing function with respect to the investment in the growth option, $(I-I^*)$, with a decreasing rate, that is, $g'(\cdot) > 0$ and $g''(\cdot) \leq 0$. It is further assumed that $g(\cdot)$ is a continuous and differentiable function.

(A.6) The value of the firm is given by the following function:

$$V = f(I^*) + g(I-I^*) - p(I-I^*,s) \quad (1)$$

where:

I^* is the actual level of investment in assets in place,

$I-I^*$ amount of investment in the growth opportunity,

$p(I-I^*,s)$ is a function indicating a "penalty" that outsiders assign against the firm's value as a result of the asymmetry of information. It is assumed that:

$$\frac{\partial p(I-I^*,s)}{\partial s} < 0 \quad (1.1)$$

$$\text{and } \frac{\partial p(I-I^*,s)}{\partial I} > 0 \quad (1.2)$$

The range of the $p(\cdot)$ function consists of non-negative numbers. Also the arguments of the $p(\cdot)$ function satisfy the condition

$$0 \leq x \leq I - I^* \quad (1.3)$$

Further it is assumed that $\frac{\partial^2 p(I - I^*, s)}{\partial I \partial s} \leq 0$ (1.4)

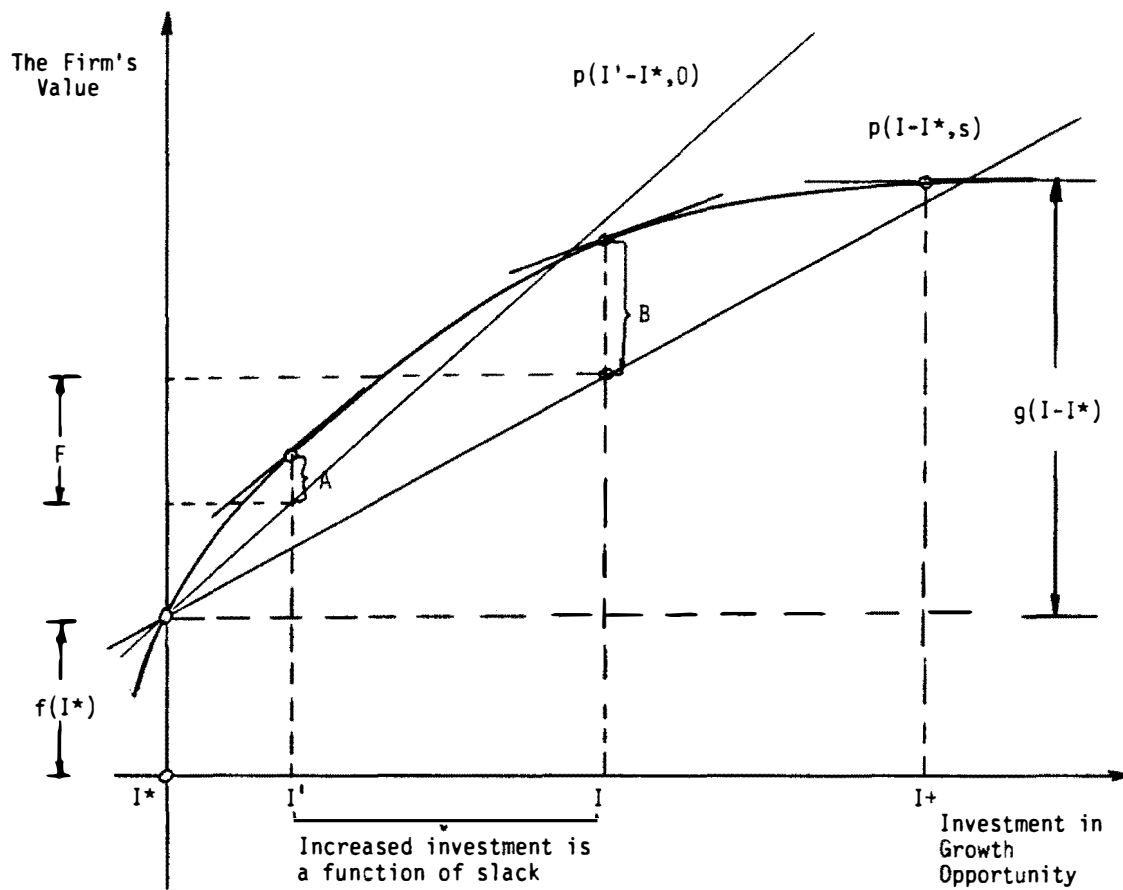
$f(\cdot)$, $g(\cdot)$ valuation functions of the assets in place and growth options, respectively.

Figure 2 represents in a diagrammatical form the relationship between investment level and the firm's value. We draw the functions $f(\cdot)$ and $g(\cdot)$ as continuous increasing functions with a decreasing rate.

- (A.7) At the beginning of the period, the firm has slack s . Carrying slack is costly. If the cost of capital is w , the opportunity cost for holding slack is $w*s$.

B. Discussion

Managers in anticipation of current needs to support the operation of the assets in place choose a level of Investment I^* . This ex-ante level of investment, which is the result of the product demand and the competitive market conditions, represents operating requirements and anticipated changes in existing real assets. If an investment opportunity appears in the horizon, managers may choose to augment this ex-ante investment level, after receiving some assessments of current cash-flows and growth opportunities, by asking for more capital. However, managers are unable to communicate



I' : Level of investment without slack
 I : Level of investment with slack
 I^+ : Optimum level of investment without penalty
 $p(I-I^*,s)$: The penalty function
 A, B : Loss in value due to penalty
 F : Market Value gains due to the availability of slack

Figure 2. Investment Level and the Value of Slack

the true quality of the investment opportunity to outsiders for a number of reasons. First, information about new investments has proprietary value. In an imperfectly competitive market an announcement of a good investment project attracts new competitors who substantially reduce the rents generated by this opportunity. A second and complimentary reason is that managers are concerned with the appropriability and protection of returns associated with the superior information they hold. An open disclosure of information about the characteristics of the project endangers the firm's ability to derive long-term risk adjusted returns.

While the managers dilemma is well recognized and understood, it does impose some problems on the suppliers of capital. Since outsiders possess imperfect knowledge about the new project, they are not able to assess with certainty their modified opportunity set. As Hirshleifer (1973) pointed out, individuals being in this position are subject to technological uncertainty in the sense that they are unsure about their resource endowments and productive opportunities. Moreover, outsiders reason that managers maximizing current shareholders wealth will be reluctant to take any action which transfers wealth to an outside constituency. Need for external financing is perceived as an action that exploits new shareholders' wealth in favor of current shareholders (Myers and Majluf (1984)).

In summary, the following plausible conditions force capital market participants to assign a penalty function to the firm's value: (a) managerial inability to communicate news to outsiders

in a verifiable and credible way, for reasons of confidentiality and appropriability of information, (b) imperfect assessment from outsiders of their new opportunities due to incomplete information, and (c) outsiders' reasoning, since asymmetric information prevails, that the new capital will be used as a vehicle in partially exploiting their wealth. Therefore, the penalty function is justified on the basis of any or all of the above arguments.

A different interpretation, however, is possible for the penalty function. We can argue that the penalty function represents a "premium" that capital markets assign to those firms that want to purchase the major factor of production, that is, investment (capital) in the spot market. This premium is charged to the firm as a result of the asymmetric information among the parties involved, rather than as the outcome of a costly transaction contract.

In order to substantiate our argument we consider a variation of the "lemon" problem presented by Akerlof (1970). Investors buy an issue without knowing whether the issue is a good or bad issue. Managers, as sellers of financial instruments, have more knowledge concerning the risk characteristics and generally the quality of the securities offered. All other things being equal, good and bad issues should sell at the same price, since it is impossible for a buyer to tell ex-ante the difference between a good and a bad issue. Nevertheless, investors learn ex-post about "lemon" issues. Rational investors, since they "learn by making mistakes," discount ex-ante possible suboptimal quality, when new securities are offered in the

capital markets. With our framework, there is an obvious quality uncertainty problem which arises from the asymmetry of information.

The penalty function was presented with two arguments: the investment size $(I-I^*)$ and the slack level s . It is assumed that the larger the outside capital requested for financing, the larger the aggregate penalty on the firm's value. It is also assumed that function p is itself a decreasing function in slack. This assumption is based on the observation that a higher level of slack implies that shareholders have a greater stake in the growth opportunity; that is, shareholders own a large percent of the project. Leland and Pyle (1977) imposed a similar condition on the problem of intermediation. A large slack on a project by the insider-manager communicates favorable news to outsiders who place a positive value on this growth opportunity. Similarly, in our framework shareholders perceive accumulated slack resources as a part of their participation in an investment project. To the extent that there are not conflicts of interests between shareholders and managers, the larger the slack, the smaller the penalty on the firm's value. The assumption that $\partial^2 p / \partial s \partial I$ is non-positive is, in fact, the only interesting case of alternative specifications of the penalty function. It implies that the investment level is a non-increasing function of slack and that the marginal penalty with respect to investment $(\partial p / \partial I)$ is a decreasing function in slack.

Our model is consistent with the observed regularity of stock price decline when there is an announcement of external financing.

Ibbotson (1975) was among the first who documented an underpricing regularity of new issues. Recent studies by Asquith and Mullins (1986) and Korwar (1986) offer more detailed analysis of the phenomenon. Finally, Dann (1981) and Varmaelen (1981) found that the opposite action, that is, the repurchase of the firm's common stock results in a positive market reaction. The empirical evidence presented in these studies clearly demonstrates that an announcement of external financing has a negative impact on the firm's value.

C. Analysis

With the separation of the investment from financing decisions managers accept or reject projects independently of the way of financing. However, in an environment of asymmetric information the last statement is not always true. In particular, in view of the penalty rule (1) managers weigh the benefits of a new investment ($I-I^*$) against the incremental costs that occur to the shareholders. The benefits of an investment opportunity are summarized in the $g(I-I^*)$ term, whereas the costs are reflected in the penalty form $p(I-I^*,s)$.

The costs associated with the issue of new securities, i.e., the penalty function, can be reduced by holding slack because there is an inverse relation between penalty and slack. Since more capital is invested in the growth opportunity, an additional benefit is realized and it is reflected in the increased value of the growth opportunity $g(I-I^*)$. Certainly, holding slack is an interesting

proposition, because of its benefits, that is, the reduction of foregone profitable investment opportunities due to penalties associated with issuing stock. However, holding large amounts of slack is unwarranted and unnecessary. This is true because in addition to the cost of holding slack, it is quite possible that the incremental improvements on the value of growth opportunity will not outweigh the incremental costs associated with the penalty, p , which results from the decision to issue securities. The manager being aware of this distinct possibility makes a decision regarding the amount of funds invested in the project, as well as the level of slack.

The value of slack is derived from the benefits for carrying slack. If a firm carries slack, the investment in growth opportunity increases and the penalty cost from the issue of new securities declines. Benefits associated with the holding of slack can be calculated by comparing two situations: (a) when the firm carries slack, s ; and, (b) when the firm carries zero slack, i.e., $s=0$. For each one of the above alternatives the manager can either accept the project and issue new securities, or reject the project. In essence, there are four cases that describe all the alternatives open to managers.

Case #1: The firm holds slack and issues securities by investing $(I-I^*)$ in the project (hold slack, issue and invest). Under these circumstances, the firm's value can be expressed as: $V(\text{accept}, I/s)$.

Case #2: The firm holds slack but it does not invest in the project (hold slack and do nothing). The firm's value is given by $V(\text{reject}, I=0/s)$.

Case #3: The firm holds zero slack and issues securities by investing $(I'-I^*)$ in the project (issue and invest without slack). The firm's value is $V(\text{accept}, I'/s=0)$.

Case #4: The firm holds zero slack and it does not invest in the project, i.e. do nothing. In this case, the firm's value is expressed as $V(\text{reject}, I=0/s=0)$.

From the above cases those of interest to us are cases #1 and #3. Case #2 dominates case #4. The manager taking into consideration the valuation equation (1) will compare the firm's value that results from alternative decisions: issue, invest and carry slack.

Our model has a distinct characteristic: it separates the valuation of assets in place from the valuation of growth opportunities. Investments in assets in place are considered as routine replacement-type decisions. Investment in growth opportunities are perceived as not repetitive decisions. Our model assumes that there is one profitable opportunity in which managers can invest infinite amount of capital. Also, it is implicitly assumed that if the growth opportunity is accepted, the risk characteristics of the firm do not change, that is, the investment opportunity and the existing assets belong to the same risk class.

IV. THE MAXIMUM LEVEL OF SLACK

A. The Cost Function

While there are benefits for holding slack, there are also some reasons for not holding excessive liquid balances. Carrying slack in anticipation of profitable growth opportunities is a costly proposition. Some of the costs involved are described below.

- (1) Costs associated with tax liabilities. If slack is invested in short term securities, taxes should be paid on interest earned.
- (2) Transaction costs. These costs are associated with the acquisition, as well as the maintenance of slack. Acquiring slack requires set up costs. Maintaining unused debt capacity, such as revolving credit or credit lines, entails payments of mandatory fees.
- (3) Monitoring and/or contracting costs. As a result of asymmetric information agency problems become intensive. Even if we assume perfect enforceability of the contracts, there are costs associated with this solution.

The cost of slack should be related to the cost of capital. For simplicity it is assumed that if the cost of capital is w , the cost of holding slack is expressed as:

$$c(s) = ws \quad (2)$$

B. The Benefits Derived from Holding Slack

In order to derive the benefits of holding slack we will

compare the firm's value when managers hold slack and when they do not hold slack. The difference between these two situations will provide the incremental benefits for holding slack. Later on in our analysis the costs of holding slack are considered. Using a simple optimization technique costs and benefits are weighed against each other, and the optimum level of slack is derived. Based on equation (1) we have:

The firm's value when it maintains a level of slack, s , is given by:

$$V(\text{accept}, I/s) = f(I^*) + g(I-I^*) - p(I-I^*,s) \quad (3)$$

The firm's value without slack is given by:

$$V(\text{accept}, I'/o) = f(I^*) + g(I'-I^*) - p(I'-I^*,0) \quad (4)$$

By subtracting (4) from (3) we can obtain the actual benefits associated with the maintenance of slack. More specifically, the benefits of holding slack are:

$$B = g(I-I^*) - g(I'-I^*) + p(I'-I^*,0) - p(I-I^*,s) \quad (5)$$

If the firm holds zero slack, the firm's value is maximized for a level of investment I' that satisfies the first order condition:

$$g'(I'-I^*) = \frac{\partial p(I'-I^*,0)}{\partial I} \quad (6)$$

Alternatively, when the firm carries slack, its maximum value with respect to the investment variable is given by:

$$g'(I-I^*) = \frac{\partial p(I-I^*,s)}{\partial I} \quad (7)$$

Figure 2, page 23, offers an illustration of conditions (6) and (7). It is shown that the slope of the $g(\cdot)$ function for the investment

level I is less than the slope of the same function at I' . This is because:

$$\frac{\partial^2 p(I-I^*,s)}{\partial I \partial s} \leq 0. \quad (8)$$

Relation (7) can be presented as follows:

$$H(I,s,p(I,s)) = 0 \quad (8.1)$$

It is assumed that $H(\cdot)$ has continuous partial derivatives. The function $H(\cdot)$ defines an implicit function of the form:

$$I = h(s,p(I,s)) \quad (8.2)$$

The transition from (8.1) to (8.2) takes place under the assumptions necessary for the application of the implicit-function theorem.¹

Moreover, it is assumed that the implicit function $h(\cdot)$ is continuous and has continuous partial derivatives with respect to the arguments p and s .

Substituting (8.2) into (5) we obtain a general expression for the benefits accrued to holding slack:

$$B = g(h(s,p(I,s)) - I^*) - g(I' - I^*) + p(I' - I^*, 0) - p(h(s,p(I,s)) - I^*, s) \quad (9)$$

The last equation indicates that the benefits of slack are expressed as function of the investment level, the penalty function, and the amount of slack carried.

¹The implicit-function theorem states that for the implicit function $f(x,y)=0$ there exists a neighborhood of points about (x,y) such that for any x value in the neighborhood there corresponds a unique y value in the neighborhood with the property that $f(x,y)=0$. It is assumed that $f(x,y)=0$ is a continuous function and that it has continuous first partial derivatives.

C. The Optimum Amount of Slack

The previous analysis has shown that the value of slack is derived from the net benefits of holding slack. That is, the value of slack is the difference between benefits and cost of holding slack.

We can obtain the value of slack by subtracting equation (2) from (9):

$$V(s) = g(h(s, p(I, s)) - I^*) - g(I^* - I^*) + p(I^* - I^*, 0) - p(h(s, p(I, s)) - I^*, s) - ws \quad (10)$$

The optimum amount of slack is derived from the first order conditions of (10).

$$g_I(h_s + h_p p_s) - p_I(h_s + h_p p_s) - p_s - w = 0 \quad (11)$$

or

$$(g_I - p_I)(h_s + h_p p_s) = w + p_s \quad (12)$$

(Subscripts p, s and I indicate partial differentiation of functions g, h and p with respect to p, s and I.)

The solution of (12) provides the optimum amount of slack. The condition for local maximum is determined from the second derivative of (10):

$$g_{II}(h_s + h_p p_s) - p_{II}(h_s + h_p p_s) + g_I(h_{ss} + h_p p_{II}) - p_I(h_{ss} + h_p p_{II}) - p_{II} < 0$$

or

$$(g_{II} - p_{II})(h_s + h_p p_s) + (g_I - p_I)(h_{ss} + h_p p_{II}) - p_{II} < 0$$

By following the above simple optimization procedures, we can obtain the optimum level of slack as a function of the penalty function, the cost of capital, and the implicit function h(.). Since this

latter function, $h(\cdot)$, is determined by the investment level in the growth opportunity, it follows that relationship (11) provides indirectly the association between slack and investment.

D. An Example

Without loss of generality let us assume that $I^*=0$. The investment in the growth opportunity is represented by the variable x , i.e., $I-I^*=x$. It is further assumed that:

$$g(x) = \log(x), \text{ and}$$

$$p(x,s) = (kx)/(1+s)$$

where: k is a parameter such that $0 \leq k \leq 1$.

If x' is the investment level when there are no slack resources, equation (9) yields:

$$V(s) = \log(x) - \log(x') + kx' - (kx/(1+s)) - ws \quad (13)$$

From condition (7) we can derive the implicit function $h(\cdot)$

$$\frac{\partial \log(x)}{\partial x} = \frac{\partial (kx/(1+s))}{\partial x}$$

$$x = (1+s)/k \quad (14)$$

Therefore, by substituting (14) into (9) we obtain:

$$V(s) = \log((1+s)/(k)) - \log(x') + kx' - (k/(1+s)) (1+s)/k - ws$$

or

$$V(s) = \log(1+s) - \log(k) - \log(x') + kx' - 1 - ws \quad (15)$$

The optimum amount of slack is obtained from the first derivative of the above relation.

$$1/(1+s) = w$$

$$s = (1-w)/w$$

This is also the maximum amount of slack, since the second order conditions of (15) with respect to s is negative

$$(V''(s) = - 1/(1+s)^2).$$

V. CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

Announcement effects of external financing may prevent the firm from accepting a continuum of same risk-class projects. This imperfection leads to a suboptimal investment decision. To overcome this imperfection managers are forced to hold financial resources before an announcement of the acceptance of a new project takes place. However, holding slack in an effort to avoid some negative reaction in the capital markets is a costly proposition. Among other elements, tax liabilities and contracting costs make managers cautious regarding the amount of slack that they should carry. In this setting, an optimum amount of slack represents a trade off between the costs and benefits of holding slack. Benefits of holding slack include the increased investment in the growth opportunity and the reduction of the adverse penalty due to external financing.

Although slack does not resolve the suboptimum investment problem and the previously described imperfection, it is considered as a vehicle through which the firm internalizes a market externality. In our framework a costly announcement effect of external financing is treated as a market externality. Despite its costly consequences, internalization of costly external financing offers an

improvement in the investment decision. Casson (1979) and Dunning (1981) have described the internalization process of market imperfections for a multinational firm. Firms internalize costly constraints associated with the international institutional environment. A similar argument can be presented for the case of a domestic firm.²

The study presented seems to open new questions for exploring important topics in finance theory in general, and in the area of liquidity in particular. The basic observation made in this study is that the investment decision jointly with the desire to hold slack financial resources has an information content that the market must consider in the firm's valuation. Although issues of slack signalling were addressed indirectly in this essay, it is conceivable that managers, under certain conditions, can signal to the market the firm's quality by using as a signalling device the amount of slack that they hold before the investment decision is made. This raises questions about the nature of the appropriate technology, i.e., the nature of the signal that firms should adopt so that an equilibrium condition is obtained. An effective signal should allow market participants to distinguish "good" firms from "bad" ones, that is, the signal should provide separating equilibrium conditions.

²Internalization of a costly announcement of external financing may signal the firm's intention to "appropriate rents" associated with possible information about the investment decision.

Despite the inherent difficulties of a signalling approach to our problem, there are some alternative routes that can be explored in an effort to provide some extension to the proposed framework. One interesting approach is to consider the penalty function with some additional arguments. The nature of financing (debt vs. equity) and the type of firm (owner control vs. management control firm) are two variables that can be included in the penalty function. Based on our proposed model, an empirical analysis can determine the actual size of the penalty function and the responsiveness of the firm's value to the announcements of new security issues. Still an interesting extension worth exploring is the issue of an optimum capital structure for a firm that can issue both debt and equity securities. Our model examined the simplest case of an all equity financed firm. The selection of a capital structure will come out as a sequence of studying the behavior of the penalty function under different specifications of the main arguments.

Another line of analysis is the investigation of the availability of slack in a multiperiod framework. A more precise statement of the investment options in a multiperiod setting is required.

When looking in retrospect at the basic conclusions of this essay, the notion of holding an optimum amount of slack has an intuitive appeal. Use of financial resources is not a costless proposition. Slack is used up to the point that marginal benefits equal the marginal costs.

PART I
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PART II

THE PRINCIPAL-AGENT MODEL UNDER A MULTIDIVISIONAL STRUCTURE

I. INTRODUCTION

The principal-agent literature offers helpful insights regarding the risk allocation among the actors involved in a contractual relationship. In the present essay we introduce a modified version of the standard principal-agent model that will allow us to analyze problems of information and risk-sharing in a multidivisional firm. Specifically, the paper examines the principal-agent relation in a setting that explicitly takes into consideration the internal organizational structure of the modern corporation.

The form of internal organizational structure alters the motivational assumptions of the agents engaged in a contractual relationship. The approach presented here incorporates the impact of a multidivisional form of organization on the risk-sharing rules and compensation schedules, as well as on the value of information in the principal-agent framework. It will be apparent from the discussion in the following sections that the internal managerial structure, the nature of information about divisional output, and other variables play an important role in determining the risk-sharing rules between the principal and the agent.

The extension of the standard agency model to a framework that considers the internal organizational structure provides helpful suggestions to questions related to the allocation of outcome between the principal and the agent. For example, an interesting question arises when someone considers the issue of efficiency of

the sharing rule: is it appropriate to develop a sharing rule on the basis of aggregated or divisional cash flows?

The work for this research was motivated by the observation that the traditional theory of agency deals with only one type of firm: the firm whose top coordinator expends his effort to accomplish one task. A careful review of the current literature reveals that all the relevant models have isolated the managerial function from the internal corporate structure. The top coordinator is assumed to make decisions in absence of any internal restrictions or constraints. It is also assumed that all possible conflicts that arise from the allocation of the top manager's effort are costlessly resolved. In our judgment the traditional principal-agent model can be extended to the direction of a multidivisional managerial effort that will allow us to draw some further insights on issues of risk sharing and value of information.

A. Organization of the Paper

The remainder of the essay is divided into four sections. Section II briefly reviews the recent literature in the area of agency theory. We provide a clear distinction between two related theoretical models: the risk-sharing agency model and the agency model dealing with the analysis of contracting environment. We address some limitations that appear in both models, and in a subsequent section we review the current literature dealing with the risk-sharing agency model.¹ In essence, we extend the literature

¹A more in-depth analysis of the agency model dealing with

towards a direction that takes into account the multidivisional structure of the modern corporation.

In section III we examine the principal-agent relationship when the agent is the top coordinator of a multidivisional firm. We briefly review the multidivisional form of organization and justify the multidimensionality of effort. Also, we examine how the risk-sharing rules change if the top coordinator's effort is multidivisional. The risk-sharing agency model, after appropriate adjustments, will address this problem. In this section the major propositions are introduced. Section IV summarizes the significance of the results obtained.

II. REVIEW OF THE PRINCIPAL-AGENT LITERATURE

A. A Taxonomy

Economists and social scientists, in an effort to explain why organizations take the form they do and why they behave the way they do, initially accepted the idea that an organization behaves as a black box. The "theory of the firm" was the first step towards the understanding of the organizational complexities; it was developed to articulate on a set of organizational characteristics which could explain the firm's internal structure. However, the "theory of the firm" is essentially a theory of markets. The firm is modeled as an entrepreneur who maximizes, in the absence of complicated

the contracting environment appears in the third part of this dissertation.

behavioral problems, profits or value in an environment which is characterized by perfect and costless enforceability of contracts. There are no information problems, and as a result, this method of analysis has no implications on how organizations function internally. Despite the fact that classical economic concepts were used in the development of the theory of organizations, they were not enough to promote an understanding of the internal structure of corporations. Moreover, problems of internal resource allocation were not discussed. It was obvious that a substitute of the "black box" was needed.

The agency theory was developed with the objective of providing solutions to a set of complex contractual arrangements that describe the equilibrium behavior of maximizing agents who have diverse and conflicting objectives. In defining the firm as a set of contracts,² attention is concentrated on the problems which the contracts are intended to solve, that is, on how things get done within the organization. Since the original papers by Spence and Zeckhauser (1971) and Ross (1973), developments in the literature have focused on two different and almost entirely separate areas. The first, the contracting environment theory of agency, has focused on the analysis of the contracting environment and the nature of monitoring and bonding activities of the firm's contracts. Major works by Jensen and Meckling (1976), Smith and Warner (1979), Myers (1977), Fama (1980), Leftwich (1981), and Fama and Jensen (1982, 1983a, 1983b)

²Precisely, the firm is defined as "a legal entity that serves as a nexus for a complex set of contracts written and unwritten." (Jensen and Meckling (1976), p. 137).

examine information costs, degree of capital intensity, the internal and external labor markets, and other factors of the contracting environment.³ The second area of research in the principal-agency relationship is the risk-sharing theory of agency. Among the diverse problems addressed in this literature are the following: the structure of preferences of the parties engaged in contracts, the nature of uncertainty, and the informational structure in the environment. The significant element here is the risk-sharing form of the optimal contract between the principal and the agent. Papers of the risk-sharing theory of agency include the works by Spence and Zeckhauser (1971), Ross (1973), Harris and Raviv (1978, 1979), Mirrlees (1976), Townsend (1979), Holmstrom (1979, 1983), Sappington (1983), and Shavell (1979).

Both literatures address the contracting problem. They differ, however, on mathematical and empirical grounds. Specifically, the contracting environment theory of agency is generally conceptual with some empirical orientation. In contrast, the risk-sharing theory of agency is heavily mathematical without an empirical orientation. The former literature places emphasis on the understanding of the observed phenomenon and the cost structure associated with it. The latter literature stresses the importance of the variables that define the principal-agent relation rather than the

³This literature is reviewed in the subsequent part that focuses directly on aspects of contracting environment and financial decisions of a divisional firm.

effects of markets and other factors on the contracting process. Table 1 provides further insight on the differences between the two literatures.

Therefore, we are left with two schools of thought that seemingly address the same problem. However, their analytical or conceptual approach for resolving principal-agency problems is quite distinct. There are questions that can be addressed only within the contracting environment theory of agency, but the answers needed belong to the framework of the risk-sharing theory of agency. Occasionally, general qualifications regarding agency problems are desirable, but their vague interpretations are not valid for policy decisions. Frequently a heavy mathematical orientation is not attractive for practical recommendations. Obviously, there are limitations of both agency frameworks regarding the nature of the problems addressed and the quality of the answers produced from the analysis.

Despite the above-mentioned limitations, our classification offers a clear distinction among the parameters that play a significant role in the analysis of contractual arrangements among agents. However, another dimension of significance is the internal organizational structure, that is, the type of firm. In our judgment the traditional theories of the principal-agency relationship deal with only one type of firm: the firm whose top coordinator allocates his effort in one productive activity. This paper attempts to differentiate the principal-agency models not only according to the

Table 1

Two Different Agency Literatures

THE CONTRACTING ENVIRONMENT AGENCY THEORY	THE RISK-SHARING AGENCY THEORY
<ul style="list-style-type: none"> ● Conceptual orientation ● Emphasis on the analysis of contracting environment ● Cost/Benefit analysis ● Bonding, monitoring costs are important variables ● Analysis at the firm's level ● Possible empirical testing hypotheses ● Clear separation of ownership and control ● Focus on the effect of markets on contracting process 	<ul style="list-style-type: none"> ● Mathematical treatment ● Emphasis on the risk-sharing forms of an optimal contract ● Optimization techniques ● Structure of preferences of agents are important variables ● Analysis at the participant's level ● Difficulties with empirical testing ● No clear separation of ownership and control (distinction is irrelevant) ● Focus on the effect of agent's preferences on the contracting process

scope of analyzing contractual arrangements among agents, but also according to the firm's type. Distinguishing between types of firms is important, because the risk-sharing rules depend upon certain elements of the firm's internal structure. Obviously, there are so many different types of firms in the real world that any method of classifying them is subject to the criticism of being arbitrary. Nevertheless, we have developed a taxonomy of firms based on two dimensions: the type of internal organizational structure, and the scope of analyzing agency problems. We have concentrated solely upon these two dimensions because they have a direct relationship to the contractual arrangements between the agent and the principal. The first dimension, the type of internal organizational structure, can take the discrete values of a unitary mode or a multidivisional form. In regard to the second dimension, the scope of analyzing the agency problem, the previous discussion has revealed that there are two models that analyze contractual relationships: the risk-sharing agency model and the contracting environment agency model.

Our point in introducing this taxonomy of firms is to illustrate our belief that (1) different risk-sharing rules should be formulated for different types of firms, and (2) the traditional analysis of the principal-agent model applies to a limited number of firms--even though they may be important.

B. Review of the Risk-Sharing Theory of Agency

The common characteristic of the papers dealing with the risk-sharing agency theory is the investigation of an optimum sharing rule between the principal and the agent. In addition, emphasis is placed upon the welfare comparisons of the equilibrium-contracting solutions in the presence of information costs. All the papers reviewed place attention on the analysis of the structure of preferences of the parties engaged in contracts. Therefore, the focus of the risk-sharing literature is on the information structure at the level of participants or organizational actors, rather than on the firm's level.

In one of the earliest papers, Ross (1973) identified a set of utility functions that motivate the agent to perform a task and still improve the Pareto efficiency. Harris and Raviv (1979) developed a theory of contracts and investigated the problem of how the availability of information affects the sharing rules. From their analysis, it is apparent that the optimal contract, which provides incentives to the agent, depends upon the availability of information concerning effort. Shavell (1979) examined the relationship between outcome, sharing rules, and potential information about the agent's effort. He addressed the question of whether or not any additional information about the agent's effort is useful. Shavell's results indicate that the agent's share of the outcome depends to some extent on information which the principal has about his effort. This result was also proven by Holmstrom (1979). However, Holmstrom's analysis is more general in that it derives

the necessary and sufficient conditions for imperfect information to improve the sharing rule. The implication of this study is that any imperfect information about the agent's effort can be used to improve the efficient allocation of risk sharing between the parties engaged in a contract. Finally, Sappington (1983) investigated the contracting relationship in a more realistic setting. He assumed that the agent observes the states of nature before he chooses the level of effort and that there is a minimum loss that can be imposed on the agent. His analysis indicates that the principal will not offer the agent a first-best contract.

One of the limitations of the risk-sharing theory of agency is that it describes how the top coordinator expends effort to manage effectively just one production facility. However, common observable behavior of managers has shown that "effort" contains many subtasks. It is reasonable to conjecture that, depending on the critical importance of the task and the disutility associated with the specific task, managers would concentrate their effort in a small number of tasks. Bounded rationality, asymmetric information, and other behavioral problems limit the top coordinator's ability to manage simultaneously all the tasks.

III. THE PRINCIPAL-AGENT MODEL UNDER A MULTIPLE-EFFORT STRUCTURE

A. Elementary Considerations

The principal-agent model applies to situations which are characterized by the following structure: one individual, called the agent, chooses some action to produce an outcome, which will

be divided between the agent and another individual, called the principal. The particular outcome depends on the agent's effort and the state of the world that actually prevails at that relative time. In the most general case the agent's actions cannot be observed directly, although the resulting outcome generates utility to the principal. The agent in return for his effort receives a payment from the principal. Therefore, the agent's utility depends on the payment and the effort extended to accomplish a task. The major problem in designing a contract between the agent and the principal is the unobservability of the agent's effort. The lack of observability of effort implies that the agent will choose an effort to maximize his own expected utility, and this in general means that the contract between the principal and the agent does not reflect optimum risk sharing. According to the analysis provided by Holmstrom (1979) and others, the moral-hazard problem affects the Pareto-optimum risk sharing between the agent and the principal, simply because the actors engaged in a contractual relation possess different informational sets.

To deal with this problem, the principal can consider one of the following strategies. The first strategy, suggests that the principal pays the agent a fixed wage. Any residual outcome is retained by the principal. This strategy implies that the agent does not have any real economic incentive to perform the agreed level of effort, since an unacceptable outcome can be justified on uncontrollable factors (i.e., a bad state). It is well understood that the principal avoids costly incentive schemes,

although he faces the risk of receiving a suboptimum outcome. The second strategy recommends that the principal rents the firms to the agent for a fixed cost and foregoes any claims on the residual outcome. This strategy imposes a suboptimal level of risk on the agent since, regardless of the outcome of the state variable, he would have to compensate the principal on the basis of a predetermined fee. Certainly, this approach favors the principal by providing gains from risk sharing, but it is questionable if the agent voluntarily will subscribe to this recommendation. The third strategy suggests a compromising solution. The principal offers some incentives to the agent. Indeed, the principals' objective will be to tradeoff some gains from sharing risk with some costs of providing incentives to the agent. Incentives through an employment contract will impose some risk on the agent in order to motivate him to expend some agreed level of effort.

Although the third strategy is more realistic, it entails considerable complications in terms of a feasible solution, in particular, in view of the fact that the agent always has a disutility for his effort. Obviously, the principal must take into account the fact that his choice of a compensation fee will determine the level of the agent's effort via the agent's utility maximization procedure. This leads to a departure from the optimum risk-sharing solution.

With an appropriate incentive scheme, the above-mentioned problem could be avoided. Incentives through an employment contract

will impose some risk on the agent in order to motivate him to expend some agreed level of effort. Holmstrom (1979), Harris and Raviv (1979), Shavell (1979) and Shappington (1983) examined the optimal incentive schemes (i.e., sharing rules) under the assumptions that either the agent's effort is perfectly observable or that there are imperfect indicators of the agent's effort. First and second best solutions of an incentive contract are finally derived under distinct preference structures, i.e., when agents are neutral or risk averse. The whole analysis is based on an expected utility model which represents the preferences of the principal and the agent. The disutility of the agent regarding the effort creates the moral hazard problem, because of the principals' inability to observe perfectly the agent's action.

B. Multidivisional Effort

However, the moral hazard problem has been defined under the limited case of a unidimensional effort. Effort has been determined in a rather narrow sense. In practical situations agents are confronted with several tasks simultaneously. For example, a manager is faced with more than one responsibility which comprises his function. In an extreme case, if there is just one responsibility it can be defined across different qualitative dimensions. In more practical terms, the top manager of a multidivisional firm is charged with the supervision of several production processes and the direction of all the divisions. A multidivisional effort

approach to the principal-agent problem is definitely desirable, since it provides a more realistic framework within which incentive problems can be examined.

To substantiate our argument for a multidivisional effort, we examine the part of the literature that deals with the internal organizational structure.⁴ It is true that multidivisional structures have been documented by many researchers and that both the industrial organization literature and the management literature have exhaustively examined questions addressing the degree of decentralization, span of control, and other normative and behavioral factors affecting organizational design. Chandler (1977,1982) provided an analysis of the transformation of the corporation from its unitary form (U-form) to its recent multidivisional MD-form. Armour and Teece (1978) and Teece (1981) documented a positive correlation between profitability and multidivisional form of organization. Indeed, this finding justifies the adoption of the multidivisional form. Williamson (1973,1975) argued that the multidivisional form is the outcome of the product and capital market's inability to regulate decision making in corporations. Consequently, the firm internalizes potential externalities and behaves as a miniature capital market in terms of allocating resources. A related body of literature examined aspects of internal administrative regulation and incentives in large organizations. Simon (1957), Wilson (1975), Stiglitz (1975),

⁴This literature is reviewed extensively in the subsequent essay that focuses on the financing decisions of the multidivisional corporation.

Alchian and Demsetz (1972), Mirrlees (1972), and Williamson (1975) provided reasons that explain why firms adopt hierarchies. Therefore, the current literature has established that the multidivisional structure is a common form of organizing economic activities and that the hierarchical structure allows the top manager to coordinate activities among divisions.

From the above discussion, it is reasonable to assume that the top coordinator supervises the operation of n -divisions of a diversified corporation. His effort is multidivisional in the sense that he allocates a fraction of his overall productive ability to each division. Depending on the agent's risk attitudes, an appropriate sharing rule will determine the allocation of the firm's output (cash flow) between the principal and the agent. However, a multidivisional effort raises issues of the optimality of sharing rules across different productive activities. From the principal's point of view the informational asymmetry problem becomes more complicated, because it entails conditions of imperfect observability across many divisional outputs (cash flows). Another problem is associated with the implicit assumption that the agent has superior information and correct assessments concerning disutilities of different tasks. This presupposes the absence of any misinformation problems down in the hierarchy. Therefore, an application of the risk-sharing agency model to the case of a multidivisional effort naturally suffers from limitations related to the imposed assumptions.

In addition, some elements are missing from the analysis.⁵ Despite the shortcomings in our analysis, our models provide a first approximation to a solution of an already complicated problem.

C. The Model

The development of our model takes place under the most general conditions. In subsequent sections alternative specifications of the model will be discussed. We provide the following scenario along the major assumptions:

- (1) A firm consists of n independent divisions. Each division has a cash flow (outcome) of x_i . The addition of cash flows from all divisions provides the firm's overall outcome X .
- (2) The principal has a utility function over the monetary outcome which is given by the function $G(\cdot)$. It is assumed that $G' \geq 0$ and $G'' < 0$. $G(\cdot)$ is a real function of the type $R \rightarrow R$.
- (3) The principal delegates to an agent authority for the decision making and coordination of the firm's units. The agent expends an effort, which together with the realization of an uncertain state variable, w , will determine the firm's cash flows.
 - (3.1) The firm's cash flows are derived from the function $X = y(e, w)$, where w is the state variable, and e is the aggregate effort. It is assumed $dX/de > 0$ and $d^2X/de^2 \leq 0$ for all w .

⁵Other missing variables are the pay structure for unknown ability, the labor market considerations, and the technological constraints.

- (3.2) The effort devoted to the management of the i division is e_i . The additivity property can be applied for divisional efforts. The level of effort expended by the agent can be observable or unobservable.
- (3.3) The agent's overall utility function with respect to effort and outcome is $H(X,e)=U(X)-V(e)$. The agent's function $U(X)$ satisfies the conditions $U' > 0$, $U'' \leq 0$. In addition, the agent demands a minimum level of utility, H^* , which is determined by his opportunity set and other exogenous factors.
- (3.4) The agent has narrow atomistic incentives and has disutility for the effort e which is given by $V(e)$. The function $V(\cdot)$ is defined over effort and in the field $R \rightarrow R$. Major properties of this function are $V'(\cdot) > 0$, and $V''(\cdot) \leq 0$.
- (4) The outcome X is allocated after the end of the period between the principal and the agent. The sharing rule, $s(\cdot)$, specifies the amount of output that goes to the agent. The principal receives $X-s(\cdot)$. The extreme values of $s(\cdot)$ are known. The sharing rule should have an upper and a lower limit for the occurrence of a solution. Finally, the sharing rule is measurable.
- (5) There is an n -dimensional vector x' that indicates divisional performance. If we consider n -divisions, x' is equal to (x_1, x_2, \dots, x_n) .
- (6) The joint density function of x and e is given by $f(x,e)$. For a given level of effort e , both the principal and the

agent have identical beliefs about the conditional probability distribution over the outcome. Also, it is assumed that the partial derivatives of $f(\cdot)$ with respect to each divisional effort exist. Finally, the marginal cumulative distribution functions are assumed to satisfy first order stochastic dominance. That is, if $F(x_i, e_i)$ is the marginal cumulative distribution function of e_i , then $F'(\cdot) < 0$.

(7) We denote by $\text{argmax}(\cdot)$ the set of arguments that maximize the expression in parenthesis.

The following formulation considers the case of an unobservable effort. Generally, the principal's problem is given by the set of equations:

$$\text{Max}_{s(\cdot), e} \int G(X-s(X))f(X, e)dX \quad (1.1)$$

subject to:

$$\int (U(s(X)) - V(e))f(X, e)dX \geq H^* \quad (1.2)$$

$$e \in \text{argmax} \int (U(s(X)) - V(e))f(X, e)dX \quad (1.3)$$

It is assumed that the maximum of the expression (1.3) exists and it is a measurable quantity. Therefore, the last equation can be simplified to the set of equations (n-equations):

$$U(s(X))f(X, e)dX = V_i(e), \text{ for } i=1, 2, \dots, n \quad (1.4)$$

where $V_i(e) = dV(e)/de_i$

When $x' = (x_1, x_2, x_3 \dots x_n)$ is observable an alternative specification of the model is as follows:

$$\text{Max}_{s(\cdot), e} \int G(X - s(x')) f(X, e) dX \quad (1.5)$$

subject to:

$$\int (U(s(x')) - V(e)) f(X, e) dX \geq H^* \quad (1.6)$$

$$e \in \text{argmax} \int (U(s(x')) - V(e)) f(X, e) dX \quad (1.7)$$

Discussion

The principal's problem is to specify a sharing rule that maximizes his expected utility. This sharing rule should comply with the following requirements: (a) it should compensate the agent for the effort he expends in accomplishing the task, and (b) it should be sufficient to motivate the agent to perform the agreed task. The principal is indifferent to the agent's choice of effort as such, and is concerned only with the value of the outcome net of the portion that must be paid to the agent.

The principal's objective function is given by the above equation (1.1). If the agent's effort is observable, the principal maximizes his utility function $G(\cdot)$ subject to the constraint (1.2). This constraint expresses the condition that the principal's share is determined in such a way that a minimum expected reward for the agent is considered. The minimum reward for the agent, H^* , is determined by the competitive labor market forces and other factors outside the principal's influence, that is, the H^* level is exogenously determined.

Constraints (1.2) represent a forcing contract for the principal. If the agent's effort is not observable, the principal's maximization problem is constrained by an additional condition, the relationship (1.3). The constraint (1.3) indicates that the self-interested agent will choose a level of effort so that his utility net of any costs associated with the allocation of effort is maximized. It is implicitly assumed that the cost of effort for the agent is a measurable quantity and is reflected in the function $V(e)$, which is the disutility of effort. Obviously $V'(e) > 0$.

Therefore, the principal must take into consideration the fact that his choice of a sharing rule will determine the value of effort via the agent's maximization procedure. The only feasible solution for the principal would be to provide some incentives to the agent. More specifically, the principal trades off some gains from sharing risk with some costs of providing incentives to the agent--the need to control the agent's choice of effort.

The condition (1.3), which is called the incentive constraint, can be simplified to the set of equations provided by the relationship (1.4). Holmstrom (1979) and Mirrless (1975) pointed out a strong condition that should be satisfied for the smooth transition from (1.3) to (1.4). The crucial assumption here is that the first and second derivatives of the p.d.f. function $f(\cdot)$ with respect to effort exist. Indeed, in starting our assumptions we were careful to include this condition. (See assumption 6.) Essentially, conditions (1.4) imply the existence of an optimum level of effort, since

the disutility of effort is a function of the agent's expected utility provided by the sharing rule.

An interesting point is the derivation of the probability distribution function $F(X,e)$. This function is determined jointly by the density function $f(w)$ and the function $y(X,w)$. For some level of effort e , there is always an outcome X which is associated with the probability function of the state variable w , $f(w)$. In our case X is invariant to e . Generally, increasing e leads to "better" distributions of $f(X,e)$. This implies that the distribution resulting from a higher value of e is always preferred by the principal to one resulting from a lower value of e . It is also assumed that the $f(X,e)$ is differentiable to any desirable order.

The literature review conducted in section II revealed that the principal-agent framework addresses various issues of risk-sharing under alternative specifications of effort. The introduction of an additional variable, in our case the nature of cash flows (divisional/aggregate), augments the solutions to the problem.

Before we proceed with the alternative specifications of our model, we should mention here the restrictions placed on the sharing rule. More precisely, the requirement for a solution to the system of equations (1.1), (1.2), and (1.3) is that the sharing rule should be restricted to an interval (s_{min}, s_{max}) . (Holmstrom (1979), p.77).

Different Specifications of Effort

Observable. The solution of the system of equations (1.1) and (1.2) provides the first-best solution under the assumption that both

the effort and the outcome are observable by the principal without moral hazard. The first-best solution is used for comparison purposes; it represents a solution to a complicated problem when ideal conditions prevail. If the agent and principal are risk neutral, the level of effort is found from the condition that equates the marginal disutility of effort with the marginal increase in the expected outcome. The derived optimal level of effort e^* , which is observable by all parties involved, is used to determine the sharing rule. Table 2 gives the reward structure for the agent and the principal under different preference assumptions (risk neutrality, risk aversion). A conclusion from the analysis is that interesting results are obtained when both the agent and the principal have different risk attitudes; one is risk averse and the other is risk neutral. If both the agent and the principal are risk averse, the sharing rule is the same even though the divisional cash flows are different, provided that the aggregate output is the same.

Unobservable. The second-best solution provides a more realistic setting. It assumed that the principal is not able to detect the level of effort that the manager places in each division. We can examine the problem under two different sets of assumptions regarding cash flows. The first alternative is to analyze the morale hazard problem when the principal receives information about the aggregate level of cash flows. A second-best solution is feasible. The second

Table 2

First-Best Solution When Both Effort and Outcome Are Known

PRINCIPAL AGENT	RISK NEUTRAL	RISK AVERSE
RISK NEUTRAL	<p>The sharing rule is determined by the relationship:</p> $\frac{df(x,e)}{de} = \frac{dv}{de}$ <p>marginal increase on exp. outcome marginal disutility of effort</p> <p>Agent : $s(x) = H^* + V(e^*)$</p> <p>Principal: $x - s(x)$</p>	<p>Agent : $s(x) = x - k$</p> <p>Principal: $x - s(x) = k$</p> <p>k : fee paid to the principal</p> <p>Principal is "fully insured"</p>
RISK AVERSE	<p>Agent : $s(x) = 1$</p> <p>Principal: $x - s(x) = x - 1$</p> <p>1 : fee paid to the agent</p> <p>Agent is "fully insured"</p>	<p>Agent : $s(x)$</p> <p>Principal: $x - s(x)$</p>

alternative allows for observability of divisional cash flows. We examine conditions under which additional information about divisional output is a valuable and informative signal.

Case #1: Effort is unobservable but the aggregate cash flow is observable by the principal. We can derive the second-best solution only under restrictive assumptions placed on preferences. We assume a risk-neutral principal and a risk-averse agent. In addition, we assume an HARA utility function for the agent. The derived sharing rule indicates that the agent is compensated according to the output produced. For expositional purposes, we provide the sharing rule when the $f(\cdot)$ is a p.d.f. which belongs to the family of normal distributions. Therefore, our approach analyzes the functional relationship between divisional effort, sharing rules, and aggregate cash flows.

We use the $\log(x)$ function to describe the agent's preferences. This function is derived from the general HARA utility function:

$$U(x) = \frac{1-\gamma}{\gamma} \left[\frac{\beta x}{1-\gamma} + n \right]^\gamma \quad (2.1)$$

$$\beta > 0, \gamma \neq 1$$

$$\left[\frac{x}{1-\gamma} + n \right] > 0 \quad (2.2)$$

$$\text{For } \gamma = 0, \text{ we obtain } U(x) = \log x \quad (3)$$

From the equations (1.1), (1.2) and (1.4) we obtain the following formulation:

$$\max_{s(\cdot), e} \int [G(x-s(x)) + \lambda \cdot U(s(x))] \cdot f(x, e) dx \quad (4)$$

$$\text{s.t.} \int U(s(x)) f(x, e) dx = \frac{\partial V_i(e)}{\partial e_i} \quad \forall_i = 1, 2, \dots, n \quad (5)$$

The solution of above system of equations is provided in the relation

(6). If $\lambda \neq 0$ and $\mu_i \neq 0$, $\forall_i = 1, 2, \dots, n$ we obtain

$$\frac{G' [(x-s(x))]}{U' [s(x)]} = \lambda + \frac{\sum_{i=1}^n \mu_i \frac{\partial f(x, e_1, e_2, \dots, e_n)}{\partial e_i}}{f(x, e_1, e_2, \dots, e_n)} \quad (6)$$

where:

λ and μ_i 's are the Lagrangian multipliers for the relations (1.2) and (1.4)

$s(x)$ is the sharing rule. It is given that $s(x) = [s_{\max}, s_{\min}]$

n is an index indicating division

$$\frac{\partial f(x, e_1, e_2, \dots, e_n)}{\partial e_i} = f_i(x; e_1, e_2, \dots, e_n). \quad \text{It is assumed that}$$

$$\partial f(\cdot)/\partial e \quad \text{and} \quad \partial^2 f(\cdot)/\partial e^2 \quad \text{exist}$$

From (6) and $G'[\cdot] = 1$ we have:

$$\frac{1}{U' [s(x)]} = \lambda + \frac{\sum_{i=1}^n \mu_i f_i(x, e_1, e_2, \dots, e_n)}{f(x, e_1, e_2, \dots, e_n)} \quad (7)$$

Considering (3) and (7) we receive:

$$s(x) = \lambda + \frac{\sum_{i=1}^n \mu_i f_i(x, e_1, e_2, \dots, e_n)}{f(x, e_1, e_2, \dots, e_n)} \quad (8)$$

For a non-decreasing sharing rule the following condition should be satisfied:

$$\frac{\partial}{\partial x} \left[\frac{f_i(x;e)}{f(x;e)} \right] > 0 \quad \forall_i = 1, 2, \dots, n$$

Below we examine the case of normal probability distribution function.

It is assumed that:

$$\left. \begin{array}{l} x_1 \sim N(e_1, \sigma_1^2) \\ x_2 \sim N(e_2, \sigma_2^2) \\ \vdots \\ x_n \sim N(e_n, \sigma_n^2) \end{array} \right\} X \sim N(e_1 + e_2 + \dots + e_n; \sigma_1^2 + \sigma_2^2 + \dots + \sigma_n^2) \quad (9)$$

$$f(x;e) = \frac{1}{\sqrt{2\pi}} \exp \left[-\frac{(x-M(e))^2}{2\sigma^2} \right] \quad (10a)$$

$$\frac{\partial f(x;e)}{\partial(x;e)} = \frac{M'(e)}{\sigma^2} [x-M(e)] \quad (10b)$$

where: $M(e)$ = is the summation of efforts

x_i = is the divisional cash flow

From (8), (9) and (10) we have:

$$s(x) = \lambda + \mu_1 \left[\frac{x - \sum e}{\sum \sigma^2} \right] + \mu_2 \left[\frac{x - \sum e}{\sum \sigma^2} \right] + \dots + \mu_n \left[\frac{x - \sum e}{\sum \sigma^2} \right] \quad (11)$$

where: $M(e) = e_1 + e_2 + \dots + e_n$

$$\sum \sigma^2 = \sigma_1^2 + \sigma_2^2 + \dots + \sigma_n^2$$

Another expression of (11) is

$$s(x) = \lambda - \left(\frac{\sum_{i=1}^n \mu_i \sum_{j=1}^n e_j}{\sum \sigma_1^2} \right) + \left(\frac{\sum_{i=1}^n \mu_i}{\sum \sigma_1^2} \right) x$$

or

$$s(x) = \zeta + \psi x$$

The last relationship shows that the sharing rule depends directly on the output produced. This intuitive result was obtained under the restrictive assumptions of normal p.d.f. of x_i 's and logarithmic utility function.

In the next section we shift our interest in topics of disaggregation of information by discussing the conditions under which the principal will be better off knowing each divisional cash flow rather than the aggregate cash flow.

Case #2: Effort is unobservable but the divisional cash flows are observable. We address two issues. First, we examine whether or not additional information about divisional cash flows is a valuable signal for the principal. Lemma I will address this issue. This problem is related to the controversial issue of reporting segmented financial information. In the past, the S.E.C. has required that business firms report information according to their product line classifications. Research on the empirical front has shown the usefulness of reporting information of different product

lines of an entity, which also has welfare implications. For example, Collins (1975) argues that segment revenue data can be used to successfully anticipate changes in the total earnings of an entity which would be otherwise "unexpected" if only consolidated data were available. An important implication is that the efficiency of the capital markets could be improved with the release of more precise and accurate financial data. With Lemma I we prove that additional information is of value to the principal.

A second issue of importance is the aggregation of the sharing rules. If additional information about divisional cash flows is provided, we examine how the sharing rule should be determined. Proposition I addresses the question of compensating the agent on the basis of disaggregated output. This issue is of vital importance for the principal. A sharing rule based on aggregate outcome should be compared to the sharing rule obtained under the assumption of divisional performance.

D. A Lemma and A Proposition

Lemma I relies on Holmstrom's (1979) interpretation of the notion of a valuable signal. To improve the contractual arrangement between the principal and the agent, in addition to the observed parameter X , a signal can be used. More specifically, a signal x' is considered as valuable if the contract $s(X, x')$ is superior to $s(X)$. To determine the sharing rule $s(X, x')$, x' is treated as a state variable. The function $f(X, x')$ gives the joint probability

of X and x' given $e (=e_1, e_2, e_3 \dots e_n)$. Again the principal's problem is to maximize at each pair of values (X, x') the sharing rule $s(X, x')$. We obtain an expression similar to (8)

$$\frac{G'(\cdot)}{U'(\cdot)} = \lambda + \mu \frac{fe(X, x', e)}{f(X, x', e)}$$

Now fe/f varies with x' and the sharing rule will be modified in light of the observation of x' . However, observation x' is a valuable signal only when:

$$\frac{fe(X, x', e)}{f(X, x', e)} \neq h(X, e), \quad (X, x'), h(\cdot) > 0$$

Notice that the right hand side of the above equation does not contain the parameter x' . By solving the differential equation we receive an equivalent expression:

$$f(X, x'; e) \neq g(X, x') * h(X, e), \text{ for every } (X, x')$$

where $g(\cdot), h(\cdot) > 0$.

(Proof (not included in Holmstrom (1979)):

$$\begin{aligned} fe(X; e) &= \int fe(X, x', e) dx' = h(X; e) \int g(X, x') dx' \\ f(X; e) &= \int f(X, x'; e) dx' = h(X; e) \int g(X, x') dx' \end{aligned} \Rightarrow \frac{fe}{f} \neq h(x, e)$$

Now we formally state our lemma:

LEMMA I

The disaggregation of output is a valuable signal.

Let us assume that the disaggregation of the output is given by $x' = (x_1, x_2, \dots, x_n)$. The signal x' is valuable and informative if:

$$f(X,x'|e) \neq g(X,x') * h(X,e), \text{ for every } (X,x') \quad (12)$$

where $g(.), h(.) > 0$

Proof:

We prove Proposition I by contradiction. Assume that the relation (12) holds in equality form. According to Holmstrom (1979) this implies that X is the sufficient statistic of the (X,x') with respect to e , which means that X carries all the relevant information about e and x' , and "adds nothing to the power of inference." However, the dimension of X is 1 while the dimension of x' is n . Since the dimensions of X and x' differ, it is impossible that X is a sufficient statistic for the pair of (X,x') .

Therefore, we conclude that X is not sufficient statistic of the pair of (X,x') w.r.t. e , and that relationship (12) is valid. This means that the disaggregation of divisional cash flows is a valuable and informative signal.

Discussion:

Although Lemma I has an intuitive appeal, we should explain why specific information about divisional cash flows improves risk between the principal and the agent.

A contract between the principal and agent should include some incentive elements that are designed to motivate the agent to perform the agreed effort even under conditions of uncertainty (for more discussion on the rationale for incentives and alternative forms of incentives please refer to section IIIa). The essential

reason of incorporating the divisional cash flows into the contract is not the need for additional information regarding the unobservable effort, but rather is the need of providing *additional incentives* to the agent. The agent is given an indirect way of *increasing his value of effort* which is expended to various divisions. In similar terms, additional information about divisional cash flows reduces the principal's *cost* of providing the agent with the right kind of incentives.

Another way to explain the incentive aspects of providing information about disaggregated cash flows is by looking at the $f(X,e)$, the joint distribution of X,e . A contract that depends only on aggregated cash flows X creates ambiguity with respect to a fair compensation of the agent. A high observed value of X will lead to a *high* payment to the agent, even though the effort expended is *low*. Similarly, a low observed value of X will result to a very low payment to the agent, even when the agent chooses a high effort. A contract based on aggregated cash flows alone, i.e., a contract of the $s(X)$ form, implies a compensation which can not separate state uncertainty from effort. It is possible that this situation is undesirable from the principal's point of view.

If additional information about the components of aggregated cash flow is provided, that is, information about the disaggregation of the output, it becomes less unlikely that high values of both the X and x' would be observed when in fact effort is very low. Similarly, it is implausible that low values of both X and

x' would be observed when in fact effort is high. Therefore, incorporating information about divisional cash flows into the contract reduces the chance of *rewarding the agent for the wrong reason*. Or, equivalently, the principal can substantially reduce the possibilities of either *wrongly rewarding low effort*, or *wrongly penalizing high effort*. From a rational point of view, the inclusion of divisional cash flows into the contract protects the agent's interests.

While Lemma I highlights the importance of the disaggregated information, proposition I enhances the analysis by investigating the compatibility of the sharing rules derived under the conditions of disaggregated and divisional information.

Proposition I

In a multidivisional firm sharing rules based on aggregate cash flows are different from sharing rules which are based on divisional cash flows. This implies that if the principal observes the vector $x'=(x_1, x_2, \dots, x_n)$, rather than the figure $X(X=x_1+x_2+\dots+x_n)$, the sharing rules $x(x')$ and $x(X)$ satisfy the relationship:

$$s(x') \neq s(X) \tag{13}$$

Proof:

Let us assume that the principal can observe the disaggregation of cash flows $x' = (x_1, x_2, \dots, x_n)$. The joint density function of x'

and all the efforts e_1, e_2, \dots, e_n is given by $f(x_1, x_2, \dots, x_n; e_1, e_2, \dots, e_n)$ or $f(x'; e_1, e_2, \dots, e_n)$. We can obtain similar results to relation [8]:

$$\frac{1}{U'[s(x)]} = \lambda + \frac{\sum_{i=1}^n \mu_i \frac{\partial f(x', e_1, e_2, \dots, e_n)}{\partial e_i}}{f(x', e_1, e_2, \dots, e_n)} \quad (14)$$

where: $f(\cdot)$ is the p.d.f. with similar assumptions to our assumption 6.

To simplify our proof we assume:

1. A multivariate normal probability distribution for the $f(\cdot)$ function
2. The agent has a logarithmic utility function
3. There are two divisions, $n = 2$, with cash flows x_1 and x_2 . Cash flows are related with a correlation ρ

Therefore, we have:

$$x' = (x_1, x_2) \sim N(\bar{e}, A) \quad (15)$$

$$A = \begin{bmatrix} \sigma_1^2 & \rho\sigma_1\sigma_2 \\ \rho\sigma_1\sigma_2 & \sigma_2^2 \end{bmatrix}$$

ρ : correlation coefficient

σ_1, σ_2 : standard deviations

A: covariance matrix

Also we know that:

$$f(x_1, x_2) = \frac{1}{2\pi\sigma_1\sigma_2\sqrt{1-\rho^2}} \exp \left\{ \frac{1}{2(1-\rho^2)} \left[\frac{(x_1-e_1)^2}{\sigma_1^2} + \frac{(x_2-e_2)^2}{\sigma_2^2} - 2\rho \left(\frac{x_1-e_1}{\sigma_1} \right) \left(\frac{x_2-e_2}{\sigma_2} \right) \right] \right\} \quad (16)$$

We define: $f_1(\cdot) = \frac{\partial f(x'; e_1, e_2, \dots, e_n)}{\partial e_1}$

$$f_2(\cdot) = \frac{\partial f(x'; e_1, e_2, \dots, e_n)}{\partial e_2}$$

From (16) we obtain:

$$\left. \begin{aligned} \text{For division 1: } f_1(x_1, x_2) &= \frac{(x_1-e_1)}{\sigma_1^2(1-\rho^2)} - \frac{(x_2-e_2)}{\sigma_1\sigma_2(1-\rho^2)} \\ \text{For division 2: } f_2(x_1, x_2) &= \frac{(x_2-e_2)}{\sigma_2^2(1-\rho^2)} - \frac{(x_1-e_1)}{\sigma_1\sigma_2(1-\rho^2)} \end{aligned} \right\} \quad (17)$$

Combining (13), (15) and (16) we receive:

$$\begin{aligned}
s(x') &= \lambda + \mu_1 \left[\frac{x_1 - e_1}{\sigma_1^2(1-\rho^2)} - \frac{\rho(x_2 - e_2)}{\sigma_1\sigma_2(1-\rho^2)} \right] + \mu_2 \left[\frac{x_2 - e_2}{\sigma_2^2(1-\rho^2)} - \frac{\rho(x_1 - e_1)}{\sigma_1\sigma_2(1-\rho^2)} \right] \\
s(x') &= \lambda + x_1 \left[\frac{\mu_1}{\sigma_1^2(1-\rho^2)} - \frac{\rho\mu_2}{\sigma_1\sigma_2(1-\rho^2)} \right] + x_2 \left[\frac{\mu_2}{\sigma_2^2(1-\rho^2)} - \frac{\rho\mu_1}{\sigma_1\sigma_2(1-\rho^2)} \right] \\
&\quad - e_1 \left[\frac{\mu_1}{\sigma_1^2(1-\rho^2)} - \frac{\rho\mu_2}{\sigma_1\sigma_2(1-\rho^2)} \right] - e_2 \left[\frac{\mu_2}{\sigma_2^2(1-\rho^2)} - \frac{\rho\mu_1}{\sigma_1\sigma_2(1-\rho^2)} \right] \quad (18)
\end{aligned}$$

If cash flows x_1 and x_2 are independent, $\rho = 0$ and (18) yields

$$s(x') = \lambda + \left(\frac{\mu_1}{\sigma_1^2} \right) x_1 + \left(\frac{\mu_2}{\sigma_2^2} \right) x_2 - e_1 \left(\frac{\mu_1}{\sigma_1^2} \right) - e_2 \left(\frac{\mu_2}{\sigma_2^2} \right) \quad (19)$$

Also, for $n = 2$ (Equation 11) yield:

$$s(X) = \lambda + \left(\frac{\mu_1 + \mu_2}{\sigma_1^2 + \sigma_2^2} \right) (x_1 + x_2) - \left(\frac{\mu_1 + \mu_2}{\sigma_1^2 + \sigma_2^2} \right) (e_1 + e_2) \quad (20)$$

A simple comparison of the sharing rules derived in relations (20) and (19) leads to the conclusion that generally:

$$s(x') \neq s(X) \quad (13)$$

An interesting question arises with respect to the direction of the inequality of (13), that is, is it true that $s(x') > s(X)$ or $s(x') < s(X)$. Unfortunately, our analysis provides an ambiguous answer.

By subtracting (20) from (19) we obtain:

$$s(x') - s(x) = x_1 \left[\frac{\mu_1}{\sigma_1^2} - \frac{\mu_1 + \mu_2}{\sigma_1^2 + \sigma_2^2} \right] + x_2 \left[\frac{\mu_2}{\sigma_2^2} - \frac{\mu_1 + \mu_2}{\sigma_2^2 + \sigma_1^2} \right] - e_1 \left[\frac{\mu_1}{\sigma_1^2} - \frac{\mu_1 + \mu_2}{\sigma_1^2 + \sigma_2^2} \right] - e_2 \left[\frac{\mu_2}{\sigma_2^2} - \frac{\mu_1 + \mu_2}{\sigma_1^2 + \sigma_2^2} \right] \quad (21)$$

$$s(x') - s(x) = (x_1 - e_1) \left[\frac{\mu_1}{\sigma_1^2} - \frac{\mu_1 + \mu_2}{\sigma_1^2 + \sigma_2^2} \right] + (x_2 - e_2) \left[\frac{\mu_2}{\sigma_2^2} - \frac{\mu_1 + \mu_2}{\sigma_2^2 + \sigma_1^2} \right]$$

It is true that $\sigma_1^2 < \sigma_1^2 + \sigma_2^2 \Rightarrow \frac{1}{\sigma_1^2} > \frac{1}{\sigma_1^2 + \sigma_2^2}$ ($\mu_1 > 0$)

However, the sign of the terms inside the brackets is unclear. We can prove that $s(x') > s(x)$ only under the following strict conditions:

$$\left. \begin{array}{l} \text{(a)} \quad (x_1 > e_1) \text{ and } (x_2 > e_2) \\ \text{(b)} \quad \mu_1 \sigma_2^2 > \mu_2 \sigma_1^2 \text{ or } \frac{\mu_1}{\mu_2} > \left(\frac{\sigma_1}{\sigma_2} \right)^2 \\ \text{(c)} \quad \mu_1, \mu_2 > 0 \end{array} \right\} \quad (22)$$

All three conditions should be satisfied simultaneously.

Although the set of conditions (a) is reasonable, conditions (b) impose a problem with respect to the interpretation of the results obtained.

Another problem of related interest is the search for the necessary conditions for the equality of (21). It turns out that conditions similar to (22) can be derived. These are

$$\left. \begin{array}{l} \text{(a')} \quad (x_1 = e_1) \text{ and } (x_2 = e_2) \\ \text{(b')} \quad \frac{\mu_1}{\mu_2} = \left(\frac{\sigma_1}{\sigma_2} \right)^2 \end{array} \right\}$$

However, conditions (a') are unrealistic.

Discussion:

In general, a contract between the principal and the agent calls for a higher payment at a relatively high values of aggregated cash flows and a lower payment at relatively low values of aggregated cash flow. To the extent that the agent allocates his effort correctly among divisions this approach is acceptable. However, since effort is unobservable there are two issues: first, the problem of misallocation of effort; and second, the issue of the proper incentives to the agent.

Misallocation of effort

The agent can allocate his effort to divisions which are characterized by higher marginal productivity of effort or by lower marginal disutility of effort. It is in the best interest of the agent to expend effort to those divisions that exhibit higher productivity since the final compensation depends upon the aggregate

cash flow. This behavior can create a cross-substitution of efforts among different divisions and fails to distinguish intentional behavior for higher share of the final outcome from true effort expended to divisions. A way out of this problem is to require the agent to report divisional cash flows rather than aggregate figures. To the extent that divisional effort and divisional cash flows are correlated, the problem of effort misallocation can be reduced.

Issues of incentives

The essential reason for incorporating divisional cash flows into the sharing rule is to provide the agent--in a discriminating manner--an additional incentive to increase his value of effort. A contract that depends on aggregate cash flow alone does not take into consideration the divisional uncertainties. A low aggregate cash flow observed implies a low compensation to the agent even through his effort placed on several divisions was high. To avoid this issue the agent should offer an incentive to the manager by specifying a contract according to divisional cash flows. As a final result the agent is compensated in a fair manner.

The above discussion highlights an important issue in designing a contract, namely the issue of efficiency of the sharing rule. The principal is concerned with an efficient way of compensating the agent. Since the agent can reallocate his effort in divisions for which his marginal disutility of effort is minimal, the problem of the agent's compensation is complicated considerably. For control

purposes the principal should require the agent to report divisional cash flows. However, it is not clear if the principal's share of the final outcome increases with this arrangement. On one hand, a contract based on divisional cash flows reduces the agent's motivation to allocate effort in divisions that minimize his disutility of effort. On the other hand, compensating agents according to divisional cash flows does not really allow for the full exploitation of the manager's marginal productivity of effort. However, what is clear is that sharing rules based on aggregate cash flows are different from those which are based on divisional cash flows.

IV. CONCLUSIONS

The focus of this essay has been on the application of the risk-sharing agency model to a multidivisional structure. At the beginning of the paper we provided a taxonomy of firms based on two distinct dimensions: the type of internal organizational structure; and the scope of analyzing the agency problem. Our emphasis was on the impact of information regarding aggregate or divisional cash flows on the sharing rules between the principal and the agent. Our analysis indicates that information regarding divisional performance is helpful in assessing the agent's compensation.

Contractual arrangements cannot eliminate problems of informational asymmetry regarding effort from the principal's point of view. If effort is an unobservable variable divisional performance can be used as a valuable, although imperfect, signal to improve the

risk sharing between the parties involved in a contract. The central hypothesis of our analysis concerns the sharing rules of aggregated or divisional cash flows. Certainly, the principal regards the disaggregation of cash flows as a desirable valuable signal.

Some limitations of our analysis were discussed in section III. However, our framework can be extended to the direction that will allow us to derive the optimum amount of effort allocated by the agent to different divisions.

PART II
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PART III

FINANCIAL DECISIONS, AGENCY CONSIDERATIONS, AND
THE INTERNAL ORGANIZATIONAL STRUCTURE

I. INTRODUCTION

There is a convincing body of literature which demonstrates that the modern corporation is characterized by a separation of ownership from control. Separation allows qualified managers to control the crucial resources of the corporation presumably at the shareholder's benefits. However, possible conflicts of interest between shareholders and managers generate a suboptimal allocation of resources within the organization which result in a reduction of shareholders' wealth.

The contracting environment theory of agency¹ has examined the sources of productive inefficiencies that result from the manager's self-interest behavior. All the relevant studies in this area have focused attention on two important elements of the manager's contracting environment: the role of capital markets and the magnitude of agency costs. However, the current agency literature has examined the agency problems without taking into consideration the internal organization structure of the modern corporation. Previous research has assumed that agency costs result exclusively from the actions taken by the top manager who is making decisions in the absence of any internal restrictions or constraints.

¹A simple taxonomy of the relevant papers in the area of agency was presented in the second essay. The review of the risk-sharing agency literature was also conducted in Part II. Our focus

Essentially, this analysis has isolated the managerial function from the internal corporate structure. It has also been assumed that all possible conflicts of interest among members of the organization are costlessly resolved. Therefore, the analysis of agency problems really deals with one type of firm: the traditional, *unitary firm* whose top manager allocates his effort in one productive activity.

Although agency problems are important in a traditional firm, issues relevant to the nature and allocation of the agency costs have not been examined for a different type of firm, namely, the *multidivisional firm*. Certainly, a multidivisional firm is more important than a traditional firm both in terms of the magnitude of the diverse resources that it regulates and the nature of internal administrative control of various corporate assets. Internal conflicts of interest in a multidivisional firm have an impact on the resource allocation and financing decisions. Clearly, the form of internal organization structure considerably complicates the analysis of agency costs. As Jensen and Meckling (1979, p. 309) pointed out,

the agency problem . . . exists in all organizations at every level of management in all firms. . . . Unfortunately, the analysis of these more general organizational issues is difficult because the nature of the contractual obligations and rights are much more varied. Nevertheless, (agency costs) exist and we believe that extensions of our analysis in these directions show promise of producing helpful insight . . ."

here, however, is to review the literature relevant to the contracting environment theory of agency.

A. Scope and Purpose of the Analysis

In this paper, we propose to augment the research on the agency theory by introducing, as an additional consideration, the internal organizational structure. The research reported in this essay has a conceptual orientation and places emphasis on the descriptive aspects of financial decisions made by managers who function under the influence of an internal administrative structure. More specifically, the paper deals with issues of agency costs and financial decisions at the *divisional level* of a well-diversified corporation. Our purpose is threefold. First, we examine in a tentative way some characteristics of the internal organizational structure of a well-diversified corporation. Second, we attempt to draw some possible implications of the internal managerial regulation for the investment and financing decisions of the firm. Third, we explore some of the most likely explanations for the survival of the multidivisional structure.

Our analysis places emphasis on some costs associated with the internal structure of the firm, raises some questions about the real managerial benefits of diversification, and explores the usefulness of an agency framework at a divisional level of a multidivisional firm. An important element of our analysis is that we take a comparative viewpoint, that is, we compare the financial decisions made by a divisional manager with the actions taken by a manager who makes decisions under the same circumstances but independently of an internal/hierarchical structure.

The remainder of the paper is divided into four sections. Section II reviews briefly some theories dealing with the multidivisional structure of a firm which is characterized by decentralization and product line diversification. The objective here is to provide some reasons that justify this organizational form, and suggest that decentralization leads to competitive adaptability. Section III describes the agency costs from the point of view of the contracting environment agency theory. In addition, this section attempts to analyze the important elements that determine the agency costs in a multidivisional firm. In section IV we compare the financial decisions of a firm which operates with one independent unit with decisions of a divisional unit of a multidivisional firm; we state some propositions regarding divisional manager's risk attitudes, and we explore some trade-offs that explain the survival of the multidivisional structure. Section V concludes our discussion with the interpretation of our findings.

II. THE MULTIDIVISIONAL FORM OF ORGANIZATION, THEORIES AND REVIEW

A. A Methodological Distinction

A major topic for research in economics and social sciences is the study of organization. Initially the theory of the firm was developed as a first step towards the understanding of major organizational complexities. Recently, independent research has concentrated on the interrelationships among the actors that interact in the firm's environment.

Coase (1937) was the first to analyze issues of internal organization. Since his exploratory work, a segment of the literature relevant to the theory of the firm has dealt with issues of the administrative structure of the modern corporation. The review of the literature reveals that there are two distinct methodologies which analyze issues of internal organization.²

The first methodology focuses on the parallel examination of the internal organizational structure and the capital markets. Under this approach, markets and firms are regarded as alternative administrative structures. The traditional production function is modified in order to include the concept of the firm as a governance structure. This parallel treatment of markets and organizations provides some direct explanations of the widespread multidivisional organizational form. According to this methodology, internal organizational structures are like markets, subject to disequilibrium and other forces that are similar to transactional frictions. Also, organizational failures, like market failures are common.

The second methodology isolates the firm from its external environment and attempts to examine issues of incentives, labor relations, and productivity of the actors that comprise the firm. The emphasis is placed on the parts that comprise the firm's

²This classification is neither exhaustive nor refined. Nevertheless, it offers considerable explanatory power in dealing with the main topics discussed in the literature of internal administrative structure.

internal operating units. The important outcome that is derived from the application of this methodology is a partial explanation of hierarchies adopted by organizations. More specifically, among the reasons that explain the adoption of hierarchies are the following. (1) Firms and hierarchies are needed to exploit the advantages of team work (Alchian and Demsetz, 1972). Since the free-rider problem is always present, teams require central monitors to control and discipline potential shirkers. Although central monitors are themselves members of teams and consequently are subject to the same dysfunctional behavior, an adoption of an institutional structure will eliminate this problem. Indeed, according to Alchian and Demsetz, top managers are monitored by potential takeover raiders. (2) The nature of the employment relation forces the firm to adopt hierarchies (Simon (1957), Williamson (1975)). (3) Economies of scale associated with the production and transmission of information is another reason that explains the internal organizational structure (Wilson, 1975).

In the following section we address the literature that examines the parallel relationship between markets, on one hand, and administrative organizations, on the other.

B. Some Issues of Internal Organization

Two major characteristics are attached to the modern corporation. First, the modern corporation contains many distinct operating units whose internal structure could allow it to operate as an

independent business enterprise. The second salient characteristic is that it employs a hierarchy of middle- and top-salaried managers who supervise and coordinate the work of the units. The managerial hierarchy is often completely separated from the ownership of the enterprise.

Chandler (1977,1982) examined the changing processes of production and distribution in the U.S.A. and the ways they have been managed. He provided documentation of the evolutionary process of corporate structure and described the transformation of the corporation from its early unitary form (U-Form) to its recent multidivisional structure (M-Form). In his more recent work, Chandler (1982) argues that the modern corporation has replaced the market mechanisms with respect to the coordination of the economic activities and the process of allocating scarce resources. Although the market place retains its function as "the generator of the demand for goods and services," its invisible role of allocating funds and coordinating cash flows was replaced by the "visible managerial hand."

The explanation of the existence of the multidivisional form is based on the argument of internalizing externalities. Possible externalities in the firm's environment include transaction costs, information processing costs, and product market uncertainties. It is well known that a functional structure exploits scale economies, whereas a divisional structure duplicates functions, unless the firm is large. However, functional departments entail more externalities

than divisions. Also, measuring the performance of a functional department has no meaning unless one knows the production function. Consequently, it may be more difficult to set operational goals and to measure performance for functional firms than for multidivisional firms.

We offer three reasons that explain the existence of the divisional form of organization:

(a) Incomplete information regarding the state of the world.

One way that leads to the reduction of this form of informational asymmetry is by using the price system. However, there are opportunity costs of expanding the necessary resources to become informed. In addition, there are costs of negotiating contracts once prices are known. The existence of these information processing costs provides incentives to explore devices for circumventing the market. Managers internalize this form of inefficiency, as long as the incremental improvement exceeds the cost of using the market for this purpose.

(b) Transaction costs economies. Williamson (1975) argues that transactions ought to be executed across markets. However, the market mechanism, due to transaction costs, cannot regulate discretionary decision making. Thus, the response to the relative inefficiencies that appear in the market place is the multidivisional corporation. This multidivisional form behaves as a small-scale

capital market with more functional efficiency due to the internalization of transactions. Therefore, for large firms divisional decentralization favors least-cost behavior and so approximates profit maximization better than does the functional form of organization.

- (c) Uncertainty regarding the product market or the technology. Firms respond in an adaptive manner to shifts in market demands by appropriately modifying their internal structures. Diversification in various product lines and vertical or horizontal integration are examples that point out the results of selecting an internal structure that serves better market needs. Therefore, a divisional structure promotes adaptiveness at the divisional and organizational levels.

The above discussion suggests that the adoption of a divisional form by organizations is a trade-off proposition which is based on a cost/benefit analysis. On the benefit side we may include informational efficiencies, diversification, savings on coordination costs, and reductions in transactions costs. On the cost side we consider possible costs that arise from the duplication of functions and losses in economies of scale. Also, the literature on hierarchies has established that with some "deadweight losses" there is a top coordinator who restricts the number of other individuals with whom anyone in the organization should maintain contact.³ Deadweight

³This restriction is called span of control and the number

losses, in this sense, include communication inefficiencies and monitoring errors that can be seen as "loss of control."

The pressures of the capital and the product markets on firms have accelerated the diffusion of the divisional organizational form. In fact, multidivisional structures have been documented by many researchers, and both the industrial organization literature and the management literature have exhaustively examined questions addressing the degree of decentralization, span of control, and other normative and behavioral factors affecting organizational design. In recent studies Armour and Teece (1981) and Teece (1981) have documented a positive correlation between profitability and the multidivisional organization structure.

In this section we briefly review the major works in the area of multidivisional firm. The modern corporation is characterized by a hierarchical structure in which there is a top coordinator whose role is to supervise the work of divisional managers.

III. AGENCY COSTS IN A MULTIDIVISIONAL FIRM

The multidivisional form represents a rational decomposition of the firm's affairs. There are two unique features assigned to the function of the top coordinator of a divisional firm. First, the top coordinator has the responsibility to plan in a strategic manner the allocation of resources among the divisions. Second,

of stages into which the control system is subdivided, i.e., the levels in the hierarchy, is the length of a chain of command.

this coordinator monitors and controls the performance of the semiautonomous divisions. Taking into account these considerations, an important question arises regarding the nature of the agency costs. In addition, a justifiable concern is whether agency costs appear in divisional structures in a degree that create problems to the overall efficiency of the corporation.

Jensen and Meckling (1976) analyzed the agency costs in an owner-manager framework. Their major concern was the examination of the contracting environment and the monitoring and bonding activities of the firm. Agency costs were defined as the sum of the monitoring expenditures paid by the principal, the bonding costs paid by the agent, and the residual losses. Fama (1980) imposed an ex-post settling up mechanism that disciplines managerial behavior, so that agency costs are not an important consideration. However, the assumption of an efficient labor market raises many questions regarding the relevance of the argument. Nevertheless, the Jensen and Meckling analysis was conducted at the level of top management and with the intention of addressing issues of ownership and control. It was assumed that the top coordinator is an owner-manager with fixed wages, and outside shareholders were introduced in the analysis without any voting rights. Although Jensen and Meckling acknowledge the usefulness of an extension of their work at different organizational levels, the literature lacks evidence of such an extension.

From a different perspective, Fama and Jensen (1983) argue that decisions in modern organizations can be decomposed into operating and strategic and that the firm's decisions possess

consists of decision management and decision control. Decision management includes the initiation of proposals and the implementation of ratified decisions, and decision control involves the monitoring of performance and the choice among the proposals presented. Fama and Jensen (1983) suggest that if there is separation between decision management and ownership, the internal decision process is dominated by an organizational form that separates decision management from decision control. The result of this internal arrangement is that agency costs are insignificant. The diffuse nature of corporate residual claims allows market and organizational mechanisms to control the agency problems. These mechanisms include: (a) The stock market, which is an external monitoring device specializing in pricing common stock. Stock prices are visible signals that summarize the quality of internal decisions; (b) The market for takeovers, which can replace inefficient decision control mechanisms, either by a direct offer to purchase stock (a tender offer), or by an appeal for shareholder votes for directors (a proxy fight); (c) The expert boards, which are established by the residual claimants in the process of delegating internal control to the agents. The boards monitor the internal agent market.

The above-mentioned reasons help to explain the reduction of agency costs in a large corporation. To the extent that there is a separation of decision management from decision control in a multidivisional firm, agency costs are not an important consideration.⁴

⁴This is an indirect implication of the Fama and Jensen (1983) framework.

Despite the relevance of this argument, more research is needed to establish that agency costs are absent in a multidivisional firm, which is characterized by a diffuse ownership structure and a weak form of separation between decision management and decision control. Only a diffuse decision control system can limit the power of individual decision agents to expropriate the interests of residual claimants. It is suggested that a diffused decision system leads to disaggregation of specific information among many internal agents. This is the result of both the delegation of decisions to different agents and the separation of decision management and control at various levels of the organization. Agency costs can be reduced by assigning the initiation and implementation of decisions to those agents with valuable specialized knowledge.

In a divisional organization there are two conditions that have pervasive consequences for the firm's internal efficiency: bounded rationality, and self-interest behavior from the part of virtually all participants of the organization. Simon (1957) and Williamson (1975) analyzed these conditions and explained the nature of conflicts that arise when managerial responsibility is assigned to human actors. While it is useful to distinguish bounded rationality and self-interest behavior, Fama and Jensen collapse these two terms under the heading of "agency costs." However, the decomposition of agency costs can be helpful in examining the intertemporal contracting problem in a divisional firm.

IV. A COMPARISON

A. A Divisional Unit vs. An Independent Unit

We consider a multidivisional firm which operates with n-divisions. Each division operates independently from all the others in different product line(s). We also assume that each division has achieved economies of scale in its functional area and that it is fully competitive with other units of similar product line(s) in the market. In other words, divisional units (hereafter D.U.) are fully compatible with competing independent units (I.U.). The only difference is the nature and degree of forces that restrict managerial behavior. Specifically, the manager of a D.U. has to reconcile the demands of the following constituencies:

- (a) Capital markets constituency: Lenders of capital want to have greater assurance that their wealth will be returned intact. Shareholders' wealth is directly enhanced or diminished by actual transfers of funds under management control. Capital markets continuously evaluate managerial performance and accordingly reward or penalize dysfunctional behavior by providing or restricting sources of capital for future expansion.
- (b) Product market constituency: Customers demand reliable products at the lowest price, and suppliers of factors of production are interested in finding customers willing to pay the highest sustainable prices. The demand for a competitive product is obvious.

- (c) Internal organization constituency: Decisions made by a D.U. manager should be in line with the internal requirements, that is, rules that have been established by the top managers. In particular, the rules may require, among other things, the integration of business units and the balancing of the product portfolio. The former implies allocation of funds in order to achieve growth and market share. The latter indicates potential cross-financing or cross-subsidization in order to implement the desirable diversification objectives.

A firm with an I.U. will have to reconcile the demands of the product market and capital market constituencies. Managers of an I.U. are evaluated by the product markets in the same way as are D.U. firms. In fact, the product market constituency will be best satisfied when the corporation's profit margin provides the lowest acceptable return to investors. However, a D.U. firm differs from an I.U. firm with respect to internal structure and administrative regulations. The manager of a D.U. firm is evaluated not only on the basis of market signals indicating the competitiveness of the product, but also according to the extent of his conformity to and compliance with internal rules.

All other things being equal, managers of I.U. and D.U. firms face the same opportunity set. However, the existence of the internal organizational constituency affects a business unit's decisions and alters managerial decision making at the divisional

level in two respects. First, the introduction of a hierarchical-managerial structure drastically modifies the opportunity set facing the D.U. manager. Secondly, the evaluation criteria applied and the maximization decision process employed by the D.U. manager are generally different from those used by an I.U. manager. For these reasons we would expect that financial decisions made by a D.U. manager would be different from those made by an I.U. manager. Both the internal managerial environment and the capital markets restrict the possible range of actions that can be taken by a D.U. manager. Thus, we can state the following propositions:

Proposition I

A D.U. manager has the tendency to adopt financial policies with shorter horizons.

Discussion

The performance of a D.U. manager is based on a control system which is financial in nature. The top coordinator, having "bounded rationality"⁵ and incomplete information concerning the operating problems of the business units, will seek to adopt control systems which are standardized across divisions. By accepting standardized control procedures, the top coordinator of a multidivisional corporation can extract that portion of information he needs in order to review divisional performance.

⁵Bounded rationality refers to human behavior that is "intendedly rational but only limited so" (Simon, 1957). Individuals experience physical limits with respect to their ability to store, receive and process information. Under certainty, contingent claim

A D.U. manager will have more information than the top coordinator about the opportunity set, expected returns, and other variables which are crucial to the financial decisions for the division. Although he knows the true probability distribution of a project's cash flow, it is difficult to communicate this information to the top coordinator with credibility. Problems associated with informational impactedness (Williamson (1975)) further complicate the transmission of information.⁶ In addition, the D.U. manager knows that he is being judged on the basis of uniform standards that do not allow for explanations of unexpected, below the average, performance. In view of the above stated conditions, the D.U. manager has the tendency to take short-term actions. Financial plans that generate long-term results involve present sacrifices for future benefits. Since the D.U. manager is judged on the basis of standardized financial criteria, the adoption of long-term plans will require explanations regarding diminishing current returns. Explanations of this sort are difficult to be presented to the top coordinator in a credible way. It should be noted that this is not

contracts can eliminate this problem. In an uncertain environment bounded rationality complicates economic problems.

⁶Information impactedness is relevant to asymmetric information among agents. It exists when the true underlying circumstances relevant to a decision are known to one party but cannot be costlessly communicated to other parties. Williamson (1975) distinguished information impactedness between buyers and sellers and specifies conditions for ex-post and ex-ante information impactedness.

a failing of the top coordinator, but simply a reflection of the fact that he experiences limitations with respect to the processing of diverse and complex information he is confronted with. To avoid the problem of imperfect communication with the top coordinator, the D.U. manager prefers to take actions having short-term results that will generate both good news in the capital and product market constituencies and at the same time satisfy the internal managerial rules.

Proposition II

The D.U. manager tends to be risk-averse. All other things being equal, he will prefer to accept projects that are less risky than others.

Discussion

It is possible for a risky project to generate negative returns. It is very hard for the D.U. manager to communicate in a credible and verifiable way the "correct" ex-ante probability distribution of a risky investment. On the ex-post basis the top coordinator might interpret negative results as an indicator of managerial inability or as a lack of effort in implementing profitable projects. Moreover, the capital markets will react unfavorably to the announcement of a failure. On the other hand, on an ex-post basis, positive performance will be justified on the basis of favorable market conditions or pure luck rather than on the D.U. manager's ability to take correct action. A more plausible

explanation would be that prevailing information asymmetry makes it difficult for the top coordinator to distinguish real managerial effort from state uncertainty. Under these circumstances, the D.U. manager perceives a potential imbalance in the evaluation of his performance by superiors and other constituencies: he feels that he is charged with the full blame for any failure, and receives only partial credit for any superior performance. Therefore, given the D.U. manager's inability to accurately communicate the risk-reward tradeoffs of a financial plan and his perception of being judged unfavorably by accepting risky projects, he will be forced to adopt policies that exhibit risk-aversion.

In extreme cases, the above proposition suggests the following conclusion: well-diversified firms of the type that we have described, despite their ability to bear business risks, behave as risk-averse institutions. Therefore, the benefits from diversification come from a cost/benefit analysis. The cost includes losses due to an unwillingness to adopt risky policies. Also, Proposition II contradicts Jensen and Meckling's results. Although in a different setting, Jensen and Meckling (1976) claim that the owner-manager, in an attempt to exploit outsiders' wealth, will adopt risky projects. However, internal managerial regulation, as was discussed above, will prevent this possibility.

The previous analysis indicates that the administrative structure of a multidivisional firm generates substantial organizational costs. We name these costs managerial regulatory costs to

distinguish them from the agency costs of the Jensen and Meckling type. Managerial regulatory costs refer to the aggregation of divisional losses due to internal administrative regulation. These costs are the result of the behavior of divisional managers who respond to market and organizational forces. In this sense, dead-weight losses occur mainly because of the indirect constraints placed on divisional managers by the internal organizational structure. On the other hand, agency costs represent losses which result from the self-interest behavior of managers who pursue personal goals which are generally different from organizational goals. Monitoring, bonding, and residual losses reflect suboptimal managerial decisions at the top of the organization. Managerial regulatory costs are the manifestation of the imperfections of the hierarchical structure of the modern corporation.

B. Exploring Some Trade-offs

Looking at the consequences of the managerial/internal regulation, we can conclude that there are some plausible conditions which force the firm to operate with internal costs. While this is not necessarily true for all companies, some negative forces are evidently present and might prevent the firm from achieving the full benefits from diversification. However, abundant evidence indicates that the multidivisional structure is a common organizational form. In order to explain this regularity, we should consider not only the internal managerial costs, but also the benefits from operating synergies and diversification.

In section II(b) of this essay we presented some economic reasons that justify the existence of the multidivisional firm. Here, we provide a different reason which is based on managerial synergies. Jensen and Ruback (1983) and Jensen (1983) argue that managers are self interested individuals, but the environment gives them relatively little freedom to satisfy their interests. Among other things, the market for corporate control forces the top manager to be quite efficient in managing corporate resources. Certainly, there is informational asymmetry between the top manager and D.U. managers regarding the general administration of the corporate assets. The behavior of the D.U. manager towards risk is a reflection of the fact that the top manager does not want to follow policies that will jeopardize his ability to compete effectively for the right to manage the firm's corporate resources.

As it was stated above, there is a cost side and a benefit side of the analysis of the divisional financial decisions. A multidivisional organization represents a balance between the marginal benefits and the marginal costs associated with additional divisionalization. The cost side includes the managerial regulatory costs which are the result of the substitution of the market disciplinary forces with an imperfect administrative structure. On the benefit side we consider the arguments presented in section II(b). Obviously, a multidivisional organization has survival value only when marginal benefits exceed marginal costs.

To say that a multidivisional firm has survival value does not imply that a free-standing firm, an I.U. firm, will disappear from the market. That is, the fact that a divisional unit of a multidivisional firm overcomes costly constraints does not necessarily mean that other firms with different internal structures will fail to exist. The reason for this is that I.U. firms and D.U. firms represent alternatives, while not necessarily compatible, ways of organizing economic activity. They differ only in the method they use to constrain behavior and, therefore, experience different levels of costs for the same transactions. The administrative structure of a multidivisional firm modifies the opportunity set faced by D.U. managers by replacing a series of financial decisions with a single employment contract. This employment contract produces behavioral constraints which force D.U. managers to make costly suboptimal decisions. Although capital markets penalize suboptimal managerial decisions, it is expected that their corrective force will take into account the benefits associated with the internal organizational structure.⁷

V. CONCLUSIONS

The focus of this essay has been on the further development

⁷Capital markets are rational in assessing managerial decisions. When capital markets discipline the D.U. manager or the top coordinator of a MD firm, they take into consideration the problems associated with the internal organizational structure.

of the agency theory. We believe that the integration of the agency literature with the concepts of internal organization will provide an operational framework within which observable managerial behavior can be explained under a set of realistic assumptions.

In this paper we address the question: How are the financing decisions of a manager who is responsible for the performance of a divisional firm different from similar decisions that would be made by the same manager if he were managing an autonomous unit (outside the influence of the multidivisional firm)? We examined this question in section IV of this paper, using a conceptual framework.

The central hypothesis of our analysis concerns the nature of financial decisions made by divisional managers. It was suggested that D.U. managers tend to select financial policies with short-term horizons. In addition, we provide arguments that support the hypothesis that D.U. managers prefer to accept less risky projects. The major cause of this behavior was explained on the basis of the internal regulatory environment that appears in multidivisional firms. In our framework we identified some deadweight losses (managerial regulatory costs) which are the reflection of the fact that a divisional manager operates under dual constraints: the internal administrative structure, and the market disciplinary forces. It was advocated that, despite the costs that result from the internal organizational structure, the multidivisional organizational form has a survival value since the marginal benefits exceed the marginal costs.

Our work deals with issues that link the internal organization with the principal-agent model. Still an unsettled issue is the pervasiveness of the Jensen and Meckling type agency costs in multidivisional structures. Even if we accept the thesis developed by Fama and Jensen (1983) regarding the agency costs in a multidivisional form, this essay has shown that there are some other potential costs that prevent the firm from operating without any internal friction. It is our belief that the managerial regulatory costs can provide a rich environment within which the investment and financing decisions can be examined in a practical manner. Indeed, the propositions developed in this essay have some practical implications.

PART III
BIBLIOGRAPHY

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