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ACCOUNTING FOR INTERNALLY DEVELOPED SOFTWARE COSTS: A
POSITIVE APPROACH

City University of New York

PH.D. 1985

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ACCOUNTING FOR INTERNALLY DEVELOPED
SOFTWARE COSTS: A POSITIVE APPROACH

by

EL-SAYED HUSSEIN AHMED KANDIEL

A dissertation submitted to the
Graduate Faculty in Business
Administration in partial fulfillment
of Doctor of Philosophy, The
City University of New York.

1985

This manuscript has been read and accepted for the Graduate Faculty in Business Administration in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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ACKNOWLEDGEMENTS

The satisfactory performance of a dissertation research project is not the result of the efforts of any one person. Instead, it is the culmination of intellectual interaction between a Doctor of Philosophy candidate and a dedicated dissertation committee. Each of my official committee members played vital roles in this research project.

Professors Victor Pastena and Martin Benis of the Department of Accounting guided me from an initial, unstructured idea through a completed dissertation. Professor Ashok Vora of the Department of Economics devoted a lot of his time to verify the results of my statistical analyses and was responsible for my proper use of the repetition technique to balance the sample. Professor In-Mu Haw of the Department of Accounting offered a constructive contribution to my research by his valuable comments.

A special word of appreciation is due to Professor Martin Benis the chairman of the Accounting Department for his assistance to me and to all the Ph.D. students during the course of our program.

Also, I would like to express my appreciation to my parents, my parents-in-law, my sisters, my brother, my

sons Ahmed and Asser for their support.

My final acknowledgement is of a very special kind. It is to my beloved wife, Aziza, whose love and often-needed encouragement as well as the many hardships she endured during the past seven years, helped me to overcome the pains of the hard times and to achieve my goal.

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CHAPTER I

INTRODUCTION

Recently the Securities and Exchange Commission (hereafter, SEC) found an increasing number of registrants starting to capitalize costs of internal development of computer software. As a result of that trend, on April 14, 1983 the SEC authorized the publication of proposed rule 3-21 of Regulation S-X and item 21 (j) of form S-18 for public comment.

The SEC expressed its concern about continuation of the trend towards capitalization because this trend created a source of incomparability in financial reporting between those registrants that are capitalizing such costs and those that are following the predominant practice of expensing them as incurred. Also, the Commission was concerned about the potential for inappropriate capitalization in the absence of clear guidance.

By issuing the proposed rules, the SEC intended to accomplish the following:

1. To maintain present practice in place during the time the private sector develops clearer guidance for the classification of the costs of these activities. Such guidance is needed regarding both the relationship of internal development of computer software to research and

development, (hereafter R&D), and the proper accounting for the costs of any such activities which are not R&D activities. The latter issue is not explicitly addressed by the existing accounting literature.

2. To facilitate comparison of financial information of companies engaged in these activities by requiring disclosure of the effect of not expensing all such costs as incurred which the SEC understands to be the predominant accounting practice in the industry.

During the comment period which expired May 31, 1983 the Commission received a total of 49 letters. (Representation among the commentators was as follows: industry and related groups (38); accounting firms and groups (8); others (3). The latter groups include a letter prepared by Financial Accounting Policy Committee of Financial Federation which stated that it encompassed the view of approximately 40 analysts who specialized in the securities of registrants in the computer service industry. A list of the commentators is included in Appendix A.) Some commentators supported the rules and others opposed them. The main proponents of the proposed rules were the financial analysts who believe that internally developed software costs should never be capitalized. Their belief is based on the following:

- 1- This cost is very similar to R&D expenditure and therefore it should be expensed according to FASB

Statement No. 2.

- 2- The substantial degree of competition in the industry as well as the very rapid pace of change makes capitalized software development costs a highly questionable asset.
- 3- There is potential for abuse in this area because of subjectivity involved.

Most of the opponents were from the industry and the public accounting firms who believe that prohibition of adopting the practice of capitalization will have the following undesirable results:

- 1- A prohibition would be inequitable because companies that had previously disclosed a capitalization practice would be allowed to continue it, while others who, for various reasons, had not made such disclosure would be precluded from adopting an accounting practice that would be appropriate for their software development activities.
- 2- Such an action by the SEC conveyed a bias against the practice of capitalization and thus would prejudice the outcome of the private sector standards-setting activities which had already begun prior to the SEC's proposal, and unfavorably impact the credibility of private sector standards-setting in general.
- 3- The companies which are prohibited from adopting the

practice of capitalization, especially smaller companies, would not be able to effectively compete in the capital markets for funds necessary for growth due to the fact that their financial statements would suffer in comparison with others in the industry permitted to continue capitalizing.

On August 4, 1983, the SEC imposed a temporary ban on the adoption of the practice of capitalizing costs of internal development of computer software to be sold or leased to others. The new SEC's rules:

- 1- prohibit any company that had not disclosed capitalized internal costs of developing computer software for sale or lease in: (a) audited financial statements issued prior to April 14, 1983, (b) a report or registration statement filed with SEC prior to that date, or (c) an offering of securities other than a registration statement made prior to April 14, 1983, from adopting such practice in financial statements filed with the Commission after April 14, 1983.
- 2- Require a company that continues to follow an approved practice of capitalizing these costs to disclose, for each period for which an income statement is required to be presented, only the amount of internal software development costs capitalized during the period, less amortization to

ascertain the impact of capitalization on the financial statements.

The Commission reminded companies that have capitalized computer software costs that their financial statements should include disclosure of the policies being followed, together with the net amount of such costs capitalized. The method and period of amortization, as well as the bases thereof, should also be disclosed. Finally, companies are reminded that careful periodic evaluation of the recoverability of capitalized cost is necessary.

Management Choice Within the Framework
of the Positive Economic Theory

"[In the recent years] attention has been given to developing a positive theory of management's role in the selection of the accounting methods and formulation of accounting standards. All of these efforts seek explanation for management's concern with the accounting procedures used in preparation of the firm's external financial reports. Attention is directed to management's motivation for choosing alternative accounting methods and for reacting to proposed and enacted standards. A positive theory seeks to explain observed phenomena by searching for the reasons that events occur. This orientation differs from descriptive research, which

focuses in depicting what actually occur. In the accounting context, positive research seeks to explain and predict the existence of an observed set of procedures rather than to identify solely what procedures managers actually use or should use in financial reporting. On a general level a positive theory asks why management is concerned with the accounting procedures used in preparing financial reports. Underlying recent research efforts is the assumption that managers (and other parties to the process) act rationally, seeking to maximize their personal wealth. In addition, informational efficiency in the stock market is presumed. Agency cost theory is the economic model underlying these efforts, wherein the firm is viewed as a set of contracts mitigating the conflicts of interest among management shareholders and bondholders" [Kelly (1983), p. 111].

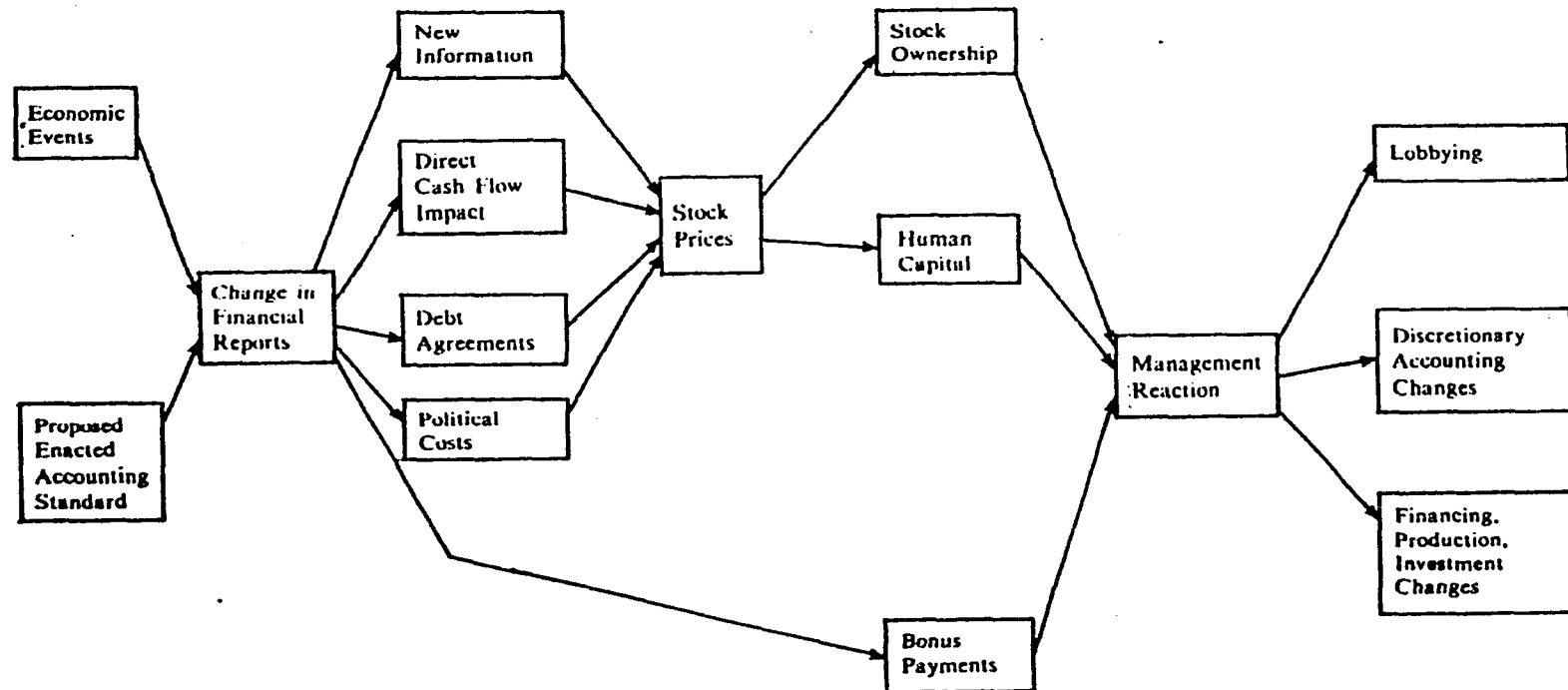
Components of Management Wealth

Intervening between a change in the firm's financial reports and management's reaction are the wealth effects of the change. The avenues for such effects and thus the incentives for reacting, are depicted in the center of Figure 1.

To understand why managements are concerned with the accounting policies used in external financial reporting it is necessary to identify the manner by which accounting

Figure 1

Wealth Effects and Reaction to Accounting Changes



Source: Kelly (1983), Journal of Accounting Literature
Spring, 1983, p. 113.

methods affect management's wealth. Managers are assumed to maximize their wealth, which is a function of current and future compensation: components of managerial compensation include salary, incentive remuneration such as cash bonuses and stock or stock option, or nonpecuniary rewards, and enhancement to the value of managerial human capital.

Incentive remuneration and the value of human capital are affected by the firm's financial reports, both directly and via the stock market. These effects may occur through changes in the level of bonus payments, the disclosure of new information, direct cash flow effects (e.g., tax effects, bookkeeping costs), and expected cash flow impacts (e.g., debt covenants, political costs).

Positive theory research focuses on the cash flow effects of accounting procedures and the resulting impact on management's wealth, as the motivation for management to choose from alternative accounting methods and react to accounting standards. Management's decisions regarding accounting procedures are intended to enhance the level of bonus payments or the firm's stock prices (thereby increasing the value of stock, stock option, and human capital).

Contracting Theory

Coase (1937, 1960) was the first to conceptualize

the firm as a nexus of contracts among the various production factors. Attention then turned to property rights, in which contracts create certain rights for each of the parties within a firm. Alchain and Demsetz (1972) viewed these contracts as necessary for team production by the various inputs. Since each member of the team is motivated by self interest, Alchain and Demsetz are concerned with shirking or the need to monitor team production to reduce malfeasance. Jensen and Meckling (1976) studied contracts between bondholders and shareholders-management and between shareholders and management. These contracts minimize the cost associated with shirking or the inherent conflicts of interest between the parties. An alternative view has been preferred by Fama (1980). The internal and external managerial labor markets are suggested as sufficient for "full ex post settling up," thus, eliminating the need for contracts to adjudicate the various conflicts.

"Viewing the firm as a nexus of contracts gives rise to issues regarding how such agreements are affected by accounting policies. How they are affected, in turn, has cash flow implications to the firm and thus wealth implications to management. Since accounting measurements are used to enforce many of the contracts, agency theory is used to explain reactions of the contracting parties to changes in methods of accounting measurements. To

determine how accounting procedures affect management's compensation, the nature of the agreements that arise in the agency theory relationship is examined," (Kelly 1983, p. 115).

Agency Theory

An agency relationship is defined as "a contract under which one or more persons (principal(s)) engage another person (the agent) to perform some services on their behalf which involves delegating some decision making authority to the agent" (Jensen and Meckling, 1976, p. 308). In the context of the firm, management acts as agent for the equity suppliers (shareholders and bondholders) who represent the principals. Two potential conflicts of interest exist: the shareholders/manager conflict, giving rise to the agency cost of equity, and the bondholders/shareholders-management conflict, giving rise to the agency cost of debt. These agency costs are composed of a residual loss, bonding expenditures by the agent, and monitoring expenditures by the principal.

Acting in their own self-interest, managers do not always make decisions that are optimal for the principal. Assuming rational expectations, shareholders and bondholders anticipate this divergence and reduce the price they are willing to pay for the firm's stock or bonds. This reduced price is the residual loss, or the

decrease in market value of the firm's equity due to the discrepancy between decisions made by the agent and those the principal would make. Ultimately, the managers bear this loss in the form of a higher cost of capital. To reduce this cost, the agent may contract to ensure that the principal's interest will not be harmed or to provide for retribution if such harm occurs. These contracts representing bonding cost that are borne by the agent. Additionally, the principal may incur expenditures in attempts to restrict the manager's actions. These monitoring costs are also borne by the agent, as they reduce the price received for the firm's equity. In equilibrium, the benefits from the bonding and monitoring contracts (the reduction in the residual loss) equal the costs of contracting and management's lost utility from placing restrictions and its actions (e.g., the reduction in shirking or perquisites taken from the firm).

Statement of the Problem

Within the framework of the positive information theory managers are judged in terms of how efficient they are in providing investors with information, as well as how efficient they are in operating the company. Thus, managers have incentives to provide information, such as accounting numbers, that assist investors in predicting the firm's cash flows. Consequently, managers change

accounting rules in response to changes in a firm's cash flows distributions induced by, for example, changes in the production process, the market for the firm's services, etc.

Holthausen and Leftwich (1982), (hereafter, H&L), argue that if managers choose accounting techniques to produce reported income numbers that are good predictors of future cash flows, one can appreciate why managers of firms lobby for, or against, particular accounting techniques.

To study and to test the management's behavior empirically, it is necessary to identify the characteristics of firms that determine whether particular accounting techniques provide income numbers that are good or poor predictors. Also it is necessary to assess the costs and benefits of alternative accounting techniques in terms of their cash flow implications. This process involves identifying the points at which the selection of accounting techniques and reactions to policy prescriptions occur. At any moment in time, it may be assumed that management has chosen from alternative procedures and disclosures to establish the original set of accounting methods which maximizes its wealth, based on the economic conditions confronted by the firm and the accounting alternative allowed.

Now, if we agree that managers have incentive within

the framework of the positive theory to release financial information, and if we agree that the economic events and changes in acceptable accounting alternatives have an impact on the firm's financial reports, then three reactions to this situation can be observed. First management may lobby policy makers to initiate a change in allowable procedures or to express support or opposition to a proposed or enacted accounting standard. Second, discretionary accounting changes can be made to mitigate the financial statement effect of the economic event or accounting standard. And last, management may change the financing, production, or investment activities of the firm, also in an attempt to assuage the financial statement's effect.

But since only the choices and reactions that arise because of accounting policies are relevant to a positive theory of management's role in external financial reporting, then it is necessary to isolate these choices and reactions from those which are due to economic events. Additionally, as it was mentioned before, the differential costs and benefits involved with alternative accounting procedures and corporate reactions must be recognized. For instance, it is probably less costly for a firm to lobby than to change financing, production, or investment activities in response to an accounting policy. Offsetting these costs, and providing the incentives for

management's choices and reactions, are benefits in terms of the effect of alternative accounting policies on management's wealth. These benefits are influenced by the probability of success of the various reactions. Thus lobbying, while less costly, may be less effective in mitigating the impact of an accounting change on financial statement.

Up to now, there is a growing body of literature that provides evidence about the managements' economic incentives to adopt those reporting option which minimize political costs, relax the bending effects of debt covenants and generally maximize managements' wealth. Watts and Zimmerman (1978), (hereafter, W&Z), and Bowen, Noreen, and Lacey (1981), (hereafter, BNL) argue that firms will lobby for or adopt accounting policies that will minimize net income if they are subject to political risk through additional taxation or regulation. Dhaliwal (1980), Holthausen (1981), and Leftwich (1981) suggest that firms' managements are motivated to maximize net income and assets if their debt to equity position approaches a level that reduce managerial flexibility because of proximity to violation of debt covenants. An example of such behavior is presented by Robert D. Carkin, vice-president and treasurer of Data Architechts Inc., who said that "the company is reviewing its procedures for recognizing revenues on third quarter product sales and on

fixed-price contracts for designing computer system." (The Wall Street Journal, October 4, 1983; p. 8). Such a change in the accounting practice of recognizing revenue, by this maker of computer software for banks, is aimed to reduce the loss the company expects to have in the third quarter ended August 31, 1983.

The objective of this research is to answer the following question: Why the managements of some firms in the computer software industry chose the practice of capitalization to account for the costs of internally developed software products while the others selected to expense these costs as incurred.

Significance of the Study

The significance of this study could be summarized as follows:

- 1- This is the first academic study that addresses the issue of accounting choice and the management motivations to adopt certain accounting practice for the costs of internally developed software.
- 2- This study establishes and empirically tests a model that may be used to explain and predict the management behavior to select a single accounting method from the available alternatives for the costs of its software products within the positive theory framework.

- 3- The results of this research can be used by accounting regulatory bodies and other accounting policy-makers to predict how firms and possibly other related parties, i.e., auditors, would react to proposed changes in accounting rules. Such prediction could aid policy makers in anticipating which firms are most likely to lobby for or against the proposed rules.
- 4- The sample used in this study exhibits special characteristics which are different from any other sample used in all previous studies. The sample used in this study consists of a majority of small, high technology firms, which are traded Over-The-Counter, and a minority of large, high-technology firms, which are listed on the organized exchanges. The structure of this sample may help in investigating how the management choice is affected, if any effect exists, by the size of the companies they belong to.

Definitions of Terms

The following definitions are basic to this study:

<u>Applications software</u>	Software to accomplish tasks and provide information for business and personal use, for example, account payable, payroll, general ledger, etc.
<u>Code</u>	A written instruction that will be executed by a computer. As a verb, it means to write the instruction.

<u>Computer services industry</u>	All firms that sell data processing services, software products and services, or turnkey (integrated) computer systems.
<u>Customer support</u>	Services performed by vendors to assist customers in their use of software products. These might include installation assistance, training classes, telephone question and answer services, newsletters, and on-site visits.
<u>Detail program design</u>	The transformation of general design or product specifications into a detailed design that serves as the lowest-level blueprint for construction of the products. It takes product function, feature and technical requirements to their most detailed, logical form before coding begins.
<u>Documentation</u>	Is a written material, usually provided with software products, which explains to customers how to use products.
<u>Enhancement</u>	An improvement or extension to software products increasing its capabilities. Enhancements are often priced separately from the originally delivered software.
<u>Hardware</u>	The physical components of a computer system, including processors, storage devices, and input and output equipment.
<u>Maintenance</u>	Post introduction services that include changes, additions and corrections to computer software to either fix errors or keep it updated with technological improvements or current information (For example, the vendor may send customers additional code so that application software results comply with a new government tax regulation)
<u>Master System program tapes</u>	Magnetic tapes that are a recorded copy of a completed software product.
<u>Software</u>	A set of coded instructions that are followed by a computer to accomplish a task. There are two general classes of software: systems software and applications

software.

<u>Systems Software</u>	Software that controls the operations of the hardware; that is, it allocates data storage space, schedules the operation of applications software, and manages data storage, retrieval and communications.
<u>Test</u>	To operate software to verify that it meets the specifications of the detail program design.
<u>Turnkey (integrated) systems</u>	A complete package of hardware and software assembled to satisfy the processing needs of a user or a group of users.

Scope of the Study

This study is organized in the following manner:

Chapter II: This chapter is devoted to present a review of the related literature. In the first section of this chapter the researcher introduces the software production cycle as a fundamental background to understand the nature of this industry. The accounting treatment of the costs of internally developed software is presented in the second section. This section presents also a comparison between the computer software industry and motion pictures and record and music industries. The last part of this section summarize the accounting issues which were investigated by the Accounting Standards Executive Committee's Task Force on Accounting for Development and Sale of Computer Software and the advisory conclusion regarding these issues. The third section of this chapter summarizes related literature in the R&D area, while

section four of this chapter presents a review of the theoretical and empirical literature in the area of the economic positive theory which constitute the theoretical ground for this study.

Chapter III: This chapter is devoted to the model and the research methodology. In the first section the researcher introduces the framework of the managerial choice and in the second section summarize the choices available to the management prior to the issuance of the new SEC rulings. The economic motivations for the choice are discussed and the hypotheses are established in the third section.

Section four of this chapter is devoted to the methodology. In this section the researcher introduces the model and the definition of the accounting measures that are used as the explanatory variables in the model, then the statistical techniques used to test the hypotheses are introduced. Section five describes the sample selection procedures and sources of data collection. The final section in this chapter describes the statistical procedures used to balance the sample to test the sensitivity of the results to the sampling process.

Chapter IV: In this chapter a descriptive analysis as well as the results of the univariate tests are presented. In the first section the researcher presents some statistical information about the magnitude of the amount capitalized.

In the second section the researcher introduces some statistical information about the alternatives available to the computer software companies to acquire or produce software products. The results of the univariate statistical tests are presented in the last section of this chapter.

Chapter V: This chapter is devoted to the results of the multivariate model and the interpretation of these results.

Chapter VI: In this chapter the researcher presents the conclusions of the entire study and presents some suggestions for future research in this area.

CHAPTER II
REVIEW OF THE RELATED LITERATURE
INTRODUCTION

When the SEC issued its moratorium on the capitalization of internally developed software costs and requiring companies that presently capitalize these costs to report the impact on earning if these costs were expensed for the reporting period, many companies claimed that they were harmed by these rulings, because the new rulings may imply that it is wrong to capitalize software. This may encourage investor discrimination against the capitalizing firms. Also, most computer software companies are small and they plan to grow through internal reinvestment of profits as well as through acquisitions. Also, forcing a company which capitalizes its software development to identify itself as deviating from "accepted" accounting practice, would limit the companies choices of acceptable acquisition candidates.

More strongly Roy W. Myers, the comptroller of Dyatron Corp, argues, in his comment letter to the SEC, that "(the) SEC has taken a step back in time on this issue. From reading the proposed rule, it is obvious that the SEC does not understand the computer services industry and takes the position that only tangible assets are

allowable for balance sheets. From an asset value standpoint, computer software is one of the few assets today that will appreciate over time" (emphasis added).

In the first section of this chapter the researcher introduces the production cycle of the software products, and in the second section presents the treatment of the costs of internally developed software in the current accounting literature. Section three reviews the empirical studies in the area of R&D, and the final section presents a review of the empirical studies in the area of positive economic theory which represents the theoretical ground for the current study.

Software Production Cycle

The software production cycle consists of a series of stages and starts from its conception through key decision points to its completion. These stages are also applicable in the enhancements cycle, though the stages are less time consuming.

This cycle is basically the same among all software manufacturers, but the details of each stage may differ from one firm to another.

For simplicity purposes, the production cycle is described here sequentially, though in practice activities in different stages may occur at the same time, and certain activities may be repeated.

Major Phases of Software Production Cycle

Software production cycle involves the following major phases:

Phase I: Planning and Design

This phase is aimed towards establishing technological, market, and financial feasibility. It consists of a series of iterative activities and decisions and it continues until final decisions are made regarding the design for the product and the technological market and financial feasibility of producing and selling it.

If the proposed software products are similar to other products then a little detailed planning will be required to establish their feasibility. But if the proposed products are different then a detailed program design and even considerable coding will be necessary to establish their technological feasibility.

In some companies, planning may be more informal; in others, planning is formally documented. In the latter case the company develops:

A- A product plan

A product plan involves the following activities:

- 1) defining the business or customer need the product will meet,
- 2) provides a market and environmental analysis,
- 3) describes the product feature requirement which involves defining all the functions the product

must perform to satisfy the business or the customer needs,

- 4) evaluates technical constraints to determine required technical characteristics,
- 5) specifies the software design in sufficient detail to support technical feasibility analysis and construction planning, and
- 6) describes documentation and customer support requirements.

B- Construction plan

The construction plan addresses the physical construction of the product. It determines methodologies for transforming the product specifications into the detailed program design and for actually building the product. It provides estimates of the project complexity, the manpower, skill levels required to construct the product, the hardware and software resources required, adequacy of resources to successfully complete the project, and the project timetable.

C- Financial feasibility plan

An appraisal of the financial return on the investment in the product is fundamental for a management decision. The financial feasibility plan therefore generally includes a forecast of sales based on estimated pricing and unit volume for the

package and a forecast of cost that reflects the personnel and computer resource requirements described in the construction plan. Other significant costs that might be included in cost estimates are travel costs incurred in surveying potential users, cost incurred in product planning, and estimated costs of products distribution.

Also management should assess its risk of failure by examining factors such as the experience of the organization, the reliability of previous planning, the capability to finance, build, market, and support the product, the nature and size of the market, the product life cycle, the viability and volatility of the market, the risk of technological and market obsolescence and the length of development time.

Those risks are considered in light of the expected return, and in some instance management may decide to proceed despite high risks, because the expected return is high as well.

The planning phase ends with a decision to accept or reject the plans for the product. If they are rejected, the process may cease or plans may be revised until management is satisfied that the feasibility has been established. If the plans are approved, the construction phase begins.

Phase II: Construction phase

The construction phase involves the following stages:

1- Detail program design.

At this stage the general design or product specifications are transformed into a detailed design that serves as the lowest level blueprint for construction of the product. This stage is required before programming the software product. It takes product function, feature, and technical requirement to their most detailed, logical form before coding begins.

This stage may also include the development of test plans and test data. The quality of the product may be tested at this point to determine if the results of the design satisfy the requirements specified in the products, construction and financial feasibility plans.

2- Code and test.

With detailed specifications complete coding of the package begins. This process is often labor intensive, requiring many resources to implement the detail design.

When all programs have been completed, the systems must be tested in its entirety. This product quality assurance step is often referred to as system testing. To make sure the system is tested impartially, many organizations use a quality assurance

group that is not part of the construction team.

In the final stages of the system testing, the system is thoroughly checked for errors, which are then corrected. Once that procedure is completed, the package is ready for introduction into the market.

3- Product Introduction

In this stage the software is promoted, duplicated, and packaged for delivery. This includes the production of the master system program tapes, documentation, and training material. The product is now ready to begin earning revenue.

Phase III: Post introduction activities

Even after a software package is introduced to the market and sold or licensed, many companies continue to perform certain activities to make sure that their product is properly installed and maintained and that users are properly trained.

In this phase, errors (bugs) may be found that were undetected in the construction phase. The errors are generally minor and are corrected either by the original designer and coder of the product or by an independent individual or group whose function is to correct program errors.

In addition, minor enhancements to the product are often created in this phase to adapt the product to changed condition. For example, a change in tax rates

would require a minor enhancement to a tax software package that was coded using tax rates in existence at the time the package was created.

The question may arise about which portion of the production cycle costs, if any, is or is not eligible for capitalization.

From a theoretical point of view, the Association of Data Processing Services Organizations (hereafter, ADAPSO) recommends that the costs of conceptual formulation (design), the market research, the market forecasting, and the maintenance costs are not eligible for capitalization. Whereas the costs of detail plans, programming, testing, documentation, integration, market materials, and enhancement and improvement costs are eligible for capitalization dependent on risk analysis.

Away from the theoretical recommendation, the researcher attempted to find out which portion of the production costs is actually capitalized. The financial statements of the selected sample (the sample selection is presented in Chapter III), which consists of 205 companies, were examined. Out of these 205 companies the researcher found that 31 companies (15.1 percent) capitalize different portions of their software production costs. The classification of those capitalizing firms according to the type of costs they capitalize is presented in Table (2.1).

From Table (2.1) it can be seen that, 17 companies (about 55 percent) capitalize the improvements and the enhancements cost. Whereas 13 companies (about 42 percent) selected to defer different portions of the construction and the development costs. It is clear that the majority chose to capitalize the costs of enhancing and improving their software depending on their belief that such costs are not R&D as defined in paragraph 8(a) and 8(b). This belief was supported by the silence of Interpretation No. 6 about enhancement and improvement activities.

The Treatment of Software Construction Costs
in the Existing Accounting Literature

Prior to October 1974, the practice of capitalizing the costs of internally developed software was common, no guidelines existed and practices varied widely. When the FASB issued Statement No. 2 (hereafter FAS#2) in October 1974 it was understood that the use of the capitalization method is disallowed based upon the premise that all software construction costs was deemed to be R&D.

This position was formally challenged by the computer hardware and software industry when some companies such as IBM Corporation continued to use the capitalization method to account for software construction costs even after the issuance of FAS#2 and up to now.

Some other companies such as Dyatron Corporation and Comserv Corporation used the capitalization method consistently since 1974 following the issuance of FAS#2. (In the annual Report of 1983 Dyatron Corp. disclosed that it switched back to the expensing method to account for the costs of internally developed software!)

A third group of companies switched to the capitalization method in recent years such as Anacomp Inc., which switched to the capitalization method in the second quarter of 1983 to account for the enhancement cost. A fourth group disclosed that they intended to switch to the capitalization method but were prohibited by the issuance of the SEC releases No. 33-6476, and 34-20061. The Continuum Company is an example of the fourth group, the company disclosed in its Annual Report of 1983, p. 19 that intention when the management stated that ". . . The company had expected to account for development costs of its new CCA system incurred after December 31, 1982, when customer payment began, as capitalizable costs (emphasis added).

To sum up, the issuance of FAS#2 and subsequent pronouncements issued by the FASB did not prevent the diversity in the practices employed to account for the costs of internally developed software. The researcher found that about 15 percent of the selected sample followed the capitalization method to account for software

construction costs.

From the above discussion it became apparent that existing authoritative literature as presented in FAS#2, FASB Interpretation No. 6, and FASB Technical Bulletin No. 79-2 was not exclusive in setting up an appropriate guideline to account for software construction costs.

In FAS#2, paragraph 8(a) and 8(b), the Board set up definitions for Research and Development. And in paragraph 31 of the same statement the Board applied those definitions to computer software when it stated that "computer software is developed for many and diverse uses. Accordingly, in each case the nature of the activity for which the software is being developed should be considered in relation to the guidelines. . . to determine whether software costs should be included (in) or excluded (from the definition of research and development). For example, efforts to develop a new or higher level of computer software capability intended for sale (but not under a contractual arrangement) would be a research and development activity encompassed by this statement" (emphasis added).

The Task Force of the Accounting Standards Executive Committee (hereafter Task Force) has discussed in detail (paragraphs 67-77) how the diversity in practice regarding software construction costs is attributed by some to ambiguities that exist in both the definitions and the

examples in FAS#2, this discussion is summarized as follows:

- 1- There is disagreement about the activities to be classified as research as it was defined in paragraph 8(a).
- 2- There are two different interpretations of how to apply the definition of development (as defined in paragraph 8(b)) to account for software as follows:
 - a) Some believe that development does not end until the software product is essentially completed, because whether it can be completed is uncertain until then. Moreover, the need for design modifications in the construction phase is evidence that development takes place throughout that phase.
 - b) Others believe that development is essentially complete before the construction phase begins and that design modifications during construction phase are too minor to conclude that development continued during construction phase. They believe that the translation of research findings and conceptual formulation, design, and testing of products alternatives occur before the construction phase. Indeed, for construction to begin there must be a single product design. Further, though testing occurs during the construction phase, they point out that it is testing of the product's operation, not

testing of product alternatives. The construction of prototype and operation of pilot plans is irrelevant in applying the definition of development to software in their view. They regard the establishment of technological feasibility as the key point in determining when development has ended.

3- The last sentence in paragraph 31 (underscored) has been interpreted in several different ways as follows:

- a) "New or higher level of computer software" means new in the technological sense, which would exclude most current software construction from the definition of development, because it does not use new technology.
- b) "New or higher level of computer software" means new or higher level in the product sense and is determined by reference to company.
- c) "New or higher level of computer software" is determined by reference to the market. If the product, or one substantially similar, already exists in the market, efforts by others to develop the product are not development. In other words, only the first company to develop, construct and market the product incurs development costs for the product.

Assuming that it has been determined that the software product is a "new or higher level capability" there are still two opinions about the phrase "efforts to

develop":

- a) The "efforts to develop" run through the entire software production cycle. Though all innovation would probably have occurred before construction begins, the entire construction process is part of "efforts to develop" and therefore is development.
 - b) "efforts to develop" are completed before construction starts.
- 4- The guidance in paragraphs 9 and 10 of FAS#2, which provides examples of activities that are and are not research and development has also been applied in diverse ways to software, for instance examples (a) through (d) of paragraph 9 are generally considered to take place before construction.

Moreover, some believe that examples (a) through (c) of paragraph 10 occur only after sales have begun and that similar activities during construction phase are part of development. Others say that those activities are construction and post introduction activities and that their presence in construction phase is a further indication that construction is not development.

On August 31, 1984, the FASB issued an Exposure Draft, "Accounting for the Costs of Computer Software to Be Sold, Leased, or Otherwise Marketed." In this proposed statement the Board deleted the following

portion of paragraph 31 of FAS#2: "For example, efforts to develop a new or higher level of computer software capability intended for sale (but not under a contractual arrangement) would be a research and development activity encompassed by this statement."

Leaving FAS#2 and moving to FASB Interpretation No. 6, we find that paragraph 7 requires that "costs incurred for conceptual formulation or translation of knowledge into a design" (emphasis on the original) be classified as research and development "if the development of software is undertaken to create a new or significantly improved product or process without any contractual arrangement." It also requires "other costs, including programming and testing software" to be classified as R&D costs if they are incurred in the search for or evaluation of product or process alternatives or in the design of a pre-production model."

However, programming and testing costs are not to be classified as R&D "when incurred, for example, in routine or other on-going efforts to improve an existing product or adapt a product to a particular requirement or customer's need" (emphasis added).

Three remarks should be mentioned about FASB Interpretation No. 6:

- 1) The interpretation does not address the classification of costs incurred after the search for or evaluation of

product or process alternatives or after the design of a pre-production model.

- 2) The interpretation uses undefined terminology, it uses an example that may be viewed as restrictive or illustrative. For instance the use of the phrase "for example" in paragraph 7 (underscored) has diminished clarity regarding the classification of costs. Some interpret the phrase to mean that these costs are not R&D only when incurred to improve an existing product or to adapt a product to particular requirement or customer's need. Others believe that the example is not intended to be restrictive and that costs of programming and testing related to activities other than those in the example can also be other than R&D costs.
- 3) A literal reading of the Interpretation No. 6 could lead to a questionable conclusion that no enhancement activities are R&D.

In its recent Exposure Draft which issued on August 31, 1984, the FASB deleted the following portions of FASB Interpretation No. 6:

- a) The phrase in paragraph 3 that states: For example, efforts to develop a new or higher level of computer software capability intended for sale (but not under a contractual arrangement) would be a research and development activity encompassed by this statement.

- b) The phrase in the first sentence of paragraph 6 that states: or as a product or process to be sold, leased or otherwise marketed to others for their use.
- c) Paragraphs 7 and 9.
- d) Portions of paragraph 8 that state: Developing or significantly improving a product or process that is intended to be sold, leased, or otherwise marketed to others in a research and development activity (see paragraph 8 of Statement No. 2). Similarly, developing or significantly improving a process whose output is a product that is intended to be sold, leased, or otherwise marketed to others is a research and development activity.

After FAS#2 and FASB Interpretation No. 6 were issued in 1974 and 1975 respectively, the Board issued its Technical Bulletin 79-2 to answer a specific question: "Are all costs incurred to produce computer software considered research and development costs under FASB2 and Interpretation No. 6?" It answers that "Statement 2 and Interpretation 6 do not require that all computer software production costs be considered research and development costs. . . ."

Also the Bulletin says that ". . . a determination that software production costs are not research and development costs does not necessarily mean that they would be inventoriable to future operations (emphasis

added).

The problem in implementing that statement is that there is no guidance on how to determine which costs are and which costs are not R&D. Also it presents no guidance on how to determine which cost might be inventoriable or deferrable to future operations.

The FASB Technical Bulletin No. 79-2 is superseded by the new proposed rule which its Exposure Draft was issued on August 31, 1984.

The subject of inventoriable costs for intangible assets which is eligible for capitalization is addressed in APB Opinion 17 paragraph 24, which states that: "a company should record as assets the costs of intangible assets acquired from other. . . (and). . . as expense the costs to develop intangible assets which are not specifically identifiable."

It is clear that the opinion is silent on accounting for the costs of internally developed identifiable intangibles, though the Opinion states in paragraph 6, that they are within the scope of the Opinion.

Also FASB Statement of Financial Accounting Concepts No. 3, Elements of Financial Statements of Business Enterprises, presents another guidance on capitalization when it defines an asset as "probable future economic benefits obtained or controlled by a particular entity as a results of past transactions or events."

Although that definition is useful as general guide, there is considerable disagreement regarding its application in recognizing and measuring costs of developing and constructing software products. The opponents based their argument on the following factors:

- 1- The useful life of the software products is generally so short that the capitalization and allocation of costs, compared with an immediate charge to expense, would result in only minor differences in the timing of expense recognition.
- 2- It is difficult to demonstrate that the future economic benefits of software construction are probable.

The researcher argues that the definition of an asset as stated in FASB Statement of Financial Accounting Concepts No. 3 could be used in recognizing the capitalized costs of internally developed software as an asset because:

- 1- Some software products require several years to construct, and their lives, which are lengthened by enhancement, may be relatively long. For instance, when the researcher examined the financial statements of those 31 companies that capitalize the construction costs found that the useful lives of the software products are five years or more in 23 companies (about 74 percent). Thus capitalization and allocation of costs, is necessary to achieve a matching of expense

with related revenue.

- 2- In paragraph 40 of FAS#2 the Board quotes a study that states that "of all the dollars of new product expense, almost three fourths go to unsuccessful products. . ."
ADAPSO found in its survey, conducted in September 1983, that over a five year period, for mainframes and minis the average cost of unsuccessful new products was 10 percent of the total spent on new product. For micros, the amount was 12 percent and for enhancements, it was 6 percent. These results show that the degree of uncertainty about the future benefits of the products in the computer software industry is less than many other industries.
- 3- Viewing the software industry as a whole, the probability of recoverability in general has improved, and the ability to demonstrate the probability of future economic benefits has also improved, because of improvement in product planning. Technical, market, and managerial risks have been reduced in many companies in the industry. The software industry is similar to other industries, and its problems in evaluating recoverability are not greater than those of other industries.

Similarity Between the Software and Motion Picture and
Record and Music Industries

It has been argued that activities in software development are similar to those activities in the development of motion pictures and music industries. For example, the creation of software for outside marketing requires an investment of time, money and talents of the programmer with the expectation of future revenues. The development of motion picture and record masters, the software industry contends, requires a similar investment, with an equally intangible projection of future revenues.

Moreover, paragraph 11 of FASB Statement No. 50, Financial Reporting in the Record and Music Industry, uses recoverability as the determining factor for capitalization: the portion of the cost of a record master borne by the record company shall be reported as an asset if the past performance and current popularity of the artist provides a sound basis for estimating that the cost will be recovered from future sales. Otherwise, that cost shall be charged to expense.

While FASB Statement No. 50 uses the recoverability as a condition for capitalization, paragraph 10 and 11 of FASB statement No. 53, Financial Reporting by Producers and Distributors of Motion Picture Films, unconditionally require that, "costs to produce a film (production costs) . . . be capitalized as a film cost inventory and. . . be

amortized. . . in the same ratio the current gross revenues bear to anticipated total gross revenues." The statement also requires that such assets be written down to net realizable value if estimated gross revenues are not sufficient to recover the film's unamortized cost.

Though the guidance in FASB Statement Nos. 50 and 53 may be clear, some believe that developing and constructing software is not an activity analogous to developing and producing records and motion pictures, and they would therefore not apply the principles in those statements to software.

This line of reasoning seems to suggest that future revenues or benefits from motion pictures or record masters can be quantified more easily than projected revenues from software sales. Or perhaps the reasoning is that motion picture and records costs can be capitalized because there is a more precisely defined causal relationship between costs and the resulting benefits in motion picture and records production than exists in computer software development.

Issues Investigated by the TASK FORCE

The Task Force investigated the following questions in an attempt to resolve the diversity in the application of existing accounting literature:

- (1) Are any costs incurred to produce computer software

for sale or lease not research and development costs?

- (2) Can any costs incurred to produce a product that is in a form that precedes a deliverable product that meets design specification to be nonresearch and development costs?
- (3) Can any costs incurred for a software product that is in a form that precedes a preliminary working version of the program, considered by some to be the prototype, be nonresearch and development costs?
- (4) Is the establishment of technological feasibility by means other than a prototype sufficient to mark completion of the research and development phase?
- (5) If technological feasibility can be established by reference to activities documented in the planning and design phase, should completion of the planning and design phase mark the end of R&D?
- (6) Should research and development activities that are repeated when the product is primarily in the construction phase be classified as R&D?
- (7) Should any construction costs be capitalized?
- (8) Should any construction costs incurred for new and significantly improved products and enhancement be capitalized?
- (9) Does existing literature provide adequate guidance regarding recoverability?
- (10) Does the existing literature provide adequate

guidance regarding the types of construction costs (i.e., direct costs, indirect costs or administrative overhead) that should be capitalized?

- (11) Does existing literature provide adequate guidance on amortization of capitalized costs?
- (12) Should post introduction costs for installation, training, and maintenance be charged to expense when incurred?

After the investigation has taken place the Task Force reached to the following advisory conclusions (7 YES, 0 NO):

- (1) consistent with FAS#2, Interpretation No. 6, and Technical Bulletin 79-2; not all costs incurred to product computer software are research and development costs,
- (2) there are many nonresearch and development costs incurred to produce a product that is in a form that precedes a deliverable product that meet design specifications,
- (3) there may be nonresearch and development costs incurred to produce a software product that is in a form that precedes a preliminary working version of the program,
- (4) the establishment of technological feasibility by means other than a prototype is, with rare exception, sufficient to mark completion of research and

development phase,

- (5) if technological feasibility can be established by reference to activities documented during the planning and design phase, completion of the planning and design phase should mark the end of research and development,
- (6) research and development activities that are repeated when the product is primarily in the construction phase should be classified as research and development,
- (7) construction costs that are probably recoverable should be capitalized and recoverability should be reassessed on an ongoing basis,
- (8) construction costs incurred for new and significantly improved products and enhancements should be capitalized if recoverability is probable,
- (9) existing literature provides adequate guidance for
 - a) making decision regarding recoverability,
 - b) determining the types of construction costs that should be capitalized, and
 - c) selecting an amortization policy for capitalized costs, and
- (10) post introduction costs for installation, training and maintenance should be charged to expense when incurred.

Review of the Related Literature

In the Area of R&D

Introduction

"Economics, we all recite, deals with allocation of limited resources towards satisfaction of unlimited wants. Resources are typically identified as land, labor, and capital plus a technology that determines their transformation into consumer goods. Disparity between the available goods and services and the desired gives rise to scarcity and the question of what, how, and for whom to produce. The focus then shifts to description and evaluation of alternative resource allocation mechanisms for making the choices. The Pareto Criterion, by which an allocation of resources is deemed efficient if any reallocation improving the position of some individual worsens the position of others, is a commonly employed gauge of a mechanism's performance. In the absence of externalities, increasing returns to scale, and uncertainty, a perfectly competitive market system yields a Pareto optimal allocation of resources; this underlies the view that individual self-interest is compatible with society's interest. The further conclusion that Pareto optimality may not be achieved via the market system in the presence of monopoly elements provides an economic rationale for antitrust laws.

The objective of a resource allocation mechanism

appears to be, according to the analysis described above, to make the best available resources. The alternative objective of relaxing constraints through expanding the resource base of developing technology seems to be beyond its scope. Thus until rather recently, technical advances had been regarded, in the mainstream of economic theory, as unmotivated by the quest for profit and substantially unaffected by resource allocation. Instead, as Schmookler (1965) observed, technology had been viewed as a parameter like the weather, affecting the outcomes of resource allocation but itself unaffected by them. Evidence that technological progress has significantly contributed to growth in productivity, together with substantial increase in research and development activity, largely financed by government and carried out by industry may have spurred reconsideration of this view." (Kamien and Schwartz (1975, p. 1).

Accounting Research Study No. 14:

Gellein and Newman (1973) addressed the following questions in the Accounting Research Study No. 14:

- 1) What activities should be described as R&D in financial statements?
- 2) Should a portion of R&D costs be deferred?
- 3) How should deferred costs be amortized?
- 4) What information pertaining to R&D should be disclosed

in financial statements.

This study was limited to the problems of accounting for R&D costs financed by industrial companies (i.e., their study did not cover company conducted research financed by federal or state agencies). Also, their study was confined only to accounting problems of going concerns, therefore, no formal conclusions were reached regarding R&D costs of development stage companies.

Using a sample of 400 companies and by using both the questionnaire and interviews methods they were able to reach the following conclusions:

- (1) Definition and classification: Several approaches to defining research and development are used in practice, most of which attempt to distinguish basic research, applied research, and development. Those distinctions, which are difficult to make in industrial setting, are neither necessary nor desirable in accounting. The primary need of a definition of R&D in accounting is to provide a uniform basis for classifying expenditures as research and development. Although a general accounting definition of R&D that is precise enough to be used in all companies probably cannot be developed, definitions on an industry-by-industry basis probably can be developed if each industry would establish a committee to undertake the task.

The distinction between the different kinds of research programs that are found in industry are more significant in accounting than the distinction between types of research and development. Four kinds of programs are found in industry, but only two are necessary for accounting analysis: (1) Continuing research and (2) substantial development projects.

- (2) Deferral or Immediate Recognition: Accounting for research and development received little attention in accounting literature before World War I. Early authoritative literature recognized deferral of R&D costs as an acceptable practice, but deferral has not been widespread practice since R&D became a significant activity in industry. The usual current practice is to recognize R&D costs as expenses as they are incurred.

The theory underlying present generally accepted accounting principles requires that costs be associated with related revenue to measure periodic net income. To accomplish that result, accountants have traditionally divided costs into product costs and period costs and have associated the two types of costs with revenue in significantly different ways. Research and developments costs have generally been treated as period costs.

The two-type classification of costs submerges a

type of costs with significantly unique characteristics that is identified in this study as "business-preserving costs." Business-preserving costs are discretionary costs and are not related directly to current operations. They are incurred to preserve the profitability of an enterprise over the long term. Research and Development costs are a major element of business preserving costs. Since those costs are intended to benefit the future rather than the present, the theory underlying current practice would seem to require that the costs be deferred and amortized over the future periods that they are intended to benefit.

The requirements of theory, however, are difficult to apply in practice. Costs incurred in continuing research programs should be recognized as expenses immediately. This conclusion represents a practical solution to an accounting dilemma. Immediate recognition is an arbitrary basis of allocation, but alternative methods are equally arbitrary and considerably more difficult to implement uniformly.

Many of the factors pertaining to continuing research also pertain to substantial development projects, but those projects represent a greater concentration of efforts, a greater probability of successful exploitation, and a closer link to expected

revenue. The need to match the costs of a substantial project with related revenue often overrides other factors. Consequently, the costs of a project should be deferred if they meet the following criteria:

- 1- A significant project to develop a single product or a series of related products or processes should be established and well defined.
- 2- The board of directors should formally approve the project.
- 3- Technical feasibility of the products or processes to be developed should be determined and documented.
- 4- Reasonable probability of meeting planned time schedules for development, production, and sale or use of the products or processes should be demonstrable.
- 5- The estimated amount and the probable timing of potential revenue should be reasonably established.
- 6- Only costs incurred after management has evaluated and approved a project should be deferred.
- 7- Deferred costs should be limited to those that are reasonably allocable to specific future periods or future contracts.
- 8- A formal program should be established to periodically evaluate the project and to write off the costs that exceed expected revenue less

completion and selling costs.

- (4) Amortization: The amounts of the deferred costs of a substantial development project that are amortized should be deducted from the revenue of the periods benefited. One criteria for deferral is that only those costs that are allocable to specific future periods should be deferred. That criteria provides a basis for allocating the costs to time periods. Specific deferral requires that costs be reasonably allocable to specific periods or future contracts at the time deferred. That requires estimates of the amount and timing of future revenue and provides a systematic basis for allocation. Although estimating the total amount of revenue expected from a given expenditure is admittedly difficult, accountants face and solve the same kind of problem for depreciable assets. Estimates of the lives of fixed assets are often inaccurate; many assets are in use long after they are fully depreciated. Since uncertainty is the essence of the future, all that can be reasonably expected is that accountants make the best estimates possible at the time of deferral.

- (5) Disclosure in financial statements:

Some companies now include information in their annual reports or in press releases on their R&D costs. Financial analysts and other users of

financial statements urge more consistent disclosure of that type of information in financial statements. Many users insist that a company should disclose R&D costs separately in the income statement and disclose its accounting policies for R&D costs. The demands of users of financial statements for more consistent disclosure appear reasonable.

- a) Continuing Research: Expenditures for continuing research programs should be disclosed separately in the income statement as a deduction from gross profit if the amounts are material. The information may sometimes be disclosed parenthetically in the income statement or in a note to the financial statements. A company should describe elsewhere in the annual report accounting policies for its continuing research program and evaluate the effectiveness of the program.
- b) Substantial development projects: Projects that meet the criteria for deferral could be critical to the future profitability of a company. Since a substantial project involves a significant commitment of company funds, stockholders are entitled to an explanation of expected benefits as well as a periodic evaluation of risks. Financial analysts generally believe that "deferment should be accompanied by full disclosure of the pertinent

details" to enable them to make appropriate analyses.

Full disclosure would require that material amounts of deferred development costs be shown separately in the balance sheet as a non-current asset or disclosed in a note to the financial statements. Amortizations during the period or amounts written off as excess costs should be disclosed separately in the income statements, if material, as a deduction from gross profit.

Research and Development Inputs and Inventive Outputs

It has been found empirically that there is a positive relationship between inventive activity and the level of resources devoted to it.

To go from the abstract concept of inputs into the innovation process to its concrete empirical embodiment poses difficulties. Usual input measures include R&D spending, R&D employees, and scientists and engineers employed. Each of these, as well as other indices of innovational efforts, has recognized deficiencies. For instance, technical improvements may not only be developed in R&D department but also in operating and other divisions.

"Other measures are susceptible to institutional distortions. David Novick noted two significant jumps in

reported R&D spending without commensurate increases in R&D activities.

First, a 1954 change in the tax treatment of research expenditures provided an incentive for firms to classify additional activities as "research." Second, Sputnik and its aftermath made R&D more fashionable, particularly in military and space related areas. The "fashion" aspect extends to other industries, where R&D may be viewed favorable by stockholders." Kamien and Schwartz (1975, p. 4).

Innovational output has been measured alternatively by patents awarded, important patents awarded, important innovations, and sales of new products. Deficiencies of patents as an output measure include the fact that the patent recipient need not have been responsible for the invention, that patented inventions are of unequal importance, and that some important inventions are not patented. Nevertheless, systematic study of patenting behavior has led Schmookler, Scherer and others to conclude that the number of patents granted a firm is a usable proxy for inventive output.

Schmookler (1966) found in his intensive study of patents and patenting that nonpatenting is not a serious problem before 1940 but post-1945 corporate patenting failed to keep pace with invention. This was attributed to both the lengthening period required to obtain patent

approval and a more hostile political and legal attitude towards patents, especially in connection with exclusive licensing. Consequently, post-1945, and pre-1940 patent statistics are not comparable.

Branch (1973) took into account this shift in patenting behavior in his study of the relationship between patent awarded firms and their real sales growth; he ran separate regressions for the pre- and post-war periods. The regression coefficient of the patent variable was about one-fourth as large for 1928-39 as for 1950-64.

Comanor (1965) employed sales volume of new products in years immediately following their introduction as another measure of inventive output. While sales volume reflects the significance of the invention, it also depends, on the size of the market and other factors.

Schmookler (1966) found similarity between changes during the period 1870-1950 in the number of scientists and engineers and number of patents. He also found patents and R&D expenditures to be closely related in 1953 for 12 major industry groups, with 85 percent of the interindustry variation in patents pending explained by the variation in R&D expenditure. Based on a sample from the 500 largest U.S. industrial firms in 1955, Scherer's (1965) regression analysis indicated a very nearly linear relationship between the number of R&D personnel in 1955

and the number of patents issued a firm in 1959 (the four-year lag reflecting the average time for filing and processing patent applications).

In another study Comanor and Scherer (1969) compared three measures of innovative activity for 57 pharmaceutical firms, namely sales volume of new products (inventive output) within two years after introduction, number of R&D personnel, and number of patents received. With the firm size held fixed, the correlation between patents and other measures of R&D input and output was positive and statistically significant.

Mansfield (1968) found for given firm size, a close relation (in the long run) between the rate of R&D spending and total number of important inventions forthcoming. Comanor's study (1965) of the pharmaceutical industry reached a similar result. Pavitt and Wald (1971) found across 13 U.S. industries a high correlation between R&D intensity and rate of technical innovation measured by the expected annual rate of introduction of new products as a percent of sales. They also found, across ten Organization for Economic Co-operation and Development (OECD) countries, high correlation between national industrial R&D expenditures and national performance in technological innovation, after correcting for population differences. There seems little doubt that, on average, a direct relation between innovational efforts and

innovational output exists. However, it is likewise true that the transformation may depend on factors other than efforts, and it may not be linear.

Firm Size and Inventive Output and R&D Spending

Innovational output has also been used as a measure when studying the influence of firm size as innovational intensity. Mansfield (1968) had trade personnel list and rank by importance the major innovations during 1919-1938 and 1939-1950 in three industries. The largest four firms in the coal and petroleum industries were found to be responsible for a larger share of their respective industry innovations than of its production capacity, but the largest four steel producers were responsible for fewer. Mansfield et al. (1971) found the market share of the four largest pharmaceutical firms exceeded their share of the industry's innovations. In this industry, the large firms' performance was slightly better in terms of weighted than unweighted innovations, where medical weight were based on judgments of physicians and pharmacologists and economic weight were based on sales during the first 5 years following introduction.

Mansfield used these data to estimate the firm size at which innovational intensity is greatest. While the regressions fit the data only moderately well, the results varied considerably among industries. Maximum

innovational output intensity occurred at about the size of the sixth largest firm in the petroleum and coal industries, however, very small firms exhibited maximum intensity. For pharmaceutical advances over 1935-1949, the maximum correspond to the size of the tenth largest firm. Peak intensity of weighted pharmaceutical innovations over 1950-1962 was found at about the twelfth largest firm, for unweighted innovations, it occurred at the size of very small firms.

Scherer (1965) used the number of patents issued a firm in 1959 as a proxy for average inventive output 4 years earlier. Within a sample of 352 firms from 1955 Fortune 500, sales volume was consistently more concentrated among the largest firms than R&D employment which in turn tended to be slightly more concentrated than patents. Smaller firms in the sample were responsible for a higher relative share of inventive activity than sales. A regression of patents on the first three powers of sales, fit for 448 firms yield a relationship increasing at a decreasing rate up to a point of inflection of \$5.5 billion sales. Only three firms in the sample were larger than this. The regression was repeated for the 14 industries and also for 4 consolidated industry groups. The essential findings were unchanged; patents output generally increased less than proportionately with sales among large corporations.

Smythe, Samuels, and Tzoannos (1972) made a similar study of 86 United Kingdom firms in chemical, electrical and engineering and electronics, and machine tools. Large firms were found more likely than small ones to participate in patenting. Patents granted during 1963-1966 were regressed on the first two powers of firm size (1963 net assets), profit and cash flow. The number of patents awarded increased more than proportionately within the chemical industry and, for all but the largest firms, within the electrical engineering and electronics industry. In contrast, patenting decreased with firm size in the machine tool industry.

Freeman (1971) in his study of some 1200 post-1945 innovations in Britain, reported that small firms (under 200 employees) accounted for about 10 percent of industrial innovations since 1945, compared with about 25 percent of employment and 21 percent of net output. The rank ordering of industries by the share of small firms in industries innovation corresponded fairly well with the ordering by share of small firms in net output. Small firms contributed more than proportionate share of innovations in industry characterized by low entry costs and low capital intensity and development costs for many products. They contributed little either absolutely or relatively, to innovations in industries of high capital intensity.

Johannisson and Lindstrom (1971) studied 181 Swedish firms with over 500 employees, in 12 industries sectors. Excepting the four largest firms, large firms' share of total patent applications in 1965-66 (inventive output) was consistently less than their share of employees in 1966 (firm size). Patent application increased faster than firm size among members of the chemical industry, but less than proportionately with firm size in engineering and metal manufacturers.

Mansfield (1964) reported that, except for the chemical industry, there is no evidence that the largest firms spent more in 1945 on R&D, relative to sales, than did somewhat smaller firms. In petroleum, drugs, and glass industries, the largest firms spent significantly less; in steel industry they spent less, but the difference was not statistically significant. During 1945-1959, there was no indication of a systematic change in the effect of size of firm on the level of R&D expenditure.

Thus the conclusion about the effect of size on innovational efforts tends to be supported and reflected in evidence on size and innovational output. Beyond some magnitude, size does not appear especially conducive to either innovational efforts or output in either the U.S. or in European countries where studies have been conducted. However, patterns differ by industry. It

seems noteworthy that the chemical industry is cited as an exception for both U.S.A. and abroad. The reason for this exception appears to be in the technology of chemical process plants; Freeman (1968) found that new plants constructed around 1968-1970 tend to be some four to five times larger than new plants built around 1950-1962. In case histories of 31 process innovations in the industry, he discovered that two-thirds cost over a million dollars each, while many cost over \$5 million.

Relationship Between FASB Regulations and the Intensity of R&D Expenditures

Prior to the issuance of FAS#2 numerous submission to the Board by managers of capitalizing firms indicated that they would reduce their R&D commitments if FAS#2 required expensing. Therefore, it may be useful to determine whether these predictions are reflected in subsequent behavior. There is some empirical research that suggests mandated changes may cause such effects, although this research is not related to R&D (see Harrison (1977), Evans, Folks, and Jilling (1978), Collins and Dent (1979), and Lev (1979)).

Based on the above mentioned claim and the empirical findings of the above mentioned studies, Dukes, Dyckman, and Elliott (1980), (hereafter, Dukes et al.) attempted to investigate whether the mandated changes in the reporting

procedures used by accountants to establish net income figure produced changes in the R&D expenditures decisions (as reflected in R&D expenses) made by firms. In order to address this issue they conducted their study in three phases involving separate tests. These three phases are:

- (1) tests based on a matched sample of twenty-four pairs of expensing and capitalizing firms (the matching variables were industry average-sales and manager-owner control) and their dependent variable was R&D as percentage of sales. Mann-Whitney and Kolmogorov-Smirnov tests were performed.
- (2) tests based on unmatched-firm sample of all capitalizing firms (27 firms) and an equal number of randomly selected expensing firms. The dependent variable was the firm's expenditure on R&D as a percentage of sales less the industry average, while the independent variables were liquidity (measured by funds flow from operations deflated by sales), the growth rate of sales for the firms relative to the industry, the dummy variable indicating whether the firm is owner or manager controlled. A linear regression model was applied to accomplish this phase.
- (3) logit prediction model is used to classify a firm as a capitalizer or an expenser. They used five predictors to serve this phase (the first is the ratio of R&D as a percentage of sales to the average industry R&D as a

percentage of industry sales; the second is the ratio of R&D to the productive capacity as measured by property, plant, and equipment; the third predictor is owner-manager classification; the fourth is the ratio of a firm's deferred federal income tax credit to total assets; and finally the firm's age is the fifth predictor).

Based on their empirical results, Dukes et al. (1980) concluded that "all three sets of tests fail to support an effect on research and development expenditures attributable to FAS2." p. 20.

The experiment of Dukes et al. (1980) was criticized by Ball (1980). First of all, he criticized the absence of theory of R&D decision because the authors failed to offer any explicit hypothesis concerning the behavior of R&D as a time-series process. Secondly, he criticized the absence of theory of accounting policy choice because the authors spell out no precise connection between agency theory and R&D accounting and the evidence cited by them to support the association between earnings and R&D was not clear. Consequently, the experiment proceeds without any significant structure to guide its design.

Horwitz and Kolodny (1980) tried to evaluate empirically the hypothesis that the mandated rules of FASB Statement No. 2 and the SEC regulations which require a single uniform method of reporting R&D expenditures had no

effect on the amount and the variability of privately funded R&D expenditures.

Horwitz and Kolodny offered two reasons that FASB Statement No. 2 might be expected to reduce R&D spending by capitalizing firms: (1) market inefficiency, whether real or falsely perceived on a widespread basis by management, and (2) the existence of restrictive bond covenants and/or compensation contracts written in terms of accounting numbers.

Based on the results of (1) statistical tests of the association of FASB Statement No. 2 and Accounting Series Release (hereafter, ASR) No. 178 with reductions in the level of R&D outlay of affected firms and (2) the responses to a questionnaire by key financial managers, they concluded that "the evidence supports the premise that the expense-only rule caused a relative decline in R&D outlay for small high-technology firms which had previously used the deferral method of measurement" p. 62.

Horwitz and Kolodny's results regarding the effects of FASB Statement No. 2 are contradictory to those reached by Dukes et al. (1980). The difference between the results may be attributed to the following factors:

- 1- the methodologies used in each study to test the hypotheses were different,
- 2- the samples used to test the hypotheses have different characteristics. The firms used in Horwitz and Kolodny

study were small and traded over-the-counter while Dukes et al.'s sample includes firms which were larger in size and listed in large exchanges.

Elliott, Richardson, Dyckman, and Dukes (1984), (hereafter, ERDD), tried to resolve the differences between Dukes et al.'s and Horwitz and Kolodny, (hereafter HK), studies. When they used averaging methodology similar to that employed by HK, they were able to identify significant relative decline in R&D expenditures for capitalizers among both listed firms and OTC firms.

Review of the Related Literature in the Positive Theory Area

Introduction

In recent years, many theoretical and empirical studies have focused on management's discretionary accounting choices and reaction to accounting standard from the vantage of the effect of accounting methods on management's wealth. These studies are categorized into those that concern management's voluntary choice of accounting method to establish the optimal mix of accounting policies and those that concern corporate reaction to mandated accounting changes (the classification of these two sections is adopted from Kelly (1983). See Holthausen and Leftwich (1982) for a different categorization). The evidence from these studies is

discussed in the following two sections.

Discretionary Accounting Choices

The major question addressed in this group of empirical studies is whether the voluntary selection of accounting procedures is used as means of influencing the level of executive incentive compensation or to reduce the restrictiveness of debt covenants or exposure to political costs and thus enhance the firm's stock prices. The researchers have focused on (1) the selection by management of the set of accounting procedures to be used at a moment in time; (2) the decision to disclose information voluntarily or engaged an external auditor.

Accounting Procedures Selection

Hagerman and Zmijewski (1979) used the probit analysis technique to identify the economic motives underlying management's voluntary choices of accounting methods for inventory (LIFO versus FIFO), depreciation (accelerated versus straight line), investment tax credit (flow through versus deferral), and the amortization period of past service pension costs (amortization over period less than 30 years versus amortization over 30 years or more). Their selected sample consisted of 300 randomly selected firms that disclosed their choice of accounting methods in their 1975 financial statements. Five factors were hypothesized as influencing whether the

firms used income-increasing or income-decreasing accounting method: (1) political costs which is measured by (a) size (sales and total assets), (b) industry concentration (sales of largest eight firms/total industry sales), (c) capital intensity (gross fixed assets/sales), and (d) systematic risk and variability of accounting earnings (beta coefficient); and (2) bonus payments measured by the existence of bonus plan. They hypothesized that large, risky, capital-intensive firms in highly concentrated industries use income-reducing methods, while the existence of bonus plans explains income-increasing procedures.

The empirical results showed that only the models explaining the choice of inventory and depreciation methods were statistically significant. The results of Hagerman and Zmijewski's study implied that managers use different economic variables to make their accounting choice. These findings raised the question why managers are motivated by different economic factors in making their choices?

Zmijewski and Hagerman (1981) tried to find an answer to the question raised by the findings of their 1979 study. They developed an income strategy approach in which the firms' accounting choices were viewed as a part of an overall financial reporting theory rather than as independent decision. Under this view, management selects

accounting procedures to achieve a long-run income strategy. The 300 selected companies were placed into one of sixteen possible combinations based on whether the inventory, depreciation, investment tax credit, and pension plan amortization period were income-increasing or income decreasing. According to their developed income strategy, the empirical findings showed that their model was statistically significant, with larger firms in highly concentrated industries using income-decreasing strategies and highly levered firms with profit-sharing plans using income-increasing strategies (they used the same five independent variables).

Dhaliwal (1980) studies the motives of selecting successful effort as opposed to full cost in the oil and gas industry prior to the issuance of FASB No. 19. He hypothesized that the average debt/equity ratio of firm using the full cost was larger than that for firms using successful efforts. The 1976 debt/equity ratios of 33 pairs of firms were compared, where the firms were matched on sales revenue to control for firm size. A statistically significant difference was found between the average debt/equity ratio of companies using full cost and those using successful efforts. This finding provided some support for the contention that the firm's leverage influence management's selection of accounting methods (Watts (1977) was the first to disclose that contention).

Lilien and Pastena (1982) examined the choice of full costs versus successful efforts and the procedural choices made by oil and gas companies. On a sample of 102 explorer-producer firms, they used n-chotomous probit analysis as well as discriminant analysis to predict the choice of oil and gas accounting methods and procedures as a function of size, leverage, proportion of dry wells to total wells, and the age of the firm.

They found that size and age were significantly and negatively correlated to the effect of accounting choice on income, while leverage and dry wells/total wells were also significant but positively related.

Bowen, Noreen, and Lacey (1981) examined the determinant of the corporate decision to capitalize interest expense related to assets under construction prior to the policy prescriptions issued by SEC and FASB. They employed both the univariate and multivariate (probit) tests to examine the association between the decision to capitalize or to expense interest associated with capital expenditures. Their explanatory variables were size, the existence of management compensation plans tied to earnings, restrictions on the payment of dividends, limits on interest coverage ratio and limits on leverage. Using a 91 matched pairs, they found that firms with financial ratios close to likely debt constraint (dividends, interest coverage, and leverage) are more

likely to choose capitalizing the interest expense. Only the very largest (top 10) petroleum firms expense interest.

Dhaliwal, Salamon, and Smith (1982) examined the relationship between the ownership control status of the firm and the choice of depreciation methods for financial reporting. They selected 83 firms to conduct their tests. They employed probit analysis to predict whether the depreciation method for financial reporting purposes is a function of leverage, size and whether the firm is owner or manager controlled. Their model was statistically significant, with the debt/equity ratio significant and positively related to the use of the straight-line method and the firm size insignificant. Ownership control was significant, with manager-controlled firms using straight line depreciation.

Daley and Vigeland (1983) focus on two opposing incentives which may affect management's choice between capitalization or expensing R&D costs. The first set of incentives was derived from those restrictions that may be imposed by debt covenants to limit the firms' ability to raise more capital or to pay cash dividends. Along with this set of variables they also attempted to investigate the effect of using public debt on the management's choice. Moreover, a political cost hypothesis, similar to that originally proposed by Watts and Zimmerman (1978),

was also employed.

Two samples are used, the first is a random sample which consists of 313 firms (178 R&D expensing firms and 135 R&D capitalizing firms), the second is the matched pairs design sample which consists of 222 firms (111 R&D expensing firms and the other 111 firms were capitalizers). The matching criteria were sales and reporting R&D expenses.

By using two statistical techniques (univariate and multivariate tests) they concluded that "deferral firms were more highly levered, employed more public debt, had a higher ratio of dividends to unrestricted retained earnings, and were smaller in size than non deferral, Daley and Vigeland (1983), p. 22."

Daley and Vigeland's results confirm previous findings by Bowen, Noreen, and Lacey (1981), Dhaliwal (1980), and Zmijewski and Hagerman (1981) with respect to the relationship between accounting principle and leverage. Their findings were also generally consistent with Bowen, Noreen, and Lacey (1981) for the effects of dividends restrictions in the random control group design. This is in contrast to Elliott, Richardson, Dyckman, and Dukes (1981) who found no difference between R&D capitalizers and expensers on this dimension. But when they used matched pairs of capitalizers and expensers the results were consistent with those of Elliott et al.

(1981).

Voluntary Disclosure and Auditing

Salamon and Dhaliwal (1981) studied management's discretionary choices regarding the level of monitoring, focusing on the voluntary disclosure of segmented information. They hypothesized that firms with less need for public external financing will have a lower level of voluntary disclosure. If small firms rely less heavily on external capital sources, their disclosure will be less extensive than those of large firms.

They used a sample of 25 diversified companies that did not provide segmented sales and profit information from 1967 through 1970 and 26 companies that disclosed this information prior to 1968 when the SEC announced that it was considering requiring segmented disclosures. The results of Mann-Whitney tests indicated that total assets of firms making these disclosures were statistically significantly larger than that of the disclosure firms.

Chow (1982) used an agency theory framework to study managements's motives to employ external auditor voluntarily. He hypothesized that there is a greater likelihood for external auditing with lower proportional management ownership. In addition, the firm's leverage and greater numbers of accounting measures used in the firm's debt covenants led Chow to expect that an outside

auditor would be employed. Finally, auditing was posited as more probable for larger firms, since there is a greater total potential wealth transfer.

Using a sample of 165 firms and by employing both the univariate and the multivariate (logit) tests he was able to conclude that there is strong evidence that higher debt level resulted in voluntary audit, moderate to strong support that more accounting measures in debt contract led to external auditing and moderate evidence that larger firms were audited.

Mandated Accounting Changes

The main question addressed in this group of studies is the impact on the firm mandated changes in the accounting procedures used to operate external financial reports. This research has focused on management's lobbying and financing, production or investment changes to the wealth effects of an accounting standard.

Watts and Zimmerman (1978) tried to predict firm's lobbying behavior for FASB proposal to require general price level adjustment (GPLA) statements. They used discriminant analysis to determine if the positions of firms which lobbied can be explained by the effect of GPLA statements on earnings, size, existence of a management compensation plan which relies on earnings, net monetary position, depreciation, and whether the firm is regulated

or not.

Using the submitted comment to the FASB with 33 companies opposing and 18 supporting the change and by employing the discriminant analysis, they found that size, is a proxy for political visibility, and the effect of GPLA statements on the firm's income are both significant at the 1 percent level with the predicted sign.

Dhaliwal (1982) studied the lobbying positions on the FASB's discussion memorandum regarding accounting for interest costs. He posited that agency theory variables and political cost consideration would explain corporate positions on the interest costs issue. Firms with higher leverage were expected to support capitalization. Larger firms were posited as opposing capitalization since lower earning could yield tax, political, and regulatory benefits. Finally, the existence of management compensation plans tied to accounting data implied support for capitalization.

Using a sample of 33 firms opposing capitalization and 14 firms opposing expensing of interest costs. Financial data were obtained for 1977, the year the discussion memorandum period, and by employing both Mann-Whitney U tests and the Chi Square analysis, he found that there is statistically significant differences only for the debt variable, with more highly levered firms against expensing. A multiple discriminant analysis

resulted in a statistically significant model, and leverage factor accounted for most of the discriminatory power.

Kelly (1982) studied both corporate lobbying and changes in financing or operating activities for the FASB Standard on foreign currency translation. Firms alleged that this accounting change made their profits more volatile. Agency theory constructs were used to explain management's opposition to the exposure draft for the standard and subsequent financing or operating decisions to overcome the impact of the accounting change. She hypothesized that the two types of reactions would be related; because the firm that lobbied against the standard would also make financing and operating changes after its passage. Five variables were used to characterize the firms that reacted: (1) Incentive compensation (measured as the existence of a bonus plan and the ratio of incentive compensation to total management remuneration), (2) leverage, (3) size, (4) management's percentage ownership of the firm, (5) the firm's foreign asset percentage of total consolidated assets (proxy for the potential financial statement effects).

Her sample was 52 firms responding to a questionnaire regarding changes in financing or operating activities following passage of the standard. Fourteen of

the firms lobbied against the standard; 26 firms made financing or operating changes. A Chi Square analysis indicated no statistically significant relationship between the two reactions. Using the financial data for 1976 and by employing both T-test and probit analysis, she was able to find that lobbying activities occurred for firms that had greater proportions of incentive compensation, greater leverage, larger asset size, and lower proportional management ownership. This last result was interpreted as evidence supporting the importance of managerial labor market as presented by Fama (1980).

Table 2.1 The Classification of the Capitalizers
of the Selected Sample (31 companies)
According to the Type of Construction
Costs They Capitalize

Type of Construction Costs Being Capitalized	Nos. of Companies	%
* Different Portions of the Development and Conversion Costs.	13	41.9
* Enhancements and Improvements Costs.	17	54.8
* Not Disclosed.	1	3.3
	31	100.0

CHAPTER III

THE MODEL AND RESEARCH METHODOLOGY

Introduction

There has been disagreement on the accounting treatment of the costs of internally developed software for more than a decade. None of the empirical studies both in the R&D and the positive theory areas tried to address this issue. The purpose of this chapter is to propose a model to theoretically and empirically test whether or not the management choice between the capitalization of these costs or expensing them as incurred could be explained by economic variables within the framework of the positive theory.

To accomplish that objective the first section of this chapter introduces the framework of the managerial choice, and the second section discusses the choices available prior to the new SEC release. The motivation to select one method from the available accounting alternatives and formulation of the hypotheses to be tested are covered in section three, while in section four the model is constructed and the definitions of the accounting measures are explained and the statistical techniques selected to perform the empirical tests are introduced.

The sample selection procedures and the data

collection discussed in section five, and finally the statistical techniques used to balance the selected sample are covered in the last section.

The Framework of the Managerial Choice

The search for an explanation of the management choice among the available accounting methods started almost three decades ago and one of the earliest explanations was the existence of 'corporate personality' [Sorter, Becker, Archibald, and Beaver (1964, 1966)]. Such explanation is based on the non-economic dimension to 'corporate personality' [Sorter et al. (1966, p. 200)] and therefore, a non-economic dimension to the process which characterizes the selection of accounting methods by firms. Parallel to that line of analysis Gordon (1964) tried to analyze the economic motives management might employ in choosing accounting principles. His conclusion was that managers will choose accounting that smooth the net income series. This analysis "is suspect since it implicitly assumes that investors cannot, or will not, fully adjust for alternative accounting principles. The empirical studies of Ball (1972), Sunder (1975), and others proved that, at the aggregate market level, adjustments are made in accordance with the efficient market hypothesis. Moreover the income smoothing research such as: Copeland (1968), Cushing (1969), White (1970),

Ball and Watts (1972), Barefield and Comiskey (1972), and Smith (1976), has been less than conclusive on this issue. Therefore, managers are probably not motivated to choose accounting principles which necessarily smooth income or growth for this reason (Zmijewski and Hagerman, 1981, p. 130).

More recently, Watts and Zimmerman (1978) presented a positive economic explanation for the management choice of the accounting methods. They argue that management's accounting choice is related to certain characteristics of the firms/or its industry. The work of Watts and Zimmerman (1978), Hagerman and Zmijewski (1979), Dhaliwal (1980, 1982), Bowen, Lacey, and Noreen (1981), and Zmijewski and Hagerman (1981), all document that there is an association between firm and/or industry characteristics and the relative income effect of the accounting methods selected by the firm's management from the set of the available accounting practices.

Watts and Zimmerman's theory is based on the proposition that managers attempt to maximize their utility which in its turn is directly linked to their compensation and hence wealth. Management compensation is increased by increasing the value of stock option awarded to the managers and/or by increasing the cash paid through incentive cash bonuses. Therefore, they argued that the following factors would increase management wealth: (1)

decrease or delayed tax payments, (2) favorable government regulations, (3) decreased political costs, (4) decreased information production costs, and (5) increased in the income measure used as the base for the incentive bonus plans. Increased firm cash flows from the first four factors would, *ceteris paribus*, lead to higher stock prices, while the last factor would result in a direct increase in managers compensation.

Using this logic, managers are expected to lobby for and select those accounting practices which decrease or delay tax payments, help secure favorable regulations decrease political costs, decrease information production costs, and/or increase managers' cash bonuses. Except for the reduction of information production costs which directly decrease cash outflows, accounting practices affect these factors by the impact they have on reported net income.

Watts (1977), using the results of Jensen and Meckling (1976), was the first to suggest that debt covenant might also influence the choice of accounting policies. Collins, Rozeff and Dhaliwal (1980), Dhaliwal (1980), Holthausen (1981), Leftwich (1980), Lilien and Pastena (1982), and Daley and Vigeland (1983) made the argument that the higher is the debt/equity ratio of the firm, the more binding are the debt covenants on the firm. The firm can attempt to loosen some of these covenants by

choosing accounting methods that increase income and assets. Therefore, they hypothesized that high debt/equity ratios are associated with income increasing accounting alternative and, with the exception of Holthausen (1981), they found that debt/equity ratio was significant in the various issues they tested.

Choices Available Prior to the New SEC's Rule

Prior to October 1974, the dominant accounting practice that governed the treatment of computer software construction costs was the capitalization of these costs.

In 1974 the FASB issued its pronouncements concerning computer software expenditures under the general topic of R&D. FAS#2 identifies those activities to be considered R&D and their appropriate accounting methods. FAS#2 suggests that all R&D costs that are incurred to develop intangible assets internally - including computer software programs - should be expensed as incurred. The costs of purchased intangible assets used in R&D activities, however, be capitalized when "alternative future uses" exists (FAS#2 par 11(c)).

The basis for this conclusion is discussed in Appendix B to FAS#2. Because computer software is developed for so many divergent purposes, the Board stated that "in each case the nature of the activity for which the software is being developed should be considered in

relation to the guidelines. . . to determine whether software costs should be included or excluded (in R&D). (Emphasis added.)

This conclusion left the door open for more controversy regarding the accounting treatment of internally developed software costs and many companies challenged the FASB's position. In 1975, the board attempted to clarify its position by issuing Interpretation No. 6. In this interpretation, the FASB stated that its "intent in Statement No. 2 was that the acquisition, development, or improvement of a process by an enterprise for use in its selling or administrative activities be excluded from the definition of research and development activities." To the extent that computer software is part of these activities, such costs - even costs for minor modification or improvement would not constitute R&D and would thus be eligible for capitalization. On the other hand, Interpretation No. 6 emphasized that the development of a new or significantly improved product or process for marketing outside the company would be considered R&D, and thus any costs incurred should be expressed.

It became apparent that both FAS#2 and Interpretation No. 6 are strongly biased toward expensing computer software costs. While the pronouncements, in particular Interpretation No. 6, deal with situation in

which computer software should be expensed as R&D, they offer few specifics on when it would be proper to capitalize these costs as expenditures that would not be considered R&D.

"The software products industry disagreed with the FASB's interpretation. On behalf of ADAPSO, James R. Porter, vice president of finance/administration, presented the industry's position to the FASB. He wrote, "it is the position of the [ADAPSO] that the FASB has not properly considered the nature of software product construction, has not properly evaluated the historical risk associated with software products, has rationalized away the importance of long-standing, generally accepted accounting principles, and has issued a ruling which may cause significant distortions in the financial reports of companies engaged in the construction of software products." He argued that, "as a result [of the rulings, the] FASB and the accounting community leave the software products industry without assets" [Burns and Peterson, 1982].

In response to this situation the board released in February 1979, a statement clarifying their position on the intent of FASB Interpretation No. 6 with regard to computer software. Subsequently the FASB formalized this clarification in Technical Bulletin No. 79-2, dated December 1979.

Based upon this clarification some companies in the computer software industry started to capitalize the construction costs of the internally developed software products based on the fact that such activities is not related to the R&D. While the other companies continued to expense the internally constructed software costs in accordance with FAS#2.

It became apparent that during the period between October 1974 and April 14, 1983 some managements in the computer software industry started to practice its discretion in selecting the accounting method of treating the costs of internally developed software.

Therefore, this research is devoted to investigate theoretically and empirically the variables which motivate the managements of those companies to lobby against FAS#2 and to regain their discretion in choosing the accounting method of treating the internally constructed software costs.

Such investigation becomes more important if we tried to answer the following questions: why only 22 percent of the companies surveyed by the ADAPSO selected the capitalization. Table (3.1) presents the results of the ADAPSO's survey when the following question is addressed: "Do you have any internally constructed software costs in your balance sheet?" .

Moreover, why did most of the commentators from

industry and public accounting firms opposed the adoption of the proposed new SEC's rules in their letters to the commission during comment period?

The only answer to the above questions is that the managements are always motivated to maintain their discretion in selecting the accounting practices to give themselves the ability to adopt those reporting options which maximize net income and asset balances, specially if their debt to equity positions approaches a level that reduce managerial flexibility because of proximity to violation of debt covenants. In particular firms with large amount of debt relative to equity are more likely to choose accounting methods which result in higher or earlier reported earnings. Evidence consistent with such behavior is documented in studies dealing with the firm's choice between the full cost and the successful efforts methods of accounting for exploration and development costs [Deakin (1979), Dhaliwal (1980), Lilien and Pastena (1982)] and in studies dealing with the firm's choice between capitalization and expensing of interest incurred during construction [Bowen, Noreen and Lacey (1981)] and in studies dealing with the firm's choice between capitalization and expensing of R&D costs [Daley and Vigeland (1983)].

Moreover, the managements are more motivated to adopt the accounting option which maximize the net income

if their compensation plans are linked to this figure directly (cash bonuses) or indirectly (Stocks, and stock options).

Motivation for Choice:

In this section the researcher hypothesizes that there are a number of economic motivations which can be employed to predict or explain these maximization decisions regarding the management choice between capitalizing or expensing the cost of internally developed computer software products.

The Effect of Size on the Management's Choice:

Watts and Zimmerman (1978) argue that the threat of political and regulatory action, taxation and rate regulation (political costs) provide managers with incentives to reduce the level and variance of reported earning. However, only the incentive to reduce the level of earnings has been widely tested.

Hagerman and Zmijewski (1979) suggest that companies characterized by high systematic risk or which are highly capital intensive or which are highly concentrated industries are more likely to select the accounting practices which reduce the reported earnings, the rational behind such argument is that firms with these characteristics and which report high profit will attract the politicians to subject them to negative wealth

transfers through regulation or by imposing implicit or explicit taxes.

Moreover, Holthausen and Leftwich (1981) argue that "if firms face potential costs, either positive or negative, reported accounting numbers have real effects because changes in those reported numbers alter the probability of taxes being imposed or subsidies being granted. In such a world, managers have incentive to choose particular accounting techniques and to lobby for or against some mandatory changes in accounting standards, p. 21."

This line of argument is valid and empirically supported in many previous studies where the samples used were consisting of large firms or drawn from industry which is subject to greater government scrutiny, such as the oil and gas industry. But if the firms are small in size, so they are not subject to much political pressure or they are not subject to any political pressure at all, the validity of the political costs hypothesis becomes questionable.

In this study, the researcher argues that the size of the firms will affect the accounting choice but for reasons other than the political costs. First of all, the researcher argues that for small, high technology firms it is important to note that they often grow at a high rate, perhaps as much as four times greater in sales than mature

companies, and are highly dependent on external sources to finance growth. Even when compared with small nontechnological firms at the early stages in their life cycle, these firms rely more heavily on external sources for growth. For instance, at the time of their first public offering, less than 1 percent of the funds generated by small, high-technology companies come from internal sources, as compared to about 25 percent internally generated by small non technological firms (see figure 2). In addition, the small technological firms receive about 48 percent from the equity market, as compared to 14 percent for the other group (National Bureau of Standards, 1976, p. 18).

Moreover, when the researcher examined the financial statement of the selected sample (205 companies, where 31 companies capitalize the costs of internally developed software and 174 expense such costs as incurred) found that 142 companies (about 69 percent) financed 50 percent or more of its operation from the equity market [See Table 3.2].

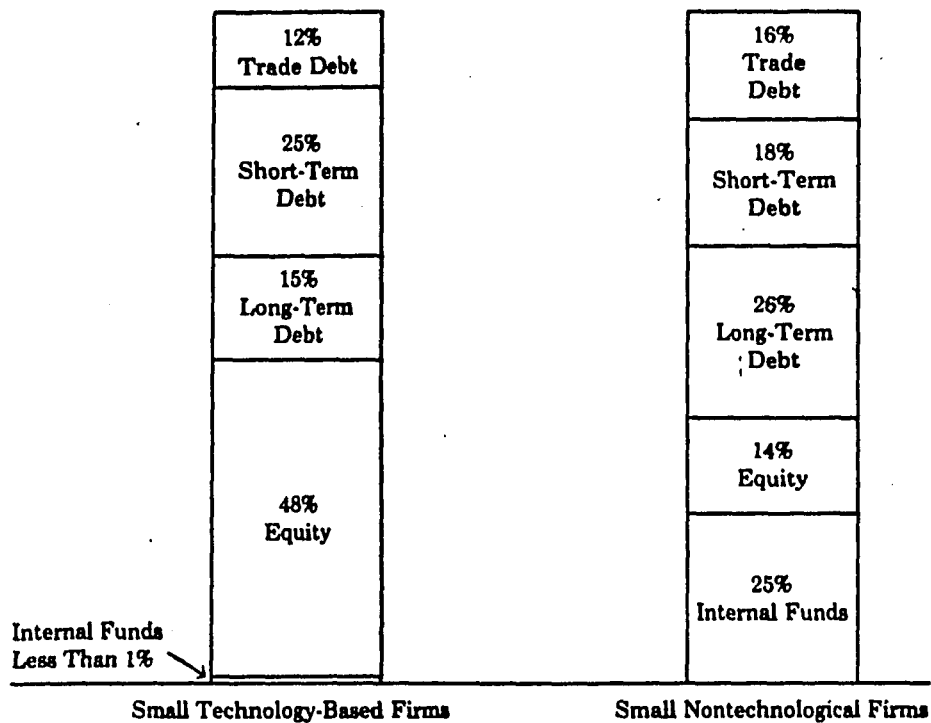
Although small, high technology firms are highly dependent on external capital, surveys of financial analysts have revealed that there is very little institutional interest in companies with less than \$50-100 million capitalization (Financial Analysts Federation, 1977). Thus it is likely that a high proportion of equity

holders of small companies are "unsophisticated." Figure 3 support this contention, revealing that for the small, high-technology firms the portion of equity raised from "unaffiliated" plus "unknown" sources is about 40 percent.

Because of the importance of funds supplied by "unsophisticated" investors, it is more likely that the management will select the accounting method which increases the reported earnings, especially if the costs of internally developed software increases in an increasing function, to avoid the unfavorable revaluation by investors, if such cost is expensed and to maintain the same level of expenditures on such activities at the same time.

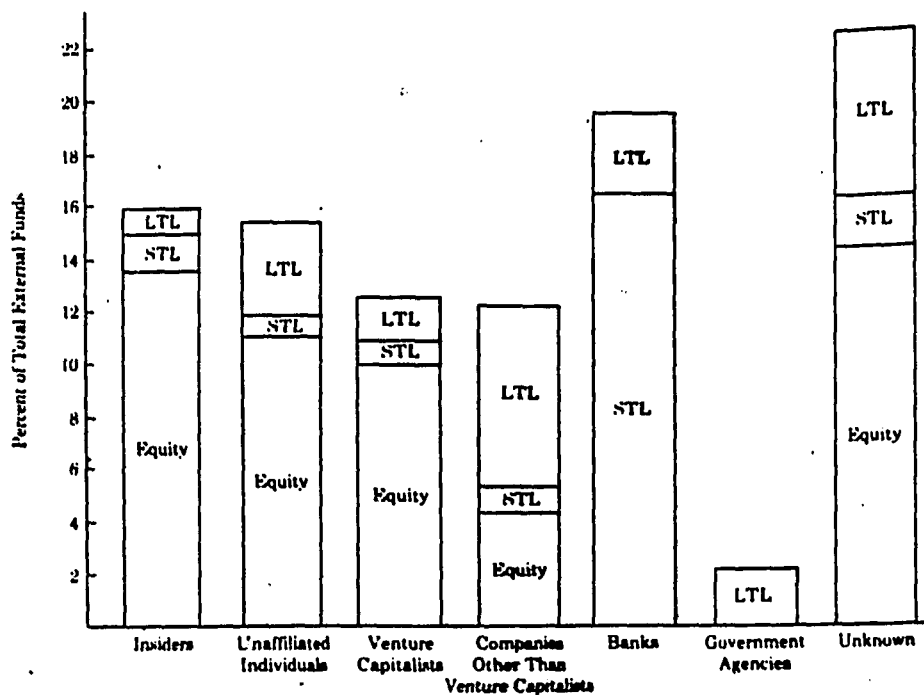
The argument regarding the possibility that the capital markets for the equities of small firms are either inefficient or are perceived to be so by managers is raised many times. When the FASB issued FAS#2 it has been argued that a financial accounting change (from capitalization to expensing) that, in fact, either led the unsophisticated investors to revalue affected firms because of a decline in reported earnings or was preceived by the managers to be likely to do so, could have led managers to reduce their R&D investment outlays in order to offset the lower earnings that otherwise would result.

A similar beliefs were expressed after the Board's rule on R&D when it issued Statement No. 7 on the



Composition of sources of all financing of a sample of small firms making initial public offerings 1970-74. Source: *An Analysis of Venture Capital Market Imperfections* (New York: National Bureau of Standards, 1976), p. 18.

Figure 3



Average composition of external funds received by small technology-based firms (percentage distribution by type of investors). LTL = long-term loans; STL = short-term loans. Source: *An Analysis of Venture Capital Market Imperfections*, p. 11.

accounting and reporting of developing stage companies (FASB, 1976). The issue here was similar to the R&D issue, that is, whether to require deferral or expense for the financial reporting of preoperating costs. And here also, although support for an expense-only rule was expressed by a number of institutional investors and venture capital firms, a high percentage of these investors believed that a mandated switch "might have an impact on the investment and credit decisions of unsophisticated investors" (FASB, 1976, para. 49).

Moreover, during the hearings before the SEC on the appropriate method of measuring the costs of exploration and drilling activities, several representatives of the largest investment banking firms testified that the capital markets for many growth-stage firms were inefficient. That is, they believed that for the small, growing oil and gas company it could become more expensive and more difficult to raise capital because of the lower reported earnings that would result from a mandated change in the measurement rule from deferral "full cost" to expensing "successful efforts." That mandate expressed in FASB Statement No. 19 was later overruled by the SEC.

In sum, because of perceived market inefficiencies the researcher argues that small firms are more likely to select the accounting practices which increases the reported income to smooth the variability in

the reported earnings to avoid the unfavorable revaluation by the unsophisticated investors and to maintain the same level of expenditures on the development of their software products.

A second possible explanation to why the management of small firms will select the accounting practices which increase the reported earnings, especially those small, high-technology firms, stem from the fact that these companies are growing at a higher rate than mature companies and are highly dependent on external sources to finance their growth. This speed of growth makes these small, high-technology firms more attractive to many mutual funds. For instance Naers and Thomas Special Fund Inc. stated in its prospectus which issued on January 31, 1984, that the fund "is an open end diversified mutual fund which seeks to obtain its objective of principal growth through investment primary in equity securities of small companies which are deemed to have better than average prospects of appreciation in market value, p.1." [Emphasis added.]

The prospectus of Vanguard specialized portfolios, which issued on May 23, 1984, showed that one of their current available portfolios is the technology portfolio. The prospectus stated that "the technology portfolio will invest in the securities of companies which develop, produce or distribute products and services related to

advances in technology. . . . This portfolio intends to capitalize on the opportunities created by rapid advances in electronic technology. . . . The portfolio will own securities in the technology field which deemed by the investment adviser to be undervalued or not widely recognized in the marketplace and those which have a long-term record of superior growth in revenues and earning," pp. 6-7." [Emphasis added.]

Vanguard specialized portfolio is currently advised by H.G. Wellington & Co. Inc. Therefore, the application for registration as an investment adviser of H. G. Wellington filed with SEC on August 13, 1984 was reviewed in an attempt to find out the adviser's method of security analysis. The researcher found that "the applicant uses standard fundamental valuation methods in our selection of industrial and public utility security. Our main goal is to select securities which we think will return, both in income and long term appreciation, a reasonable rate of return on the original investment. In our analysis we make an attempt to estimate the earnings flow of the corporation over a 3-5 year period and we estimate a range of multiples for that earnings flow. . . . In addition to this fundamental approach we try to determine the probability for industry growth or lack of growth and company growth or lack of growth. This allows us to find companies which are under valued in a static environment,

under valued in a growing environment, and companies which are fairly valued but provided some other requirements, e.g.. stability and income. (Schedule F of Form ADV, part II, 4-a).

In sum, the attractiveness of the small, high-technology firm to the mutual funds and the importance of the equity capital to finance the activities of those small firms on one hand, and the importance of the reported earnings to the mutual fund's adviser on the other hand may justify the management's choice of the capitalization to treat the costs of internally developed software as a vehicle to improve the reported earnings.

Finally, Daley and Vigeland (1983) argue that managers of large firms may draw attention to themselves and their firms when they adopt reporting rules which are deemed to be questionable by the financial press. As discussed by Bowen, Noreen, and Lacey (1981), in a world where the selection of an accounting alternative (e.g., capitalization of internally developed computer software costs) may create additional transaction costs, management will prefer to avoid potential "bad press" unless expected benefit outweigh this costs. While this cost may not be large on average, for larger firms far from covenant constraints, it may be sufficient to cause avoidance of certain nonstandard accounting policies. This is not the only "political" reason to avoid capitalization. Since

capitalization will make reported income higher (on average) it may be that the expected costs of government scrutiny are increased by this choice, as well.

This line of argument is valid for the large companies and is supported by the following empirical evidence. Upon reviewing the sample used by Daley and Vigeland (1983) the researcher found that eight companies were used in their study and in the current study. Those eight firms were classified in their study as capitalizers of R&D expense, while they were classified as expensers of the costs of internally developed software in current study. This finding may appear inconsistent with Zmijewski and Hagerman (1981) results which suggest that individual accounting policy choice decisions are part of an overall firm strategy. They argue and provide an empirical evidence that the model they established should predict either all income increasing or all income decreasing accounting policy choices for each of the firms because the set of independent variables is the same for each firms at any point in time.

This inconsistency may be understood if we note that those eight firms are large in size (measured by their total assets) and their stocks are traded on organized exchanges (see Table 3.3). Being large in size and being listed on organized exchange means that those eight companies are more likely to be followed by the financial

press.

Grant (1980) conducted a test to assess the difference that exists between New York Stock Exchange (NYSE) and Over-The-Counter (OTC) firms in the number of interim news items which appear in the Wall Street Journal. The number of interim news items appearing in the Wall Street Journal was tallied both for a random sample of 100 NYSE firms and a random sample of 100 OTC firms for the period 1960-1964. The mean and the median number of interim news items were 19.2 and 154, respectively, for the NYSE sample, compared to only 7.1 and 6, respectively, for the OTC firms. A nonparametric Mann-Whitney test of differences in the median indicates that the median number of interim news items is significantly less ($\alpha < .0001$) for the OTC firms than for the NYSE firms. This result shows that larger firms are more likely to be followed by the financial press.

The above argument and the empirical evidence provided by Grant (1980) suggests that those eight firms selected the expense method to account for the costs of internally developed software in an attempt to avoid the potential "bad press" if they select the capitalization method.

In this study the researcher argues that management of relatively large, high-technology companies whose securities are traded OTC are more likely to avoid

adopting certain accounting policies which deemed to be questionable by the financial press (such as capitalizing the costs of internally developed software especially in the existence of an accounting standard which is understood to be applicable such as FAS#2). The reason for such avoidance is not related to the political cost but it is related to the perceived inefficiency of the equity capital markets which represent a main source of financing for those high-technology companies.

A support to this line of argument could be found in the letter sent by Dyatron Corp. to the SEC regarding the prohibition of using the capitalization method to account for the costs of internally developed software. In that letter Dyatron Corp. stated that "the proposed rule discriminates against the computer services industry and specifically against the company; the SEC rule implies that it is wrong to capitalize software. This may encourage investor discrimination against the company. . . . The proposed rule could adversely affect the company's working relationship with our major lending institutes in that the SEC implies that our accounting practices are abrasive and therefore overstates our net worth." [Emphasis added.] Moreover, when the SEC prohibited the adoption of the capitalization method on August, 1983 and required from those firms that used it before March 14, 1983 to disclose the amount capitalized

and its effect on the reported income, Dyatron Corp. (OTC firm) switched to the expense method in 1983 after using the capitalization method for 9 years.

In its response to the proposed SEC's rule Comserv Corp. stated that ". . . the rule requiring companies that presently have disclosed that they capitalize software construction costs to report the impact on earnings if these costs were expensed for the reporting period is misleading and discriminatory as it implies that capitalization of software construction costs is an improper method of accounting. This results in considerable uncertainty by investors and has a negative impact on the preceived value of the company. . . . The proposed reporting may, without any change in an issuer's business, adversely affect investor's preceptions of the enterprise, due solely to the uncertainty created by the commission's rules. . . . The proposed rule may adversely affect a company's ability to obtain additional equity financing insofar as it affects the value of an issuer's stock and its shareholders' investment." [Emphasis added.]

Based upon the above discussion it may be appropriate to state the first hypothesis as follows:

Hypothesis 1: Size is negatively correlated with choice of capitalization of computer software construction costs.

The Effect of Ownership Control Status on the
Management's Choice:

As described by Dhaliwal (1982, pp. 42-45) the managerial economics provides theory and evidence that the set of accounting methods adopted by the firm is related to its ownership control status. Williamson (1964, 1967); and Monsen and Downs (1965) argue that the managers of large corporations with diffuse ownership (hereafter called management-controlled or MC firms) have considerable discretion in guiding the affairs of their firms and that this discretionary power is used to divert some resources from corporate shareholder. Hindley (1970, p. 195) argues that the current market value of the shares of MC firms will be smaller than their potential value if the managers of MC firms divert a significant amount of firm resources to themselves. This difference between the potential value and current market value of the firm's shares provides an incentive for an outside group to gain control of the corporation. Hindley (1970, pp. 199-200), and Williamson (1967, p. 13) hypothesize that managers of MC firms exercise control over the information released regarding firm performance in an attempt to present the results of firms operations in a most favorable way. The attempt to control information is intended to keep current shareholders satisfied and unwilling to support any

takeover attempts by outside groups. This line of argument suggest that the managers of MC firms are likely to choose accounting methods which result in higher or early reported earnings and higher reported equity.

The hypothesis that closely-held firms (hereafter, referred to as owner-controlled or OC firms) are likely to choose accounting methods with different income effects than the accounting methods chosen by MC firm is also implied by the positive theory of accounting method choice developed by Watts and Zimmerman (1978). The notion that management utility is tied to the amount of and timing of compensation lead to the hypothesis that MC firms will be more inclined than OC firms to choose accounting methods which result in higher or earlier reported income (e.g., capitalization of the internally developed computer software cost). In the OC firms, the owners can motivate and monitor the behavior of managers directly so the need for incentive compensation schemes based upon reported income is not great. On the other hand, the outside owners of MC firms must devise mechanisms to motivate the firm managers to act in a manner which does not ignore the interests of the outside owners. One common mechanism used for this purpose is the adoption of incentive compensation schemes (of either the cash bonus or stock option types) which depend upon reported income. Consequently, it is likely that MC firms are more likely

than OC firms to have incentive compensation schemes based upon reported income. This means that the managers in MC firms are more likely to benefit than are the managers in OC firms from the selection of accounting methods which result in high and/or early reported earnings.

The managers of OC firms do not have the same incentives to increase reported earnings as do the managers of MC firms. Smith (1979, p. 708) argues that the owner-manager of OC firms will be concerned with the acceleration of expense deductions for tax purposes, and perhaps, for reporting purposes, in order to influence labor's bargaining position. This reasoning suggest that the owner-managers in OC firms are more likely than the managers of MC firms to adopt reporting alternatives which lower or delay reported income.

This marriage between the Watts and Zimmerman positive theory and those of managerial economists will result in stating the second hypothesis as follows:

Hypothesis 2: MC firms are more likely than OC firms to use capitalization method to account for the internally developed computer software costs.

The Effect of Interest Coverage Ratios on the Managements'

Choice:

One may argue that relationship between the interest coverage ratio and the management choice to capitalize the internally developed computer software cost is not clear

cut. But the researcher argues that it is very common for debt covenants to prohibit the issuance of new debt unless the company maintains minimum prescribed ratios of income to interest expense. Capitalizing software construction costs has the effect of increasing current net income and therefore of increasing the ratio of income to interest expense.

Based on Daley and Vigeland (1983) argument the researcher will argue that the magnitude of the effect of capitalizing the internally developed computer software costs on a firm's net income depends upon the rate of growth of these costs, the proportion which is capitalized, and the length of the amortization period. In general, firms with internally developed software costs which are growing will tend to report higher net income, on average, if some of the construction costs are capitalized. Daley and Vigeland (1983) argue that firms can increase the amount of capitalized R&D without increasing expenditures over the short run since no firm capitalized all of these costs. Thus increasing the intensity of capitalization could cause higher reported income.

Based upon the above argument it becomes apparent that the capitalization of the computer software construction costs will help in relaxing the debt covenant constraint which require maintaining minimum net income to

interest expense ratio. Therefore my third hypothesis will be:

Hypothesis 3: The interest coverage ratio is negatively correlated with the selection of the capitalization method which maximize the net income.

The Effect of Debt Covenant on the Management Choice:

In the recent economic literature the firm has been modeled as a set of contracts among individuals or parties which constitute factors of team production. Those parties are motivated to maximize their own welfare which is in part determined by the performance of the entire team of firm. But since each party is compensated differently one expects conflicts of interest to arise.

The potential conflict between debt holder and equity-holder is examined thoroughly in the finance literature [Fama and Miller (1972), Black and Scholes (1973), Jensen and Meckling (1976), Galai and Masulis (1976), Myers (1977), and Kalay (1979)]. "This literature identifies actions that can transfer wealth between debtholders and equity holders. For example, if the manager chooses a higher variance project than anticipated by the debtholders, wealth is transferred from the holders of risky debt to the equity holders. Wealth can also be transferred from debtholders to the equity holders by reducing planned investments and paying out the saved outlays as a dividend." (Holthausen, 1981, p. 76.)

Although many restrictions may govern the debt contracts only those which are based on accounting numbers are important for this research. Covenants which rely on accounting numbers commonly use minimum working capital and maximize leverage constraints.

"The contracted definitions of accounting variables specified in the covenants use generally accepted accounting principles (GAAP) as a benchmark. Some covenants, particularly in private placements, then make adjustments to GAAP which are designed to reduce management discretion. Aside from these requirements, firms are not prohibited from changing accounting techniques. Thus, the choice of accounting methods for financial reporting purposes generally affects the contractual constraints in debt covenants. Managers of firms which face these constraints on production, investment and financing decisions have incentives to relax those constraints." (Holthausen (1981), p. 77.)

The hypothesis that the existence of debt covenants can influence firm's selection of accounting methods is not new and is documented in many previous studies. Moreover, Kalay's (1980) study shows that firms with high debt to equity ratio are close to technical default on their covenants, also Pogue and Soldofsky (1969) found that institutional investors often, for legal reasons, limit their investment to choose firms which meet minimum

standards in respect to earnings coverage ratios, leverage ratios and earnings fluctuation ratios. Highly leveraged firms are likely to be facing these institutional investment constraints and are more motivated to choose capitalization methods which will maximize net income and in turn ease the institutional constraints.

The computer software companies which capitalize the software construction costs may intend to decrease the book value of their leverage because capitalization increases both net assets and shareholders' equity. And the decreased leverage affects the firm's ability to issue new debt, pay dividends, merge, lease or be construed not to be in default through the leverage restriction in debt covenants. In other words when firms select to capitalize the cost of internally developed software product it temporarily increases retained earnings over that which would exist if these costs were expensed. This in turn reduces book leverage ratios. Assuming that book leverage (measured in accordance with GAAP) is the variable constrained by contract the following hypothesis is suggested.

Hypothesis 4: Leverage is positively correlated with the selection of the capitalization method that maximize income.

The Effects of Debt Types on the Management's Choice:

Leftwich (1981) and Holthausen (1981) argue that the

cost of renegotiating or redeeming public debt are higher than the costs of renegotiating or redeeming private debt. Also Zinbarg (1975) argues that lower negotiation costs are one of the major advantages of private issues.

Moreover, Leftwich (1981) shows how costly the procedures are when the debt is widely held. According to the Trust Indenture Act of 1939, it is required, whenever a company issues a debt to the public, a trustee for the debtholders must be appointed and an indenture agreement entered into by the company and the trustee. Trustee cannot approve subsequent modifications to an indenture unless they submit the proposed modifications to a vote of debtholders and obtain favorable votes from holders of a substantial majority (usually two-thirds) of the debt outstanding which means a costly procedure. By contrast, private debt agreements can be modified by mutual consent between the debt issues and the small number of purchases.

From the above discussion it becomes apparent that "the magnitude of the cost of violating constraints on leverage, interest coverage, or dividend payments is likely to depend on whether the outstanding debt was issued publicly or privately. . . . In addition, the existence of public debt will also likely alter the nature of the constraint with the bond covenants. Smith and Warner (1979) report that private debt agreements are more likely to specify the use of particular accounting

treatments in determining critical accounting ratios (e.g., leverage. . . etc.) than are public debt agreements. Public indentures are more likely to rely on GAAP as a way of reducing monitoring costs. Its constraints are measured using GAAP, management may use alternatives within GAAP to reduce the probability of violating a debt constraint." (Daley and Vigeland, 1983, pp. 5-6.) Given the above theoretical investigation the fifth hypothesis could be stated as follows:

Hypothesis 5: the ratio of public debt to total assets is positively correlated with the selection of the accounting method of capitalization.

The Existence of Management Incentive Plan and Management's Choice

Holthausen and Leftwich (1983) argue that the management compensation plan often allow managers to share profit in excess of a target level, and the target is typically stated in terms of accounting net income, or a rate of return on the book value of the assets of the firm. Thus management's wealth can be affected by voluntary or mandatory changes in accounting measurement rules if the compensation plan is not adjusted to affect the rule changes.

Furthermore, managers can respond to a mandatory change in accounting method by altering the firm's investment and financing decisions to reduce any

unfavorable impact of the mandatory change on their compensation payments. To the extent that the new set of investment and financing decisions does not maximize the value of the firm. Thus, changes in accounting rules have economic consequences and those are incentives for managers to spend resources to voluntarily switch to different accounting principles, or to lobby for or against proposed mandatory accounting rules changes.

The assumption that underly the effect of the existence of management compensation plan on the management's choice is that the directors who administer these plans do not fully adjust the plans for the accounting principles chosen. Watts and Zimmerman (1978) argue that the costs of adjustment are low so there should be no relation between the presence or absence of an incentive systems and the choice of accounting principle. Moreover W & Z provide empirical evidence which indicates that there is no statistically significant relationship in the case of supporting or opposing general price-level adjusted financial statements. Hagerman and Zmijewski (1979) argue that the FASB's proposed treatment of GPLA statement required that original cost financial statement be provided. Thus W & Z (1978), have tested a situation where the adjustment costs would be zero.

Since capitalizing the costs of internally developed software typically results in (at least) a short-term

increase in reported profits, incentive may exist for management to capitalize the costs of internal development of software products. Thus the last hypothesis is formulated as follows:

Hypothesis 6: Firms with management compensation packages explicitly related to reported earnings will have a greater propensity to capitalize the costs of internally developed software than firms that do not have such a plan.

Methodology

The Model

The empirical part of this research tests whether the management motivational variables as discussed in the above section can predict whether firms will choose to capitalize or to expense the cost of internally developed computer software products. In this test the dependent variable is classified as follows:

- 1, if the firm is capitalizing the costs of internally developed software.
- 2, if the firm is expensing the costs of internally developed software.

The model of this research could be described as follows:

$$Z = \beta_0 + \beta_1 LA + \beta_2 OS + \beta_3 ICR + \beta_4 PVD + \beta_5 PUD + \beta_6 CP$$

Where:

Z is defined before

LA = the log of total assets

OS = 0 if the firm is classified as management controlled. The firm is classified as MC if less than 10% of the voting stock is controlled by any party.

1 if the firm is classified as owner controlled.

The firm is classified as OC if one party owned 10 percent or more of the voting stock and exercised active control, or if one party owned 20 percent or more of the voting stock. Representation on the board of directors or in the management of the firm is taken as evidence of active control.

$$ICR = \frac{\text{Income before extraordinary items and taxes}}{\text{Interest expense}}$$

$$PVD = \frac{\text{Total LTD-Public LTD-Capitalized lease obligations}}{\text{Total Assets-Intangible assets}}$$

The researcher found that many companies in the selected sample do not separate the current portion of the capitalized lease obligations from the current portion of others long term debt.

Moreover, the information given in many cases were not sufficient to compute the current portion of the capitalized lease obligations. Therefore the researcher used the total long term debt and the total capitalized lease obligations (before deducting the current portions) in computing PVD ratio.

$$PUD = \frac{\text{Public LTD}}{\text{Total assets}-\text{Intangible assets}}$$

$$CP = \begin{cases} 0 & \text{if there is compensation plan related to the} \\ & \text{reported earnings exists} \\ 1 & \text{if compensation plan exists but not related to} \\ & \text{reported earnings or does not exist at all} \end{cases}$$

Statistical Analysis

To test the significance of the variables developed from the hypothesis, the researcher employs the following statistical techniques.

Univariate Analysis

This analysis is used to serve the following two purposes: (1) to prevent any potential measurement errors in one independent variable from affecting test results on another variable when the multivariate model is used, (2) the use of these tests serve as a check on the results of the multivariate results.

Probit Analysis

This statistical analysis was developed by McKelvey and Zavonia (1975) and employed in the Hagerman and Zmijewski (1979), Kaplan and Urwitz (1979) Zmijewski and Hagerman (1981), Bowen Noreen and Lacey (1981), and Lilien and Pastena (1982).

The objective of this analysis is to simultaneously perform hypothesis tests on the significance of both the

overall model and the individual independent variables.

This economic model is developed to overcome the statistical problem of using the Ordinary Least Square (OLS). The OLS (with binary dependent variables) creates unbiased estimates of coefficients but the error terms are heteroscedastic and non-normal. For this reason the standard errors of coefficients are inefficient and standard significance tests are potentially misleading.

The probit model overcomes this limitation by imposing an assumption concerning the distributional characteristics of the dependent variables. This model assumes that the dependent variable is an estimate of the probability an observation belongs in one of the two groups. The assumption imposed is the shape of the probability density function for the distribution. Probit employs a normal density function using information concerning the marginal probability of an observation being in one group (derived from sample data).

The advantage of using the probit model is to develop asymptotically efficient estimates of coefficient and standard errors using maximum likelihood estimators, which allows for asymptotic t-tests to assess statistical significance.

Sample Selection Procedures

The sample selection is difficult in this study

because:

- 1) Most of the companies that offer software products are small ones, for instance as shown in Table 3.4 the stocks of about 81 percent and 64 percent of Group I and Group II (hereafter, GI and GII) respectively are traded over-the-counter, thus obtaining a complete financial statement and identifying those which capitalize the costs of internally developed software from sources other than their annual reports, 10-K's, 8-K's, and proxy statements is almost impossible. For example, the researcher examined the financial statements of all firms that appear in Moody's Industrial and Over-The-Counter for 1983 and was not able to identify any company that capitalizes the construction costs of their software with one exception. This difficulty resulted from the fact that the disclosure regarding the capitalization of this costs was not mandatory and the size of these companies is small and the space given to them in the Moody's was small too.
- 2) The products and services offered by software, data services and professional services companies span many technologies and subindustries. Therefore, the researcher found that the population from which he will select his sample is too large and too difficult to deal with especially if we know that the data will be

collected manually.

To overcome these difficulties the following alternatives were considered:

- 1) Using the ADAPSO's membership directory. This alternative was excluded for the following reasons:
 - a) This directory includes both the private and public members and obtaining any financial information about the private companies is impossible therefore those companies were dropped. Dropping those private companies reduced the population size significantly and the possibility of having enough number of capitalizing companies was reduced too.
 - b) Using this directory will create some kind of bias because only the members of that association will be covered by the study.
- 2) Using the SEC directory. The use of this directory overcame the difficulties and the problems of the first alternative but it has its own problems. The main problems was the size of the population since it contains all the public companies which are required to file annual reports with the SEC.

The researcher selected the second alternative and to limit the size of the population he decided to go through the following steps to select his sample:

Step (1) "The Directory of Companies Required to File Annual Reports with Securities and Exchange

Commission" was reviewed. Two groups were selected from the directory.

GI: This group consists of all companies listed under SEC Code No. 7370 (This code is the same as the three-digits SIC Code No. 737). This group is titled "Computer and other data processing services." The total number of companies under this group is 183.

This group was selected because companies in the computer software industry are classified by SEC under this category.

GII: This group consists of 206 companies which classified by SEC under Code No. 3570: "Office and Computing Machines." This code is the same as the SIC three-digit code 357.

The selection of this group is attributed to the following two reasons: (1) a significant portion of software is developed and marketed by the computer hardware producers. For example, in 1983 about 38 percent of the computer software sales is accounted for by six big hardware producers, (Table (3.5) presents a list of those companies and their sales), (2) to avoid the criticism directed to the previous two surveys which have done by ADAPSO and Deloitte Haskins & Sells (hereafter DH&S) in

this area. Those two surveys excluded the computer hardware companies from the scope of their search.

Step (2): I sent letters to all companies (total of 389) listed in the SEC Directory under the above mentioned two groups requesting their Annual Reports, 10-K's, and their proxy statements.

Step (3): Included in the sample only those companies that sent their financial statements and met the following two criteria:

- a) They are manufacturing companies
- b) They went public before April 14, 1983.

Step (4): Only 113 and 116 from GI and GII respectively sent their financial statements. Item (1) of the 10-K Form of those 229 companies were examined to identify the manufacturing companies. The researcher found that 23 companies in GI were non-manufacturing firms and were dropped from the sample. The result of this process reduced the number of companies to 206.

Step (5): The financial statements of the remaining 206 companies were examined to identify those firms which capitalize the costs of internally developed software. The classification process was not an easy task because, as can be seen

from Table 3.6, about 58 percent and 64 percent of GI and GII respectively are non December firms and therefore the disclosure regarding this capitalized costs was not mandatory in their financial statements for 1983.

In the classification process one company was dropped because not enough information was available to classify it. From the remaining 205 companies the researcher was able to classify 20 (22.5 percent) and 11 (9.5 percent) in GI and GII respectively as capitalizers.

Step (6): Using the SEC library, the researcher examined the financial statements of the companies which did not send their financial statements to him (a total of 160) to find out if there is any more capitalizing firms exist under GI and GII. The researcher was not able to identify any more capitalizing firms in both groups and therefore the percentage of the capitalizers firms (15 percent) would be an upward biased estimate.

Table 3.7 presents a summary of the sample selection process while a complete list of those respondents that sent their financial statements and satisfied the above two criteria appears in Appendix B.

Data Collection

The proxy, 10-K Form, 8-K Form, and the Annual Reports for 1983 were used to construct the independent variables in this study. But this rule was violated in the following cases:

- 1- If the firm is operating under Chapter 11 and its financial statements for 1983 is not available, the last available financial statements were used.
Computer Input Services Inc. belongs to this group.
- 2- If the firm switched to the expensing method in 1983, whatever the reason is, the financial statements for 1982 were used. Daytron Corp. belongs to this group.
- 3- If the firm did not file its financial statements until June 30, 1983, the last available financial statements or the most recent prospectus for public offering were used. Two companies belong to this group. The first is Comserv Corp. and the second Arinco Computer Systems Inc.

The financial statements for 1983 for the expensing firms were available for all companies and no violation to the above mentioned rule occurred.

Balancing the Sample

From Table 3.6 it can be seen that the selected sample consists of 31 companies that capitalize the costs of internally developed software (20 companies in GI and

11 companies in GII) and 174 companies that expense these costs as incurred (69 in GI and 105 in GII). This means that the expensers companies are about six times the number of the capitalizers, and this may affect the results. To overcome this situation and to test how the empirical results of the established model are sensitive to the sampling process two statistical techniques are used to balance the sample before performing the statistical tests (the balanced samples are not substitutes for the original sample by any means but they can be considered as a complementary to it).

The Repetition Technique

The repetition technique as used in this study is based on the idea of Bootstrapping technique. (See Diaconis and Efron (1983), Freedman and Peters (1982), and Efron (1979, 1982) for more discussion on the bootstrapping method.) The researcher realizes that this technique lacks the existence of any theoretical or empirical support but he will use it as an ad hoc method to serve the following two purposes: (1) to balance the sample in an attempt to find how the results of the original sample will be changed if the sample became balanced, (2) to overcome the possibility of losing much of the information if the random sampling is used to balance the sample.

The repetition technique is used to balance the sample in two ways as follows:

- 1- The entire sample of the capitalizing firms (31) were repeated six times so that the new sample of the capitalizers became 186 companies and the size of the entire sample (both the capitalizers and expensers) became 360 companies. The researcher will call this sample the "Naïve Balanced Sample", (hereafter, R(1)). It is apparent that the repetition occurs here in random fashion.
- 2- The second balanced sample was created as follows: The capitalizers firms in GI (20) were repeated three times (the size became 60 companies), then the capitalizers in GII (11) were repeated ten times (its size became 110 companies). The size of the whole sample (both capitalizers and expensers) became 344 companies. This sample is called the "Matched Balanced Sample", (hereafter R(2)).

The Random Sampling Technique

This technique is well known to all researchers. According to that technique a random sample from the control group is selected to match the experimental sample. For the purpose of this study the control group (174 companies) was divided randomly into five samples (each consists of 35 companies except the fifth which

consists of only 34 companies). Those random samples were called: random sample (1), random sample (2), . . . , random sample (5), (hereafter, RS(1), RS(2),. . . , RS(5)).

Table 3.1. This table shows the response to the following question;
Do you have any Internally Constructed Software costs in
Your Balance sheet? [231 responses]

Response	Total	By Company Status		By Accounting Firm									
		Public	Private	AA	AY	C&L	DH&S	E&W	PMM	PW	TR	Other	None
Yes	22%	17%	25%		31	13	40	18	8	8	30	31	7
No	78%	83%	75%	100	69	87	60	82	92	92	70	69	93

Source: "Accounting Practices for the Computer Services Industry, ADAPSO, 1983

AA: Arthur Anderson
AY: Arthur Young
C&L: Cooper & Lybrand
DH&S: Deloitte Haskins & Sells
E&S: Ernst & Whinney
PMM: Peat, Marwich, Mitchell & Co.
PW: Price Waterhouse
TR: Touche Ross

Table 3.2 Percentage of Capital Financed From Equity Market
for the Selected Sample (N=205 companies)

Less than 50% derived
from equity market

50% or more derived from
equity capital

Capitalizers n=31		Expensers n=174		Total n=205	
No. of cos.	%	No. of cos.	%	No. of cos.	%
15	48.4	48	27.6	63	30.7
16	51.6	126	72.4	142	69.3
31	100	174	100	205	100

Table 3.3 The Size and the Listing of Those Common Firms that Used in Both
Daley and Vigeland's (1983) Study and the Current Study

Name of the Company	Listing	Daley & Vigeland Study 1972		Current Study 1983	
		Classi- fication	size (total assets)	Classi- fication	size (total assets)
(1) Applied Data Research Inc.	AM ¹	Cap. ³	9,497,000	Exp. ⁴	91,407,000
(2) Automatic Data Processing Inc.	NY ²	Cap.	49,178,000	Exp.	645,234,000
(3) Logican Inc.	AM	Cap.	5,233,000	Exp.	42,175,000
(4) Dataproducts Corp.	AM	Cap.	66,242,000	Exp.	248,172,000
(5) Hazeltine Corp.	NY	Cap.	52,169,000	Exp.	104.967,000
(6) Lundy Electronic & Systems Inc.	AM	Cap.	18,667,000	Exp.	33,312,587
(7) Mohawk Data Science Corp.	NY	Cap.	235,970,000	Exp.	342,772,000
(8) Sperry Corp.	NY	Cap.	1,840,634,600	Exp.	5,330.300,000

- (1) AM: American Stock Exchange
(2) NY: New York Stock Exchange
(3) Cap: Capitalizer firm
(4) Exp: Expenser firm

Table 3.4. The Stock Market of the Original Selected Sample (205 companies)

Stock Market	Capitalizers						Expensers						Total					
	GI		GII		Total		GI		GII		Total		GI		GII		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
New York Stock Exchange	1	5	2	18.2	3	10.4	7	10.1	25	23.8	32	18.4	8	9	27	23.2	35	17.1
American Stock Exchange	1	5	0	0	1	3.4	6	8.7	15	14.3	21	12.1	7	7.9	15	12.9	22	10.7
Over-the Counter	17	85	9	81.8	26	82.8	55	79.7	65	61.9	120	69.0	72	80.9	74	63.8	146	71.2
Others	1	5	0	0	1	3.4	1	1.5	0	0	1	.5	2	2.2	0	0	2	1.0
Total	20	100	11	100	31	100	69	100	105	100	174	100	89	100	116	100	205	100

GI: Group I, (SEC Code 7370) this group is titled "Computer and Other Processing Services."

GII: Group II, (SEC Code 3570) this group is titled "Office and Computing Machine."

Table 3.5. Personal-Computer Software Sales
(Wholesale 1983)

Hardware Makers	Sales (in million)
IBM	\$110
Tandy	110
Commodore	75
Apple	70
Atari	70
Texas Instrument	60
Independent Software Makers	
Microsoft	68
Lotus	53
Digital Research	48
Micro Pro	45
Visi Corp	45
Ashtcn-Tate	40
Peachtree	22
Broderbund	12
Perfect Software	12
Sierra	12
Sorcin	12
Spinnaker	12
Synapse	12
Continental	11
Software Arts	11
State of Art	11
Software Publishing	10

Source: The Wall Street Journal, February 23, 1984. p.1

Table 3.6. Respondants Profile According to Their Fiscal Year

Fiscal Year	Capitalizers						Expensers						Total					
	GI		GII		Total		GI		GII		Total		GI		GII		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
December	11	55	5	45.5	16	51.6	26	37.7	37	35.2	63	36.2	37	41.6	42	36.2	79	38.5
Non December	9	45	6	54.5	15	48.4	43	62.3	68	64.8	111	63.8	52	58.4	74	63.8	126	61.5
Total	20	100	11	100	31	100	69	100	105	100	174	100	89	100	116	100	205	100

GI: Group I, (SEC Code 7370) this group is titled "Computer and Other Data."

GII: Group II, (SEC Code 3570) this group is titled "Office and Computing Machines."

Table 3.7 Summary of the Sample Selection Process

	GI 7370		GII 3570		Total	
	No. of cos.	%	No. of cos.	%	No. of cos.	%
Total number of companies listed under each group	183	100	206	100	389	100
Number of Companies did not send their financial statements	70	38.3	90	43.7	160	41.1
Total number of companies that sent their financial statements	113	61.7	116	56.3	229	58.9
Number of nonmanufacturing companies	23	20.4	0	0	23	10.0
Number of manufacturing companies that sent their financial statements	90	79.6	116	100	206	90.0
Number of companies that were difficult to be classified as capitalizers or expensers	1	1.1	0	0	1	.5
Number of manufacturing companies that their financial statements and were the subject of the classification process	89	98.9	116	100	205	99.5
Number of companies that capitalize the construction costs	20	22.5	11	9.5	31	15.1
Number of companies that expense the construction costs	69	77.5	105	90.5	174	84.9

GI: Group I, (SEC Code 7370) this group is titled "Computer and Other Data Processing Services,"

GII: Group II (SEC Code 3570) this group is titled "Office and Computing Machines."

CHAPTER IV

EMPIRICAL RESULTS OF UNIVARIATE TESTS

Introduction

In the previous chapter the researcher introduced the positive theory as a framework of the current study. Also, the suggested motives to choose between capitalizing or expensing the costs of internal development of software were presented. Moreover the hypotheses were formulated and the statistical techniques that employed in this study were described.

In this chapter the researcher starts the first section with a presentation of the magnitude of the amount capitalized by software companies and in section two describes the relationship between software industry and partnerships as a new financial vehicle to carry R&D activities. In the third section the results of the univariate tests of factors influencing the decision to capitalize the costs of internally developed software is presented and the conclusion from these tests is present in the last section.

The Magnitude of Capitalization

When James R. Porter (1978, p.1), vice president of finance/administration of ADAPSO, presented the industry's

position to the FASB he argued that "as a result [of the rulings, the] FASB and the accounting community leave the software products industry without assets." In an attempt to find out how true this statement is the researcher examined the annual reports of the firms which capitalize the costs of internally developed software (31) and the following two ratios have been computed:

- (1) The amount capitalized during 1983 or last available year as percentage of R&D expense. The amount capitalized during 1983 for some companies was computed from the balance sheet and the footnotes when the information was sufficient.
- (2) The balance of the internally developed software as it appears in the balance sheet as percentage of the total assets for 1983 or last available year.

Table 4.1 presents the results of that review. From this table it can be seen that the internally developed software asset represents a maximum of about 26% of the total assets. These results show that the contribution of software assets to the total assets is not that significant to claim that FAS#2 and the subsequent rulings will leave the software products industry without assets. The insignificance contribution of software assets will be magnified if we noticed that the software products represent less than 10 percent of the total assets for 20 companies out of 31 (about 65 percent).

With respect to the magnitude of the amount capitalized as percentage of R&D expenditures, the researcher was able to compute this ratio for only 15 companies out of 31 (about 48 percent) because of the following two reasons:

- 1- Some companies did not disclose the amount they spent on the R&D activities or the amount was not identifiable by the companies.
- 2- The disclosure regarding the amount of the capitalized software costs was not required before the issuance of the SEC's rulings and therefore many companies did not disclose the amount they capitalized in their financial statements.

From Table 4.1 it can be seen that the capitalized costs of internally developed software as a percentage of R&D expense ranging from about 40 percent to 745 percent. And if we take into consideration that 14 companies out of 31 (about 45 percent) experienced losses in 1983, then we can conclude that the bottom line for capitalizing the costs of internally developed software is to meet the earnings objective without reducing the spending on the development activities to face the competition in this highly technological industry. This conclusion is an empirical confirmation to the line of argument raised by Richard P. Daly, Chairman and Chief Executive Officer of Comserve Corp., in his comment letter which was sent to

the SEC regarding its Release No.'s 33-64661, and 34-19674. Daly argues that "Smaller public companies, in order to meet their earnings objective, must limit the amount of investment in software construction if these costs are expensed. . . This is particularly true of companies with \$5 million to \$50 million in sales. If software construction costs must be expensed, larger companies can afford a greater investment in products and still meet their earnings objectives."

Software Industry and Partnerships

Many problems with the accounting principles for computer software costs have frustrated many companies in the computer software industry. For instance, when a company develops computer software for internal purposes, without the original intent of selling it to others, the cost incurred should be capitalized if the software will benefit the company for more than one year. Interpretation No. 6 reinforced this position, stating that this type of expenditure is not considered R&D under Statement No. 2. But when a company develops a computer software product or process for internal use and then discovers that it has external market potential, the company faces a puzzling accounting issue. GAAP will allow capitalization of internal software R&D costs only for control, administrative and marketing functions. GAAP

will not allow capitalization of the identical costs when a company takes this product or process to market despite the fact that the software has demonstrated market potential and reasonable determinable future value. The only expenditures that may be capitalized for such a product are those of modification to the existing product or process, so a situation exists in which software program costs that essentially meet all criteria for long-term assets classification are instead treated as period costs and expensed.

The source of computer software also affect the asset-expense issue. Whether a company has a full time software development department or hires a consultant for specific software projects, internally developed computer software may be capitalized only in the instance discussed above. However, the FASB view differently computer software that is purchased from others.

FAS#2, and Interpretation No. 6 specifically state that intangible assets (including software) purchased from others for R&D that have alternative future use to the company, whether in R&D or for some other purpose, should be capitalized. A company that internally develops computer software product or process for R&D must expense those R&D expenditures as incurred. If the same company were to purchase the software from others for use in R&D activities, it would capitalize the expenditure (assuming

an alternative future use).

Many argue that there is little justification for a different accounting treatment in this situation. The source of the same end product, a computer software product or process would affect a company's balance sheet and income statement differently. This forces companies to choose among three alternatives:

- 1- They may purchase software to show stronger balance sheet and income statement even though the internal development of software might be less expensive and more efficient.
- 2- They may develop software internally, increasing efficiency and reducing expenses but reflecting unfavorable short-term financial results.
- 3- They may obtain more favorable short-term accounting treatment by resorting to innovative financing vehicles, namely, by investing in a limited partnership or joint venture.

Organization and Structure of R&D Partnerships

R&D partnerships generally fall within three categories: Royalty, equity and joint venture. Since late 1970s, R&D partnerships have evolved in that order.

1- The Royalty Partnership:

In a typical royalty partnership arrangement, a limited partnership is formed to enter into a research and

development contract with a corporation, some times referred to as the "R&D Company" or the "sponsoring company." The partnership generally pays the R&D contract fee in advance, and the partnership and partners receive a current tax deduction. After the technology is developed, the R&D company exercises an option to either purchase the technology or acquire an exclusive license to use the developed technology in the manufacturing and marketing of the resulting products. As consideration for the purchase or license of the completed technology, the R&D company or its affiliate agrees to pay the partnership royalties.

2- The Equity Partnership:

These R&D partnerships are organized in the same way as royalty partnerships through completion of the R&D contract. After completion of the contract however, the partnership and the company (or its subsidiary) are merged into a new corporation. Other alternatives include merging the partnership directly into the R&D company; in each case, the partner investor eventually obtains an equity interest in continuing entity.

3- The Joint Venture.

In this category, the R&D partnership and the R&D company form a joint venture to manufacture and market the product after the technology has been developed. Until the R&D contract is completed, the joint venture approach

is essentially the same as the royalty and equity partnerships. After the joint venture has been in operation for a period, however, the partnership buys out the R&D company interest or the R&D company buys out the partnership's interest in the joint venture, in accordance with cross purchase options in the joint venture agreement.

Differences

The royalty, equity and joint venture arrangements differ primarily in the approach used to achieve capital gains treatment for the investors. In royalty partnerships, the investor's capital gains result from the passthrough of royalty income or income from sale of the technology to the R&D company. The investor receives a lump-sum payment in cash and/or stock. In equity partnerships the investor realizes capital gains on the sale or other disposition of his stock interest in the R&D company or a new company formed from the merger of the partnership and R&D company. In joint venture partnerships, the investor receives capital gains by selling his joint venture interest, or by the joint venture selling the developed technology. (See Spohr (1983) for more discussion.)

The researcher examined the financial statements of the selected sample to identify the choices pattern. The

results of this investigation presented in Table 4.2. These results indicate that the above mentioned choices are not mutually exclusive because as it can be seen from the table that 11 companies from the capitalizers group selected to purchase software products from others (about 35 percent) and 4 companies from the same group chose to enter in different types of partnerships (about 13 percent).

Table 4.2 shows that the expensers are more involved in buying or forming partnerships to acquire software than the capitalizers. This could be attributed to either the lack of ability to develop these products internally or because those firms intend to acquire what they need without exposing themselves to the unfavorable results of FAS#2 and the subsequent rulings.

Univariate Tests of Factors Influencing
The Decision to Capitalize the Costs of
Internally Developed Software

To prevent any potential measurement errors in one independent variable from affecting test results in another variable when the multivariate model is used, it may be useful to analyze the results of the univariate tests. The potential measurement problem is related to the interest coverage ratio (ICR) because many companies experienced losses in 1983 (or last available financial

statements) and therefore many observations have a negative (ICR). The number of firms with negative ICR was 21 companies in GI (8 capitalizers and 13 expensers) and 34 companies on GII (6 capitalizers and 28 expensers). Moreover for some companies interest expense was zero and therefore the ICR became ∞ . Those firms were coded by the researcher as follows: each firm with $ICR = \infty$ was given a value of ± 3000 so that the value of the ratio would exceed that of any firm in the sample with a non-zero value in the denominator. The number of firms so coded was 10 companies in GI (2 capitalizers and 8 expensers) and 8 companies in GII (one capitalizer and 7 expensers).

The non-parametric Mann-Whitney U test was used to compare each independent variable between the capitalizers and the expensers. This was done both for the entire sample and Group I and Group II. The same test was performed on the naive sample R(1) and the matched balance sample R(2). Table 4.7 through 4.9 report these results.

The non-parametric test was used for two reasons: (1) There is no a priori reason to expect the independent variables to be normally distributed, (2) the reported mean and median values in Tables 4.4 through 4.6 diverge so much for some of the independent variables that the normality assumption seems unlikely to hold for all variables.

Table 4.3 with its three panels contain in each panel Spearman correlation matrix for the variables except the dummy variables management control status (OS) and management compensation plan (CP). Below the correlation matrix are the multiple correlations obtained by regressing each independent variable on all other independent variables to gain insight into the degree of multicollinearity among the variable.

From panel A it can be seen that the largest bivariate correlation is .383 (R^2 of .147) between log of assets (LA) and ICR. The multivariate correlations range from .290 (R^2 of .084) to .418 (R^2 of .174). In general the results do not appear to be indicative of high multicollinearity, but some caution is warranted in interpreting the univariate tests below.

A similar conclusion could be reached by examining panel B and C but more caution should be warranted.

The direction of the correlation for all variables was as expected and it was almost identical in all three panels with one exception regarding the correlation between ICR and Public debt (PUD). In panel A the correlation was negative while it was positive in panels B and C but in all cases these correlation coefficients were insignificant so we do not have to worry about the direction.

The Size and the Capitalization of the Internally
Developed Software Costs - Test of H1:

Since 1978, when W&Z introduced the political costs as a potential incentive that motivate management to select certain accounting methods or to react to mandated accounting standard, it has been argued that firms seem more likely to shun income-increasing procedures if they belong to a regulated industry, are relatively larger in size, belong to a politically sensitive industry, possess larger market share or are in a highly concentrated industry, are highly capital intensive, and/or exhibit high systematic risk or earnings variability.

Using the log of total assets as a measure for size, we can hypothesize that firms which select to expense the costs of internally developed software are larger in size. From Table 4.7 with its three panels we can see that the empirical results of the univariate test support this hypothesis. A similar support is provided from Tables 4.8 and 4.9, in each panel the mean rank for the capitalizers was less than expensers and the difference was always significant. These results were significantly higher for GII than GI which is not surprising because firms in GI are more homogeneous in size than GII (from Tables 4.4 through 4.6 it can be seen that the standard deviation of LA is less for GI than for GII).

The Ownership Control Status and the Selection of
Capitalization - Test of H2:.

The managerial economics provides theory and evidence that the set of accounting methods adopted by the firm is related to its ownership control status (see Williamson, 1964, 1967; Monsen and Downs, 1965; Hindly, 1970; and Dhaliwal, 1981; for evidence on this issue). Also the positive theory of accounting choice developed by W&Z (1978) imply that owner-controlled (hereafter, OC) are likely to choose accounting methods with different income effects than the accounting methods chosen by management-controlled (hereafter, MC) firms. The notion that management utility is tied to the amount and timing of compensation lead to the hypothesis that MC firms will be more inclined than OC firms to choose accounting methods which result in higher or earlier reported income (e.g., capitalization of the costs of internally developed software). This hypothesis contrasts with one developed by Fama (1980). Fama hypothesize that the market for managerial labor acts as a sufficient disciplining mechanism such that there are no differences in the accounting methods used in different ownership structures. Dhaliwal, Salamon, and Smith (1982), (hereafter, DSS), studied the relationship between the ownership control status of the firm and the choice of depreciation methods for financial reporting. By using the financial data of

83 firms in 1962, and by using both univariate tests and probit analysis, they were able to show that the ownership structure influences the choice of the depreciation methods. MC firms were more inclined than OC firms to use the straight-line depreciation method. They interpreted their findings as an evidence against Fama's hypothesis that the managerial labor market is a sufficient disciplining mechanism.

Based on the above discussion it can be hypothesized that companies which select to capitalize the costs of internally developed software are management controlled. Because this variable is dichotomous variable its effect on the selection of capitalization was tested using a Chi-square test. The results of that test appear in Table 4.10. The obtained Chi-square for one degree of freedom for the original sample was 2.234, this is significant at .13 level and was interpreted as weak evidence that management controlled firms are more likely to capitalize the costs of internal development software.

To determine how sensitive this result to the sample size the same test was performed on the balanced samples R(1), (the sample was balanced by repeating the 31 capitalizing firms six times); and R(2), (the sample was balanced by repeating the 20 capitalizing firms of GI 3 times and repeating the 11 capitalizing firms of GII 10 times). The obtained Chi-square was 10.289 and 7.090 for

R(1) and R(2) and these are significant at .001 and .008 respectively. These results were interpreted as an indication that the weak support for ownership control status hypothesis is attributable to sample size.

This result confirms a similar result reached by Dhaliwal, Salamon, and Smith (1982) but it contradicts Kelly's (1983) result.

Interest Coverage Ratio and the Selection of Capitalization - Test of H3:

As it has been discussed earlier, some debt agreements prohibit the firm from issuing new debt unless a minimum prescribed ratio to interest expense is maintained. Thus, capitalizing the costs of internally developed software can enhance this ratio by not decreasing the numerator. As a result it was hypothesized that firms that select the capitalization as an accounting method are more likely to have smaller interest coverage ratio.

The result of performing Mann-Whitney test on this variable provides a support to the above mentioned hypothesis. In all panels in Tables 4.7 through 4.9, the mean rank of this ratio for the capitalization firms was less than the corresponding mean for the expensers and the difference was always significant.

Leverage and the Choice of the Capitalization Method -
Test of H4:

As described by Bowen, Noreen and Lacey (1981) some debt agreements prohibit the firm from issuing new debt unless the firm maintains a minimum prescribed ratio of net assets to funded long-term debt. Therefore capitalizing the costs of internal development of software can be used to enhance this ratio by increasing the net assets. Assuming that both firms in a matched pair are faced with similar constraints on leverage ratios, the firm with the smaller leverage ratio (i.e., greater leverage) should be more likely to capitalize the costs of internally developed software. The empirical result of performing Mann-Whitney test on this variable, as it appears in Table 4.7 panel A, indicates that the mean rank for the capitalizers was greater than the mean rank for the expensers but the difference was insignificant.

From Table 4.7 it appears that this variable has different impact across GI and GII firms. For GI the mean rank for the capitalizers was greater than the mean rank for the expensers but the opposite was true for GII but for both two groups the differences were insignificant.

Performing the same test on the balanced samples R(1) and R(2) provided an evidence that the failure in finding empirical support for this variable as motivator for the management choice is attributable in part to the

sample size in the original sample. From panel A in Table 4.7 and 4.9 it is clear that the predicted effect was supported but panel A of Table 4.9 provided results in the opposite direction. Moreover, Tables 4.7, 4.8 and 4.9 show that the differences were insignificant. Therefore we do not have to worry about the signs. From these results it became apparent that the actual effect of this variable is changed when the sample was balanced which was interpreted as an evidence that the empirical result of this variable is sensitive to the sampling procedures.

Although this result contradicts the results of many previous studies the researcher will relate his results only to Daley and Vigeland's (1983) results because they used the same measure that is employed in the current study. Also, they dealt with a similar problem of R&D item. The difference in the results may be attributed to the characteristics of the samples used in each study. In Daley and Vigland's study the sample consists of firms from 35 industries (two digit SIC), while my sample is selected from two high technology industries where the vast majority of firms are small. These two industries constitute only 21 percent and 15 percent of the Daley and Vigland experimental and control groups respectively. When the researcher examined the sample used by Daley and Vigeland found that the securities of 289 (about 92 percent) are traded on organized exchanges (see Table 5.8)

and that the total assets of 173 (about 55 percent) companies is \$50 million or more, while only 75 (about 36 percent) companies in my sample have total assets of \$50 million or more (see Table 5.9). This difference in the size of the companies (as measured by total assets) used in both studies explain why they found the leverage a significant motivational factor while it was not significant in the current study.

In the highly technological industries the small companies (the majority in this study) rely more heavily on the equity market to finance their operations than do small nontechnological firms. Horwitz and Kolodny (1980) reported that small technological firms receive about 48 percent of capital from equity market while the small nontechnological firms receive only 14 percent. Also they reported that the long term debt received by the small technological firms was only 15 percent as compared to 26 percent for the other group (see figure 2).

That difference in the capital structure of the sample used in their study and mine may be responsible for the difference in the results, regarding the effect of the leverage on the management choices, beside the possible effects of the size of the sample in my study.

The Relationship Between the Existence of Public Debt in
the Capital Structure and the Selection of Capitalization
- Test of H5:

Leftwich (1981) hypothesizes that when a firm finds it necessary to alter its debt constraints, public debt agreement are more costly to renegotiate than private debt agreement. Moreover, Smith and Warner (1979) reported that private debt agreements are more likely to specify the use of particular accounting treatments in determining critical accounting ratio than are public debt agreements. Public indentures are more likely to rely on GAAP as a way of reducing monitoring costs. If constraints are measured using GAAP, management may use alternatives within GAAP to reduce the probability of violating a debt constraint.

The above discussion suggests that firms which use public debt more extensively are more likely to use capitalization method to avoid covenant restrictions since for the same probability of violation the expected costs were higher for a firm with more public debt.

The result of Mann-Whitney test for the entire sample as it appears in panel A of Table 4.7 indicated that the mean rank for the capitalizers is less than the mean rank for the expensers and the difference was significant at .15. This result is in the opposite direction to the predicted effect of this variable.

As it was the case for the leverage, this variable

has different impact on the subsample GI and GII. For GI the effect of public debt was as predicted and the difference was insignificant, while for GII the mean rank for the capitalizers was less than the expensers and the difference was significant at .11.

To test how the results are sensitive to the sampling process regarding this variable, the same test was performed on the repeated samples R(1) and R(2).

From panel A in Tables 4.8 and 4.9, it can be seen that the mean rank for the capitalizers is less than the mean rank for the expensers and the differences were significant at a better level. That means the sample size affected only the level of significance, not the direction of the relation, which may be interpreted as an indication that the empirical results failed to support the public debt hypothesis as managerial motivator and that failure is not attributable to the sampling procedures as it was the case for the leverage variable.

According to the empirical results firms with higher public debt in its capital structure are more likely to expense the costs of internally developed software. This result contradicts the result reached by Daley and Vigeland (1983). The difference in the results may be attributable to the following reason: Daley and Vigeland investigated the management choice between capitalizing or expensing R&D before the issuance of FASB". In this

research the investigation is done after the issuance of FAS#2.

The existence of FAS#2 may give an explanation to why the empirical result of this research indicated that firms with higher public debt in its capital structure are more likely to expense the cost of internal development of software while Daley and Vigland concluded that firms with higher public debt to total assets are more likely to capitalize the R&D. After the issuance of FAS#2 it is considered the mandated accounting rule that should be applied to the costs of internally developed software. Therefore, the selection of capitalization may be interpreted as violation to the mandated rule. This violation may be interpreted as an indication that those firms are trying to hide some kind of financial troubles which may affect the future ability to raise external funds. Therefore, when the management makes its choice regarding the applicable accounting method in the existence of a mandated rule, reducing the costs of renegotiating the public debt agreements should not be the only factor that governs the choice. There is another type of cost which will arise if the management's action is interpreted as a violation to the existing rule. This cost may result from the necessity to pay more interest to raise more debt or from reducing the stock price of the company.

This cost may exceed the cost of renegotiating the public debt agreement and therefore the companies with higher debt in its capital structure will choose the expensing method and bear the costs of renegotiating its public debt agreement rather than choosing the capitalization and bearing the cost of considering it in violation to the mandated rule.

The Existence of Management Compensation Plan Linked to the Reported Earnings and the Selection of Capitalization - Test of H6:

It was argued earlier that if management's compensation is an increasing function of reported earnings, there are incentives for management to capitalize the cost of internally developed software. This assumes, of course, that management is free to choose accounting methods and that the compensation contract does not specify the accounting method.

The results of Chi-square test as reported in Table 4.10 were not consistent with the formulated hypothesis that firms with explicit management compensation plan linked to the reported earnings are more likely to capitalize the cost of internal development of software. For 86 companies that have compensation plan tied to the reported earning only 10 companies (11.6 percent) capitalize the costs of internally developed software,

whereas 21 (17.6 percent) of 119 companies without such plans capitalize these costs.

A similar result was obtained when the sample was balanced in a rational way (R(2)) but when we balanced the sample in random fashion (R(1)) the results indicated a significant effect and this result is attributable to the way we used to balance the sample without considering the composition of GI and GII and how this variable affects them. (The size of GI is almost twice the size of GII on one hand, and for GI 5 companies out of 20 have compensation plan tied to the reported earnings (about 25%) while for GII 5 companies out of 11 (about 45 percent) have compensation plan tied to the reported earnings, on the other hand.)

Conclusion

Performing the non-parametric Mann-Whitney tests on the independent variables of the original sample enables the researcher to reach the following conclusions:

- 1- The companies which select to capitalize the costs of internally developed software are smaller in size.

This result is similar to those reached by Watts and Zimmerman (1978); Zmijewski and Hagerman (1981); Leftwich (1981); Collins, Rozeff and Dhaliwal (1981); Lilien and Pastena (1982); Kelly (1982); and Daley and Vigeland (1983).

- 2- The hypothesis that firms controlled by management are more likely to capitalize the cost of internal development is supported at a significance level of .13. When the sample was balanced the level of significance improved dramatically which is interpreted as more evidence that the result is sensitive to the sampling procedures. This result is similar to Dhaliwal, Salamon and Smith's (1982) result which may be interpreted as more supportive evidence to the managerial economists theory and Watts and Zimmerman's theory.
- 3- A low interest coverage ratio was also a significant characteristic of those firms that select the capitalization method. These results confirm the results reached by Bowen, Noreen, and Lacey (1981) and by Daley and Vigeland (1983).
- 4- The hypothesis that the firms with higher leverage ratio are more likely to adopt the capitalization method was not supported. This result confirms those reached by Collins, Rozeff and Dhaliwal (1981) and Holthausen (1981). This result was contradictory to those reached by Dhaliwal (1980); Holthausen (1981), Bowen, Noreen, and Lacey (1981); Dhaliwal, Salamon, and Smith (1982); Zmijewski and Hagerman (1981); Leftwich (1981); and Daley and Vigeland (1983).

The failure of the leverage ratio as explanatory

variable for the managerial choice between the capitalization as opposed to the expensing is attributable in part to the sampling process. This conclusion is reached when the sample was balanced using the repetition technique.

- 5- The companies with higher public debt in its capital structure are more likely to expense the cost of internally developed software. The result is contradictory to the formulated hypothesis. This result also contradicts the result reached by Daley and Vigeland (1983).

This failure is not attributable to the sampling procedures, because the only effect that resulted from balancing the sample was the enhancement of the level of significance to support the conclusion that firms with higher public debt are more likely to expense the costs of internal development of software.

The researcher introduced the cost of violating the mandated rule as an explanation to the difference between his result and the result that was reached by Daley and Vigeland.

- 6- The results of the univariate tests indicated that firms with management compensation plans explicitly linked to reported earnings are no more likely than firms without such plans to capitalize the costs of internally developed software.

Table 4.1 The Magnitude of the Amount Capitalized as Percentages
of R&D Expense and Total Assets

Company Name	Amount Capitalized in 1983	Balance of Internally Developed Software for 1983
	R&D Exp. in 1983	Total Assets
<u>GI (7370)</u>	%	%
1. AGS Computers Inc.	N/A*	5.0
2. Anacomp Inc.	168.6	6.5
3. Astradyne Computer Industries Inc.	0	0
4. Autographic Inc.	N/A	2.9
5. BDM International Inc.	N/A	6.7
6. Computer Input Services Inc.	N/A	3.0
7. Conserv Corp.	N/A	21.3
8. Dyatron Corp.	N/A	7.3
9. First Financial Management Inc.	N/A	9.6
10. Fundsnet Inc.	N/A	2.2
11. Harris & Paulsen Inc.	0	23.7
12. Infodata Systems Inc.	40.5	20.7
13. Lodgistix Inc.	N/A	11.8
14. MTX International Inc.	39.5	8.9
15. National Computer Analysts	745.0	17.6
16. National Data Communications Inc.	0	8.7
17. National Data Corp.	164.3	11.0
18. Netword Inc.	N/A	.2
19. Psych System Inc.	597.1	8.0
20. Universal Money Centers Inc.	N/A	.2
<u>GII 3570</u>		
21. Arinco Computer Systems Inc.	N/A	N/A
22. BSL Technology	137.5	32.7
23. Computer Designed Systems Inc.	339.6	25.8
24. Denelcor Inc.	N/A	N/A

Table 4.1 (Continued)

Company Name	Amount Capitalized in 1983	Balance of Internally Developed Software for 1983
	R&D Exp. in 1983	Total Assets
	%	%
25. International Business Machines Corp.	22.2	3.5
26. Interscience Systems In.	0	0
27. Laser Scan International Inc.	N/A	5.3
28. Modular Computer Systems Inc.	0	0
29. Syntech International Inc.	41.5	12.4
30. Wiltek Inc.	N/A	4.8
31. Zonic Corp.	<u>129.1</u>	<u>9.4</u>
Mean	151.56	9.28

* The ratio is not available because either the firm did not disclose the amount capitalized or the firm did not disclose the R&D expense.

Table 4.2 Choices Adopted by the Original
 Selected Sample to Deal with R&D
 Activities of its Software.

Choices Adopted	Capitalizer	Expensers	Total
Internally developed	31	-	31
Purchase or license	11	37	48
Partnerships	4	18	22

Table 4.3 Spearman Correlation Among The Independent Variables (two-tailed significance levels in parentheses)

	Panel A. The Original Sample (N=205)			
	LA	ICR	PVD	PUD
LA ^(a)	1.00 ***			
ICR ^(b)	.383 (.001)	1.00 ***		
PVE ^(c)	.023 (.741)	-.264 (.001)	1.00 ***	
PUD ^(d)	.317 (.001)	-.087 (.213)	.163 (.019)	1.00 ***
Multiple R*	.418	.252	.399	.290
	Panel B. R(1) Sample, (N=360)			
	LA	ICR	PVD	PUD
LA	1.00 ***			
ICR	.428 (.001)	1.00 ***		
PVD	.014 (.788)	-.100 (.058)	1.00 ***	
PUD	.286 (.001)	.026 (.623)	.306 (.001)	1.00 ***
Multiple R*	.432	.233	.608	.589

Table 4.3 (continued)

	Panel (C). R(2) Sample (N=344)			
	LA	ICR	PVD	PUD
LA	1.00 ***			
ICR	.356 (.001)	1.00 ***		
PVD	.030 (.583)	-.130 (.016)	1.00 ***	
PUD	.290 (.001)	.054 (.323)	.314 (.001)	1.00 ***
Multiple R*	.406	.227	.737	.724

* obtained by regressing the variable on all other variables

(a) Log of total assets.

(b) Interest coverage ratio.=

$$\frac{\text{Income before extraordinary items \& taxes}}{\text{interest expense}}$$

(c) Private Debt ratio =

$$\frac{\text{Total LTD-Public LTD-capitalized lease obligations}}{\text{Total assets-Intangible assets}}$$

(d) Public debt ratio =

$$\frac{\text{Public LTD}}{\text{Total assets-Intangible assets}}$$

Table 4.4 Ranges, Means, Medians, and Standard Deviations of the Independent Variables for the Original Sample

Independent Variables	Statistics	Entire Sample		GI Sample		GII Sample	
		Capitalizers (N=31)	Expensers (N=174)	Capitalizers (N=20)	Expensers (N=69)	Capitalizers (N=11)	Expensers (N=105)
LA	Min.	5.528	5.272	6.054	5.527	5.528	5.272
	Max.	10.571	9.727	8.330	8.929	10.571	9.727
	Median	6.902	7.540	6.942	7.378	6.597	7.659
	Mean	7.051	7.562	7.037	7.353	7.077	7.700
	(St. dev.)	.907	.803	.624	.669	1.315	.88
ICR	Min.	-3000	-3000	-3000	-93.686	-91.473	-3000
	Max.	3000	3000	3000	3000	3000	3000
	Median	.970	6.437	1.533	11.772	-1.480	3.187
	Mean	88.954	226.664	-7.458	375.334	264.249	128.966
	(St. dev.)	944.759	936.490	973.643	960.697	907.829	911.658
PVD	Min.	0	0	0	0	0	0
	Max.	.947	1.275	.498	.731	.947	1.275
	Median	.022	.018	.029	.009	.015	.029
	Mean	.109	.080	.104	.054	.118	.097
	(St. dev.)	.199	.156	.148	.117	.278	.175
PUD	Min.	0	0	0	0	0	0
	Max.	1.406	.726	.510	.475	1.406	.726
	Median	0	0	0	0	0	0
	Mean	.089	.039	.067	.021	.129	.050
	(St. dev.)	.277	.098	.160	.070	.423	.112

GI: Group I, (SEC Code 7370) this group is titled "Computer and Other Data Processing Services."

GII: Group II, (SEC Code 3570) this group is titled "Office and Computing Machines."

LA, ICR, PVD, PUD as defined in Table 4.2.

Table 4.5 Ranges, Means, Median and Standard Deviation of the Independent Variables for R(1) (Naive Balanced Sample)

Independent Variables	Statistics	Entire Sample		GI Sample		GII Sample	
		Capitalizers (N=196)	Expensers (N=174)	Capitalizers (N=120)	Expensers (N=69)	Capitalizers (N=66)	Expensers (N=105)
LA	Min.	5.528	5.272	6.054	5.527	5.528	5.272
	Max.	10.571	9.727	8.330	8.929	10.571	9.727
	Median	6.902	7.540	6.942	7.378	6.597	7.659
	Mean	7.051	7.562	7.037	7.353	7.077	7.700
	(St. dev.)	.895	.803	.611	.669	1.263	.855
ICR	Min.	-3000	-3000	-3000	-93.686	-91.471	-3000
	Max.	3000	3000	3000	3000	3000	3000
	Median	.970	6.437	1.533	11.772	-1.480	3.187
	Mean	88.955	226.664	-7.457	375.334	264.249	128.966
	(St. dev.)	931.904	936.490	952.969	960.697	872.314	911.658
PVD	Min.	0	0	0	0	0	0
	Max.	.947	1.275	.498	.731	.947	1.275
	Median	.022	.018	.029	.009	.015	.029
	Mean	.109	.080	.104	.054	.118	.097
	(St. dev.)	.197	.156	.145	.117	.267	.157
PUD	Min.	0	0	0	0	0	0
	Max.	1.406	.726	.510	.475	1.405	.726
	Median	0	0	0	0	0	0
	Mean	.089	.039	.067	.021	.129	.05
	(St. dev.)	.274	.098	.157	.070	.407	.112

GI: Group I, (SEC Code 7370) this group is titled "Computer and Other Data Processing Services."

GII: Group II, (SEC Code 3570) this group is titled "Office and Computing Machines,"
LA, ICR, PVD, PUD as defined in Table 4.2.

Table 4.6 Ranges, Mean, Median and Standard Deviation of the Independent Variables for R(2) (Matched Balanced Sample)

Independent Variables	Statistics	Entire Sample		GI Sample		GII Sample	
		Capitalizers (N=170)	Expensers (N=174)	Capitalizers (N=60)	Expensers (N=69)	Capitalizers (N=110)	Expensers (N=105)
LA	Min.	5.528	5.272	6.054	5.527	5.528	5.272
	Max.	10.571	9.727	8.330	8.929	10.571	9.727
	Median	6.629	7.540	6.942	7.929	6.597	7.59
	Mean	7.063	7.562	7.037	7.353	7.077	7.00
	(St. dev.)	1.054	.803	.613	.669	1.259	.855
ICR	Min.	-3000	-3000	-3000	-93.686	-91.473	-3000
	Max.	3000	3000	3000	3000	3000	3000
	Median	-.293	6.437	1.533	11.772	-1.480	3.187
	Mean	168.352	226.664	-7.457	375.334	264.249	128.966
	(St. dev.)	907.941	936.490	956.998	960.697	869.542	911.658
PVD	Min.	0	0	0	0	0	0
	Max.	.947	1.275	.498	.731	.947	1.275
	Median	.113	.018	.029	.009	.015	.029
	Mean	.015	.080	.104	.054	.118	.097
	(St. dev.)	.231	.156	.146	.117	.266	.175
PUD	Min.	0	0	0	0	0	0
	Max.	1.406	.726	.510	.475	1.406	.726
	Median	0	0	0	0	0	0
	Mean	.107	.039	.067	.021	.129	.050
	(St. dev.)	.340	.098	.157	.070	.406	.112

GI: Group I, (SEC Code 7370) this group is titled "Computer and Other Data Processing Services."

GII: Group II, (SEC Code 3570) this group is titled "Office and Computing Machines."

LA, ICR, PVD, PUD as defined in Table 4.2

Table 4.7 Results of Mann-Whitney U Tests on the Independent Variables for the Original Sample

Panel A. Entire Sample (N=205)					
Hypotheses	Variables	(1) Capitalizers Mean Rank	(2) Expensers Mean Rank	Z-score	one-tail probabil- ity
(1) < (2)	LA	67.18	109.38	-3.650	.0002
(1) < (2)	ICR	74.90	108.01	-2.863	.0021
(1) > (2)	PVD	104.53	102.73	-.159	.4369
(1) > (2)	PUD	94.71	104.48	-1.045	.1481
Panel B. GI Sample (N=89)					
Hypotheses	Variables	(1) Capitalizers Mean Rank	(2) Expensers Mean Rank	Z-score	one-tail probabil- ity
(1) < (2)	LA	35.15	47.86	-1.936	.0264
(1) < (2)	ICR	28.85	49.68	-3.177	.0008
(1) > (2)	PVD	49.75	53.62	-.956	.1695
(1) > (2)	PUD	45.30	44.91	-.082	.4672
Panel C. GII Sample (N=116)					
Hypotheses	Variables	(1) Capitalizers Mean Rank	(2) Expensers Mean Rank	Z-score	one-tail probabil- ity
(1) < (2)	LA	33.09	61.16	-2.634	.0042
(1) < (2)	ICR	45.68	59.84	-1.329	.0920
(1) > (2)	PVD	52.68	59.11	-.6132	.2699
(1) > (2)	PUD	48.50	59.55	-1.205	.1142

LA: Log of total assets

ICR: Interest Coverage ratio

PVD: Private debt

PUD: Public debt

Table 4.8 Results of Mann-Whitney U Tests on the
Independent Variables for the Naive
Balanced Sample [R (1) Sample]

Panel A. Entire Sample (N=360)					
Hypotheses	Variables	(1) Capitalizers Mean Rank	(2) Expensers Mean Rank	Z-score	one-tail probabil- ity
(1) < (2)	LA	144.68	218.79	-6.753	.0000
(1) < (2)	ICR	152.40	210.53	-5.298	.0000
(1) > (2)	PVD	182.03	178.86	-.2957	.3837
(1) > (2)	PUD	172.21	189.36	-2.0471	.0203
Panel B. GI Sample (N=189)					
Hypotheses	Variables	(1) Capitalizers Mean Rank	(2) Expensers Mean Rank	Z-score	one-tail probabil- ity
(1) < (2)	LA	85.15	112.13	-3.266	.0006
(1) < (2)	ICR	78.85	123.09	-5.355	.0000
(1) > (2)	PVD	99.75	86.74	-1.611	.0536
(1) > (2)	PUD	95.30	94.48	-.141	.4441
Panel C. GII Sample (N=116)					
Hypotheses	Variables	(1) Capitalizers Mean Rank	(2) Expensers Mean Rank	Z-score	one-tail probabil- ity
(1) < (2)	LA	60.59	101.97	-5.322	.0000
(1) < (2)	ICR	73.18	94.06	-2.685	.0040
(1) > (2)	PVD	80.18	89.66	-1.249	.1059
(1) > (2)	PUD	76.00	92.29	-2.572	.0050

LA: Log of total assets
ICR: Interest Coverage ratio
PVD: Private debt
PUD: Public debt

Table 4.9 Results of Mann-Whitney U Test on the Independent Variables for the Matched Balanced Sample [R (2) Sample]

Panel A. Entire Sample (N=344)					
Hypotheses	Variables	(1) Capitalizers Mean Rank	(2) Expensers Mean Rank	Z-score	one-tail probabil- ity
(1) < (2)	LA	135.75	208.40	-6.775	.0000
(1) < (2)	ICR	144.71	199.65	-5.124	.0000
(1) > (2)	PVD	171.32	173.65	-.223	.4116
(1) > (2)	PUD	163.00	181.78	-2.293	.0109
Panel B. GI Sample (N=129)					
Hypotheses	Variables	(1) Capitalizers Mean Rank	(2) Expensers Mean Rank	Z-score	one-tail probabil- ity
(1) < (2)	LA	55.15	73.57	-2.791	.0027
(1) < (2)	ICR	48.85	79.04	-4.577	.0000
(1) > (2)	PVD	69.75	60.87	-1.338	.0842
(1) > (2)	PUD	65.30	64.74	-.120	.452
Panel C. GII Sample (N=215)					
Hypotheses	Variables	(1) Capitalizers Mean Rank	(2) Expensers Mean Rank	Z-score	one-tail probabil- ity
(1) < (2)	LA	82.59	134.62	-6.133	.0000
(1) < (2)	ICR	95.18	121.43	-3.095	.0010
(1) > (2)	PVD	102.18	114.10	-1.445	.0743
(1) > (2)	PUD	98.00	118.48	-3.051	.0012

LA: Log of total assets

ICR: Interest Coverage ratio

PVD: Private debt

PUD: Public debt

Table 4.10 Results of Chi-Square test on
ownership control status and
management compensation plans
for the Original, R(1)*, and R(2)**
Samples.

Samples	d.f.	Chi-square	Significance Level
<u>OS Variable</u>			
Original Sample	1	2.284	.131
R(1) Sample	1	10.289	.001
R(2) Sample	1	7.090	.008
<u>CP Variable</u>			
Original Sample	1	.979	.322
R(1) Sample	1	4.514	.034
R(2) Sample	1	.840	.359

* R(1): Naive balanced sample

** R(2): Matched balanced sample

CHAPTER V
EMPIRICAL RESULTS OF MULTIVARIATE ANALYSIS

Introduction

The results of the univariate tests in Chapter IV provided a strong support for the size effect and the interest coverage hypotheses. The ownership control status was also supported but at level of significance of .13. But the effect of leverage on the management choice was not supported and its failure was attributed partially to sampling procedures. Finally, the existence of public debt in the capital structure has the opposite effect to the predicted one and was significant at higher level than the conventional one.

In the first section of this chapter the results of performing the multivariate tests on the original sample are presented and compared with the univariate results, while section two presents the results of performing the multivariate tests on the random samples RS(1) through RS(5) as well as a comparison with the results of the original sample. In section three the results of performing the same tests on the balanced samples using the repetition technique are introduced. The final section draws the conclusion of the multivariate analysis.

The Results of Multivariate Model for
The Original Sample

To assess the individual impact of each independent variable, all variables were included in the following cross sectional regression:

$$Z = \beta_0 + \beta_1 LA + \beta_2 OS + \beta_3 ICR + \beta_4 PVD + \beta_5 PUD + \beta_6 CP$$

where

Z = Probability of the management choice to treat the costs of internally developed software, set equal to 0 if the management selects the capitalization method, 1 if the expensing method is the choice.

LA = The log of total assets.

OS = 0 if the firm is classified as management controlled. The firm is classified as management controlled if less than 10 percent of the voting stock is owned by any party.

1 if the firm is classified as owner controlled. The firm is classified as owner controlled if one party owned 10 percent or more of the voting stock and exercised active control, or if one party owned 20 percent or more of the voting stock. Representation on the board of directors or in the management of the firm is taken as evidence of active control.

ICR = $\frac{\text{Income before extraordinary items and taxes}}{\text{interest expense}}$

$$PVD = \frac{\text{Total LTD-Public LTD-capitalized lease obligations}}{\text{Total assets - Intangible assets}}$$

$$PUD = \frac{\text{Public LTD}}{\text{Total assets - Intangible assets}}$$

$$CP = \begin{cases} 0 & \text{if there is compensation plan related to the} \\ & \text{reported earnings exists.} \\ 1 & \text{if compensation plan exists but not related to} \\ & \text{reported earnings or does not exist at all.} \end{cases}$$

The predicted signs of the coefficients are negative for LA and ICR and positive for the rest of the variables.

Given a dichotomous dependent variable, ordinary least square is not appropriate for estimating the parameters. Multivariate discriminant analysis is also rejected because the independent variable OS and CP are dichotomous and because the variance covariance matrices for the capitalizers and expensers are not equal.

Probit analysis was selected. This technique gives significant test on overall classification as well as significant tests on the individual independent variables.

Table 5.1 reports the probit regression results for the entire sample. In version (2) in this table the interest coverage ratio is adjusted as follows: for each company with negative interest coverage ratio the ratio was coded zero instead of the negative value because the negative ratio first is meaningless and second it may cause distortion in the obtained coefficient. The coded interest coverage ratio was labeled adjusted interest

coverage ratio (AICR).

From Table 5.1 it is clear that all variables have the predicted sign for both versions except the private debt (PVD), but only log of assets (LA) and public debt (PUD) were significant at .005 and .06 respectively in version (1) and at .004 and .07 respectively in version (2) and ownership status (OS) variable was significant at .16.

The estimated R^2 was .13 in both versions. This by itself does not prove that the model is significant. Such a test can be constructed by multiplying -2 by the maximum likelihood estimate (MLE). The resulting statistic is distributed as a Chi-square with degree of freedom equal to the number of independent variables. This statistic is reported in Table 5.1 and show that the model is significant at .02 level for both versions.

Adjusting the interest coverage ratio did not affect the coefficients significantly. Also the direction of all variables remained unchanged and the R^2 for the whole model did not change either. This was interpreted as an indication that the existence of negative ratio in version (1) do not affect the results of the model in a significant way.

In the rest of this study the results of version (2) are reported for comparison purpose but the interpretation is limited to the results of version (1) for the sake of

simplicity.

The model achieves 85 percent correct classification, but this result is meaningless and misleading. Pinches (1978) provides insight as to what would be achieved under naive classification schemes given the population priors that approximately 85 percent of the software producers use the expensing method and 15 percent use the capitalization method to treat the costs of internally developed software. The naive classification method which maximizes correct classification is the maximum change criteria under which all firms are classified into the large group. Under this naive criterion all firms would be classified as expensers and this would produce a correct classification rate of 84.9 percent. If the best naive classification is required to maximize correct classification over all groups, Pinches (1978) points out that the proportional chance criteria would be used. The proportion chance method would achieve only 74.5 percent success rate in predicting management choice between capitalizing or expensing the costs of internally developed software. The current probit result is almost the same as this achieved under the first naive model, but it exceeds the results achieved under the second naive model at .001 level of significance.

From Table 5.2 it can be seen that type I error for the capitalizers (14.7 percent) is greater than the

corresponding type of error for the expensers (0 percent).

Reconciling the Divergence in the Results Between the
Univariate and the Multivariate Tests

Comparing the results of the probit model with those achieved under the univariate tests we can see that in both tests all variables have the predicted sign except PUD in the Mann-Whitney test and PVD in the probit analysis.

The results of both tests provided an evidence that firms that select the capitalization method are more likely to be smaller in size. Moreover both tests indicate that the leverage as measured by the private debt (PVD) and the existence of management compensation plan related to the reported earnings variables (CP) failed in discriminating between those which select the capitalization and those which select to expense the costs of internal development of software as incurred.

The relationship between the ownership control status (OS) and management's choice was not supported at .10 level (the significance levels in the univariate and the multivariate tests were .13 and .16 respectively).

Finally, the effect of public debt (PUD) and interest coverage ratio (ICR) on the management's choice was inconsistent in both tests. The divergence in the results between the multivariate and the univariate test

may be attributable to a significant multicollinearity or measurement errors among the variables. This possibility is resolved by dropping the variables which are candidates for multicollinearity or measurement errors.

In version (6) of Table 5.3 the ICR variable was dropped from the model because this variable is a candidate for measurement error and may be responsible for the divergence between the univariate and the multivariate analysis. But as it can be seen there is no change in the direction of the signs of all variables and there is no significant change in the significance levels.

In version (3) the LA was dropped to test for the effect of multicollinearity between this variable and the other variables on the model. The only significant change in the model was the improvement of the level of significant of OS variable but the sign for all variables remains unchanged.

The possible multicollinearity between PVD and PUD was tested in versions (4) and (5). When PVD was dropped the PUD still significant and has the right predicted sign which contradict the result of the univariate test. All other variables almost remained unchanged.

When PUD was dropped the PVD variable remains insignificant but it has the right sign and confirms the results of the univariate tests. This was interpreted as an evidence that the multicollinearity between PVD and PUD

may be responsible for divergence between the univariate and the multivariate results but anyhow this variable in both tests turned to be insignificant in explaining the management choice regarding the accounting treatment of the costs of internally developed software.

From the above discussion we can conclude that the empirical result of the multivariate analysis provided an evidence that firms which select to capitalize the costs of internal development of software are smaller in size and their capital structure contain a high portion of public debt. This result is similar to those reached by Daley and Vigeland (1983). Also the results did not provide a support for the ownership control status (OS) at a conventional level.

Moreover, the existence of management compensation plan related to the reported earning was not a significant motivational variable and this result confirms those achieved by Watts and Zimmerman (1978); Bowen, Noreen and Lacey (1981); and Holthausen (1981).

A consistent results regarding the interest coverage ratio (ICR) was provided by this study and by Daley and Vigeland (1983). Finally, the results of both the univariate and the multivariate indicated that the leverage variable is not a significant motivating variable regarding the accounting choice to treat the costs of internally developed software. This result contradicts

those reached by BNL (1981), Dhaliwal (1980), Dhaliwal, Salamon and Smith (1982), Lilien and Patena (1982), Zmijewski and Hagerman (1981), Leftwich (1981), And Daley and Vigeland (1983).

It is not surprising to find that the leverage (as measured by the private debt, PVD) is insignificant motivational variable in this study because the sample consists of small, high technology companies which depend more heavily on equity capital. Table 3.4 shows that securities of 146 (about 71 percent) companies are traded OTC. Moreover, upon reviewing financial statements of the selected sample (205 companies) the researcher found that 142 (about 69 percent) companies financed 50 percent or more of its activities from the equity capital (see Table 5.8) this finding support the evidence provided by Horwitz and Kolodny (1980) who found that small, high technology firms raise about 48 percent from equity market, as compared to 14 percent for the small nontechnological firms.

Also, the sample used by Daley and Vigeland (1983) was examined to find out if their sample consists of small or large, high technology firms. Table 5.9 shows that the securities of 289 (about 92 percent) are traded in organized exchanges which means that their sample consists of large, high-technology firms. Moreover, the researcher found that the amount of total assets for 173 (about 55

percent) companies is 50 million or more in their sample (see Table 5.9), while only 75 (about 36 percent) companies in the current study have total assets 50 million or more which means that the size of firms in their sample is larger than the size of firms used in the current study. These findings explain why the leverage variable was significant in their study and was not significant in the current research. The large, high technology firms rely less on the equity capital and use more long term debt while the opposite is true for small, high-technology firms (see figure 2).

The Results of the Balanced Samples - Random Sampling Technique

It was mentioned earlier that using an experimental sample of 31 firms to test against a control group consists of 174 firms can not provide reliable result regarding the significance of the motivational variables of the constructed model. Moreover the empirical results in the previous section indicated that the ability of the current model to classify the firms correctly was not different from those achieved by the naive model.

Two remedies were introduced to balance the sample. The first was using the balanced random samples. The 174 firms were divided randomly into 5 groups each consisting of 35 firms (the fifth group consists of 34 firms only).

These five random samples were run separately against the capitalizing firms. The second was using the repetition method to balance the sample in two different ways.

The results of applying the probit model on those 5 random samples are reported in Table 5.4. From this table with its 5 panels it can be seen that LA, OS, PUD, and CP variables have the predicted sign but the other two variables ICR and PVD their signs varied from sample to another.

The only variable that turned to be significant in 4 samples of 5 was the LA which confirmed a previous conclusion that the firms that select the capitalization method are smaller in size. The other five variables were insignificant in four samples out of five. The model was significant only in two samples out of five (the Chi-square and its significance level is reported in the last column of Table 5.4).

Two explanations could be offered to interpret the instability of the results of those five samples. The first is that the sample size (66 observations) is too small to apply the probit technique to it and another technique such as the ordinary least square combined with jackknife technique may be more appropriate especially if the normality assumption is violated. The second explanation to the instability of the results may be attributed to losing a large amount of information in

each sample (using 35 firms in each random sample means losing 139 observations each time).

Although the probit model was significant in samples 3 and 5 the five samples achieved correct classification of 62.1 percent, 69.7 percent, 71.2 percent, 74.2 percent, and 69.2 percent for RS(1) through RS(5) respectively.

The naive classification which maximizes correct classification achieves 53 percent for samples RS(1) through RS(4) and 52.3 percent for random sample RS(5). The proportional chance method achieves 50.2 percent for samples RS(1) through RS(4) and 51.7 percent for RS(5). the current probit results exceed those achieved under either naive model at the .005 level of significance.

From Table 5.5 it can be seen that running the whole control group (174) against the 31 capitalizers firms in five different runs resulted in classifying 15 firms out of 31 (about 48 percent) in the same group consistently while the other 18 companies were classified differently in the five samples (the variance is not 0 for 18 companies in the last column of Table 5.5).

Finally, only 12 companies out of 31 (about 39 percent) were classified correctly in all five samples.

The Results of the Balanced Samples -
Repetition Technique

From the previous section it became apparent that the results of the random sampling were of a little help in testing the reliability of the results achieved from the unbalanced sample in the original model. Two reasons were introduced in the previous section to explain the instability of the results of the five random samples.

In this section the researcher reports the results of balancing the sample by using the repetition technique. The sample, as it was mentioned earlier was balanced in two different ways:

- 1- In the first the sample was balanced in naive way by repeating the financial data of the 31 companies six times.
- 2- In the second the sample was balanced in a matched way. To balance the first group (GI) the financial data of the 20 capitalizers of GI was repeated 3 times while the 11 capitalizers of GII was repeated 10 times.

Although the repetition of the sample as employed in this research lacks a theoretical supports it was used because of the following reasons.

- 1- Increasing the experimental group may not represent the reality but we may appreciate the use of this method for the following two reasons: a)if we realized

that the purpose of this increase is to test the sensitivity of the results in the original sample to the sample structure where the experimental group is too small as compared to the control group, and b) if we realized that this experimental group, represents the whole population in this two groups (GI and GII) so there is no other way to increase the experimental group.

- 2- The use of the repetition technique allows us to perform the test on the whole sample without losing any piece of information.
- 3- The balanced repeated replication is similar in spirit to the bootstrapping, jackknife, and cross validation but quite different in detail. In each of the above mentioned procedures we generate a "fake" data sets from the original data and assess actual variability of a statistic from its variability over all the sets of "fake" data.
- 4- The statistical structure of the capitalizing firms does not change significantly as it can be seen from Table 4.3 through 4.5.

The results of performing the probit analysis on the repeated samples R(1) and R(2) are reported in Table 5.6. From the reported results it can be seen that the firm size (LA), ownership control status (OS), interest coverage ratio (ICR), and public debt (PUD) all have the

predicted sign in both samples and that confirm the results obtained from the original sample. The leverage (PVD) in both samples has the opposite of the predicted sign and the existence of management's compensation plan related to the reported earning (CP) has a different sign in each sample.

The results also provide an evidence that the interest coverage ratio, leverage, and the management compensation plan which is linked to the reported earnings do not have a significant effect on the choice of the accounting method. These conclusions confirm the corresponding results achieved from the original sample.

Finally, it became apparent that firms which capitalize the costs of internally developed software are more likely to be controlled by management as it can be seen in Table 5.6 where the OS variable was significant at .1 or better level of significance.

The probit model is significant at .001 level for both samples and the correct classification was 65.3 percent for R(1) and 64.2 percent for R(2). The current probit results exceed those achieved under either naive model at the .001 level of significance.

Reconciling the Divergence in the Results Between the Balanced Samples R(1) and R(2)

From Table 5.6 it became apparent that there is a

divergence in the results between R(1) and R(2) regarding the direction of the effect of CP variable. In this section the researcher discusses the possible reason for this divergence.

If we examine the composition of the entire original sample we can see that it consists of two groups: GI and GII, and GI consists of 20 capitalizing firms and 69 expensing firms. GII group consists of 11 capitalizing and 105 expensing firms. Two important ratios can be constructed from these numbers. The first is the ratio of capitalizing firms in both groups which is about 2:1 for GI and GII. The second ratio is the relationship between the entire size of GI and GII, using GII as a base it can be seen that the size of GI is about 77 percent of the size of GII.

In R(1) the sample was balanced in a naive way and the balancing process ended with 120 capitalizing versus 69 expensing firms in GI and 66 capitalizing versus 105 expensing firms in GII. Now if we computed the same ratio we computed for the original sample we can see that the size of the capitalizers firms in GI is about two times the size of expensing firms in GII (120:66) but the size of GI as whole became 111 percent of the size of GII

$$\left(\frac{120 + 69}{66 + 105} \right).$$

In R(2) the sample was balanced in more rational way

and the balancing process ended with 60 capitalizing versus 69 expensing firms in GI and 110 capitalizer versus 105 expensers in GII which means that the size of the capitalizing firms in GI became about one half of the size of capitalizers in GII ($\frac{60}{110}$). The size of GI as a whole became about 60 percent of the size of GII ($\frac{60 + 69}{110 + 105}$)

The divergence in the results between R(1) and R(2) and between R(1) and the original sample and the similarity in the results between R(2) and the original sample indicated that the differential effects of the suggested variables varied across the subgroups GI and GII and this may caused the divergence in the results. To test for this possibility the probit model was applied to the balanced subgroups of R(2). The subgroups of R(2) were used because we are interested in examining the differential effect of the suggested variables on the groups GI and GII as well as between the capitalizers and the expensers. The results of applying the model on those groups are reported in Table 5.7.

From Table 5.7 it can be seen that the direction of the effect for LA, OS, ICR, and PUD variables was as predicted in both groups (GI and GII). Also the results provide an evidence that the effects of PVD and CP variables were as predicted for GI and in the opposite direction for GII.

Moreover, it is clear that the leverage (PVD) variable was statistically significant in both groups but in two different directions as it was mentioned earlier but the significance level is better for GII than for GI and that may explain why this variable has the wrong direction in both R(1) and R(2) even when the size of GI became 111 percent of GII.

The OS variable is a significant motivation factor for GI and insignificant for GII and that explains why when GI dominated R(1) the variable was statistically significant at .05 but when we maintained the relationship between the size of GI and GII as it was in the original sample the variable was significant at .10 level.

From these results we can conclude that the differences in the direction and the magnitude of the suggested variables across GI and GII is responsible for the divergence in the results that achieved from R(1) and R(2), also it can be seen that the results of R(2) is more comparable with the results of the original sample because of the similarity in the construction of GI and GII in both samples.

Conclusion

The results of the multivariate analysis provided an evidence that firms which select the capitalization method to account for the costs of internally developed

are smaller in the size and have more public debt in their capital structure than those which select the expensing method. Also, the results indicate that there is a weak support for the hypothesis that the capitalizer firms is controlled by management.

Also the results provided an evidence that the ICR, PVD, and CP variables are not significant motivational factors.

Moreover, the results indicated that some of these suggested variables have different effects across GI and GII and this may restrict the generalizability of the model and may also explain the insignificance of the leverage variable in this current study as a motivational factor that govern the management's choice of the accounting methods.

Table 5.1 The Parameters Estimates of the Multivariate Model for the Original Sample

	Panel A. Original Sample (N=205)									
	Constant	LA	OS	ICR	AICR	PVD	PUD	CP	Estimated R^2	χ^2
Predicted Sign	N/A	-	+	-	+	+	+	+		
Version (1) Coefficients	1.455	-.366	.244	-.000		-.316	1.122	.069	.134	13.487
t-Score	1.227	-2.455	1.039	-.512		-.455	1.527	.288		
Significance	.114	.007	.160	.290		.304	.066	.345		.038
Version (2) Coefficients	1.505	-.372	.245		-.000	-.279	1.099	.062	.134	13.443
t-Score	1.274	2.505	1.043		-.465	-.405	1.490	.259		
Significance	.102	.006	.159		.302	.316	.071	.352		.039

LA: Log of assets
OS: Ownership status
ICR: Interest coverage ratio
AICR: Adjusted interest coverage ratio
PVD: Private debt
PUD: Public debt
CP: The existence of compensation plan linked to reported income.

Table 5.2 Type I Error in the Classification
for the Original Sample

	Predicted Capitalizer	Predicted Expenser	
Actual Capitalizers	1	30	31
Actual Expensers	0	174	174
	1	204	205

Table 5.3 Parameter Estimates From the Multivariate Model for the Original Sample

	Constant	LA	OS	ICR	PVD	PUD	CP	Estimated R ²	X ²
Predicted Sign	N/A	—	+	—	+	+	+		
Version (3) Coefficients	-1.431		.380	-.000	-.057	1.043	.234	.073	7.178
t-Score	-6.366		1.689	-.769	-.082	1.416	1.027		
Significance	.001		.047	.227	.396	.082	.163		.218
Version (4) Coefficients	1.358	-.356	.238	-.000		1.026	.064	.132	13.278
t-Score	1.166	-2.418	1.016	-.421		1.432	.267		
Significance	.129	.056	.166	.312		.079	.350		.022
Version (5) Coefficients	1.393	-.354	.223	-.000	.047		.081	.116	11.042
t-Score	1.183	-2.388	.958	-.476	.076		.338		
Significance	.124	.009	.180	.299	.398		.333		.051
Version (6) Coefficients	1.502	-.374	.237		-.237	1.120	.059	.133	13.219
t-Score	1.273	-2.518	1.012		-.347	1.513	.248		
Significance	.102	.006	.167		.331	.068	.355		.022

LA: Log of assets

OS: Ownership status

ICR: Interest coverage ratio

AICR: Adjusted interest coverage ratio

PVD: Private debt

PUD: Public debt

CP: The existence of management compensation plan linked to the reported earnings.

Table 5.4 The Parameters Estimates of the Multivariate Model for the Random Samples

Panel A. RS(1) (N=66)										
	Constant	LA	OS	ICR	AICR	PVD	PUD	CP	Estimated R ²	X ²
Predicted Sign		-	+	-	+	+	+	+		
Version (1) Coefficients	1.537	-.249	.349	-.000		-1.142	1.576	.056	.148	6.420
t-Score	.906	-1.170	.967	-.776		-1.173	1.346	.163		
Significance	.195	.131	.180	.226		.130	.093	.375		.326
Version (2) Coefficients	1.570	-.250	.371		-.000	-1.062	1.438	.071	.160	7.155
t-Score	.940	1.196	1.036		-1.146	-1.101	1.239	.205		
Significance	.187	.124	.163		.136	.147	.114	.365		.267
Panel B. RS(2) (N=66)										
	Constant	LA	OS	ICR	AICR	PVD	PUD	CP	Estimated R ²	X ²
Predicted Sign		-	+	-	+	+	+	+		
Version (1) Coefficients	2.459	-.376	.070	.000		.478	1.374	.100	.198	7.096
t-Score	1.532	-1.908	.192	.084		.403	.879	.288		
Significance	.068	.032	.368	.395		.317	.201	.345		.290
Version (2) Coefficients	2.438	-.375	.074		.000	.506	1.394	.100	.200	7.133
t-Score	1.516	-1.902	.202		.210	.423	.883	.294		
Significance	.071	.032	.319		.364	.312	.200	.344		.288

Table 5.4 (continued)

	Panel C. RS(3) (N=66)									
	Constant	LA	OS	ICR	AICR	PVD	PUD	CP	Estimated	
Predicted Sign		-	+	-	+	+	+	+	R ²	X ²
Version (1) Coefficients	1.153	-2.269	.596	.000		2.215	.194	.456	.305	13.017
t-Score	.735	-1.359	1.731	.252		1.263	.154	1.295		
Significance	.236	.092	.045	.354		.108	.378	.100		.044
Version (2) Coefficients	1.054	-.263	.620		.000	2.418	.263	.455	.328	13.891
t-Score	.669	-1.332	1.787		.946	1.346	.206	1.303		
Significance	.252	.095	.041		.185	.093	.365	.099		.033
	Panel D. RS(4) (N=66)									
	Constant	LA	OS	ICR	AICR	PVD	PUD	CP	Estimated	
Predicted Sign		-	+	-	+	+	+	+	R ²	X ²
Version (1) Coefficients	3.263	-.467	.142	-.000		-.713	1.024	.080	.200	9.543
t-Score	1.877	-2.186	.411	-.623		-.680	1.001	.220		
Significance	.034	.018	.315	.264		.250	.172	.362		.159
Version (2) Coefficients	3.397	-.484	.142		-.000	-.699	1.035	.050	.194	9.249
t-Score	1.972	-2.286	.409		-.319	-.664	1.008	.137		
Significance	.027	.014	.316		.338	.254	.170	.382		.175

Table 5.4 (continued)

Panel E. RS(5) (N=65)										
	Constant	LA	OS	ICR	AICR	PVD	PUD	CP	Estimated R ²	X ²
Predicted Sign		-	+	-	+	+	+	+		
Version (1) Coefficients	2.891	-.436	.151	-.000		-.780	1.402	.393	.253	11.796
t-Score	1.789	-2.170	.423	-1.413		-.578	1.097	1.115		
Significance	.041	.018	.312	.084		.275	.148	.144		.070
Version (2) Coefficients	3.003	-.448	.164		-.000	-.807	1.400	.358		11.071
t-Score	1.855	-2.233	.462		-1.168	-.594	1.101	1.027		
Significance	.036	.016	.303		.131	.271	.147	.165		.089

LA: Log of assets

OS: Ownership status

ICR: Interest coverage ratio

AICR: Adjusted interest coverage ratio

PVD: Private debt

PUD: Public debt

CP: The existence of management compensation plan linked to the reported income.

Table 5.5 The Predicted Classification
of the Capitalizing Firms Under
Version (1)* for the Five Random
Samples

Co. No.	Actually	Classification in Sample No.					VARIANCE
		(1)	(2)	(3)	(4)	(5)	
1	1	2	2	2	2	2	0
2	1	2	1	2	2	2	.2
3	1	1	1	1	1	1	0
4	1	2	1	1	1	1	.2
5	1	2	2	1	2	2	.2
6	1	1	2	1	1	1	.2
7	1	2	1	1	2	2	.3
8	1	1	2	1	2	1	.3
9	1	2	1	1	1	1	.2
10	1	1	1	1	1	1	0
11	1	2	2	2	1	1	.3
12	1	1	1	1	1	1	0
13	1	1	1	1	1	1	0
14	1	2	2	2	1	1	.3
15	1	2	2	2	2	2	0
16	1	1	1	2	1	1	.2
17	1	1	1	2	1	1	.2

Table 5.5 (continued)

Co. No.	Actually	Classification in Sample No.					VARIANCE
		(1)	(2)	(3)	(4)	(5)	
18	1	1	1	1	1	1	0
19	1	2	2	2	1	1	.3
20	1	1	1	1	1	1	0
21	1	2	2	2	2	1	.2
22	1	2	2	2	2	2	0
23	1	1	1	1	1	1	0
24	1	1	1	1	1	1	0
25	1	2	2	1	2	2	.2
26	1	2	1	1	2	2	.3
27	1	1	1	1	1	1	0
28	1	2	2	2	2	2	0
29	1	1	1	1	1	1	0
30	1	1	1	1	1	1	0
31	1	1	1	1	1	1	0

*The variables used in this version are;

LA: Log of total assets

OS: Ownership status

ICR: Interest coverage ratio

PVD: Private debt

PUD: Public debt

CP: The existence of Management Compensation plan linked to the reported earnings.

Table 5.6 The Parameters Estimates of the Multivariate Model for the Balanced Samples R(1) and R(2)

Panel A. R(1) Sample (N=360)										
	Constant	LA	OS	ICR	AICR	PVD	PUD	CP	Estimated R ²	X ²
Predicted Sign		-	+	-	+	+	+	+		
Version (1) Coefficients	2.386	-.352	.247	-.000		-.303	1.047	.104	.165	39.723
t-Score	3.487	-4.168	1.686	-.968		-.639	2.171	.699		
Significance	.001	.001	.047	.177		.259	.016	.244		.001
Version (2) Coefficients	2.448	-.359	.250		-.000	-.283	1.028	.093	.164	39.43
t-Score	3.593	-4.272	1.701		-.872	-.598	2.129	.631		
Significance	.001	.001	.046		.201	.269	.018	.261		.001
Panel B. R(2) Sample (N=344)										
	Constant	LA	OS	ICR	AICR	PVD	PUD	CP	Estimated R ²	X ²
Predicted Sign		-	+	-	+	+	+	+		
Version (1) Coefficients	2.079	-.280	.189	-.000		-.518	1.020	-.052	.133	30.449
t-Score	3.336	-3.917	1.266	-.402		-.997	2.303	-.353		
Significance	.001	.001	.104	.317		.170	.011	.329		.001
Version (2) Coefficients	2.100	-.300	.188		-.000	-.515	1.011	-.052	.133	30.549
t-Score	3.358	-3.938	1.260		-.511	-.996	2.283	-.353		
Significance	.001	.001	.105		.290	.171	.012	.329		.001

Table 5.7 The Parameters Estimates of the Multivariate Model
for Balanced Subgroups GI and GII of the Matched Balanced Sample R(2)

Panel A. Balanced GI (N=129)										
	Constant	LA	OS	ICR	AICR	PVD	PUD	CP	Estimated R^2	χ^2
Predicted Sign		-	+	-	+	+	+	+		
Version (1) Coefficients	1.641	-.325	.363	-.000		1.362	2.211	.321.	.239	22.063
t-Score	1.032	-1.579	1.427	-1.599		1.548	2.044	1.185		
Significance	.162	.059	.080	.031		.063	.022	.124		.001
Version (2) Coefficients	2.169	-.391	.348		-.000	1.354	2.265	.294	.219	19.961
t-Score	1.410	-1.951	1.368		-.805	1.528	2.090	.955		
Significance	.082	.026	.088		.218	.066	.020	.181		.003
Panel B. Balanced GII (N=215)										
	Constant	LA	OS	ICR	AICR	PVD	PUD	CP	Estimated R^2	χ^2
Predicted Sign		-	+	-	+	+	+	+		
Version (1) Coefficients	2.211	-.296	.197	-.000		-1.227	1.255	-.177	.162	24.955
t-Score	3.003	-3.471	1.021	-.891		-1.622	2.279	-.941		
Significance	.002	.001	.164	.196		.053	.012	.184		.001
Version (2) Coefficients	2.236	-.298	.191		-.000	-1.313	1.292	-.164	.158	24.315
t-Score	3.103	-3.485	.987		-0.400	-1.787	2.387	-.873		
Significance	.053	.001	.173		.318	.039	.009	.201		.001

Table 5.8 The Stock Market of the Selected Sample
Used in Daley and Vigeland's (1983) Study
(313 companies)

	Capitalizers		Expensers		Total	
	No. of Cos.	%	No. of Cos.	%	No. of Cos.	%
New York Stock Exchange	56	41.5	116	65.2	172	55.0
American Stock Exchange	71	52.6	46	25.8	117	37.4
Over-The-Counter	1	.7	6	3.4	7	2.2
Missing*	7	5.2	10	5.6	17	5.4
	135	100	178	100	313	100

*The missing companies were not found on the Compustat Annual Industrial or Over-the-counter files.

Table 5.9 The Size of the Total Assets of Companies Used in Daley and Vigeland's (1983) Sample and Companies Used in the Current Study

The Amount of Total Assets	Capitalizers		Expensers		Total	
	No. of Cos.	%	No. of Cos.	%	No. of Cos.	%
<u>Daley and Vigeland's Sample (313 companies), 1972 data</u>						
Less than \$50 million	69	51.1	54	30.0	123	39.3
\$50 million or more	59	43.7	114	64.1	173	55.3
Missing*	7	5.2	10	5.6	17	5.4
	135	100	178	100	313	100
<u>The Selected Sample for the Current Study (205 companies), 1983 data.</u>						
Less than \$50 million	24	77.4	106	60.9	130	63.4
\$50 million or more	7	22.6	68	30.1	75	35.6
	31	100	174	100	205	100

*The missing companies were not found on the Compustat Annual Industrial or Over-The-Counter files.

CHAPTER VI

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Introduction

In the previous two chapters the empirical results of both the univariate and the multivariate tests were reported. In this chapter the researcher summarizes the formulated hypotheses and briefly describes the methodology in the first section. While in section two he reports the overall conclusions of the study. Finally, section three provides some recommendations and suggestions for further future research in this area.

Summary

This research employs the economic positive theory framework to analyze the managements' incentives to choose between capitalizing or expensing the costs of internally developed software. Within that framework it was hypothesized that ownership control status (OS), Leverage (PVD), the existence of public debt in the firm's capital structure (PUD), and the existence of management compensation plan linked to the reported earnings (CP) are more likely to increase the probability that a firm will choose to capitalize the costs of internally developed software. The firm size (LA), and the interest coverage

ratio (ICR) are predicted to have the opposite effect.

Data on the selected firm characteristics were collected from the annual reports and the Form 10-K's for 205 companies (31 capitalizers and 174 expensers) for 1983 or last available financial statements. Those 205 companies were selected from "The Directory of Companies Required to File Annual Reports with Securities and Exchange Commission." Those firms belong to two SEC codes: (a) 7370 - computer and other data processing services [this group was called GI], (b) 3570 - office and computing machines [this group was called GII].

A balanced sample was created by using two different techniques. The first was the random sampling technique which is known to all researchers. To apply this technique the control group (the expensing firms) which consists of 174 companies was divided randomly into 5 samples each of which consists of 35 companies (the fifth sample consists of 34 firms). Those samples were called RS(1), RS(2), . . . , RS(5). Each of these samples was run separately against the capitalizing group (31 firms). The second was the repetition technique. This technique was applied in two different ways as follows:

- (1) The financial data of the capitalizing firms (31) were repeated six times, so, an experimental group consists of 186 companies was created to be matched with the control group (174 firms) this repeated sample was

called (R)1.

- (2) The financial data of the capitalizers of GI (20 firms) were repeated three times and the capitalizers of GII (11 firms) were repeated ten times so, an experimental group consists of 170 firms was created to be matched with the control group (174 firms) this repeated sample was labelled R(2).

Both the univariate and the multivariate tests were performed on the original sample as well as the balanced sample [five random samples and two repeated samples].

Conclusions

The empirical results enabled the researcher to reach the following conclusions:

- (1) There is a strong support for the hypothesis that smaller firms are more likely to choose the capitalization method to account for the costs of internally developed software. These results confirms those reached by Watts and Zimmerman (1978), Collins, Rozeff and Dhaliwal (1981), Leftwich (1981), Zmijewski and Hagerman (1981), Lilien and Pastena (1982), and Daley and Vigeland (1983),

In this study the researcher argues that the size of small, high-technology firms affect the accounting choice but for reasons other than the political costs hypothesis because such firms are not

subject to much political pressure or they are not subject to any political pressure at all. The importance of the equity capital markets to those firms as a source of financing was introduced and the perceived inefficiency (by managers) of those markets was suggested as motivational factor that influences the management choice between the income increasing or income decreasing policies.

- (2) Also, the results provide evidence that firms with larger portion of public debt in its capital structure are more likely to choose the capitalization method. A similar results are provided by Leftwich (1981), and Daley and Vigeland (1983).
- (3) The results provide a weak support for the hypothesis that the management controlled firms are more likely to capitalize the costs of internally developed software. This result provides a weak confirmation for the result of Dhaliwal, Salamon, and Smith (1982). The results contrast with Fama's theory (1980). Fama theorizes that the market for managerial talent is such that there will be no difference in behavior between the managers of management controlled firms (MC) and owner controlled firms (OC). The results of this research provided a weak evidence that there exists a difference in the accounting treatment of the

costs of internally developed software adopted by MC and OC firms in the direction hypothesized and, thus, the results are inconsistent with the prediction of Fama's theory.

- (4) The results of this study indicate that the existence of low interest coverage ratio (ICR) is not a motivational factor to select the capitalization method. This result confirms Daley and Vigeland's result (1983), but it is inconsistent with Bowen, Noreen, and Lacey's results (1981) who found a significant effect at 9 percent level.
- (5) The results also indicate that the leverage (PVD) is not a significant factor that influence the management's choice between capitalizing or expensing the costs of internally developed software. This result is contradictory to most of the previous studies such as Dhaliwal (1980), Bowen, Noreen and Lacey (1981), Zmijewski and Hagerman (1981), Holthausen (1981), Leftwich (1981), Lilien and Pastena (1982), Dhaliwal, Salamon and Smith (1982), and Daley and Vigeland (1983).

Two complementary reasons are introduced to explain the inconsistency between my results and the results of the above mentioned studies. The first, is the use of the private long term debt as a measure for the leverage, Daley and Vigeland (1983) used the same

measure. The second, is that the selected sample in this study exhibits two special characteristics which are different from the characteristics of most of the samples used in the previous studies. The selected sample in this study consists from a majority of small and highly technological firms.

In the highly technological industries the small companies (the majority in this study) rely more heavily on the equity market to finance their operations than do small nontechnological firms. Horwitz and Kolodny (1980) reported that small technological firms receive about 48 percent from equity market while the small nontechnological firms receive only 14 percent. Also they reported that the long term debt received by small technological firms was only 15 percent as compared to 26 percent for the other group (see figure 2).

- (6) Moreover the results of this study provided an evidence that the existence of management compensation plan linked to the reported earnings is insignificant motivational factor that influence the management choice between capitalizing or expensing the costs of internally developed software. This result is similar to those reached by W & Z (1978); Bowen, Noreen and Lacey (1981), and Holthausen (1981).
- (7) The results also indicate that some of the independent

variables have different impact across GI and GII firms. In both groups the firm size (LA) was significantly smaller for the capitalizers and the portion of the public debt in the capital structure of the capitalizers firms was significantly higher. However, there is less agreement on the other variables both in the direction and the magnitude (see Table 5.7).

- (8) The results also indicate that the probit analysis is not an appropriate technique to be applied if the sample size is small and unbalanced.
- (9) Finally, the results may indicate that the random sampling is not the appropriate technique to be used if the experimental group consists of a small population and if it is used some other techniques such as the bootstrapping method should be used as a complementary analysis to verify the reliability of the estimated parameters.

Recommendations

On August 1984, the FASB issued its Exposure Draft that would require capitalization of the costs incurred for coding, testing and producing product master after an enterprise determine that:

- Recovery of the costs of probably, by meeting specified criteria that establish market, financial,

and technological feasibility.

-It has or can obtain the resources to produce and market the product as is committed to doing so.

All other costs would be charged to expense as incurred.

If the capitalization method is allowed and some of the expensing firms continued to expense the costs of internally developed software it will be interesting to replicate the current study as it is with only one change, that is, using the expensing firms as experimental group and the capitalizers as a control group.

An extension to the current study can be done as follows: the dependent variable could be expanded to four categories. The first, consists of those firms that capitalize the costs of internally developed software, the second, consists of those that capitalize the costs of purchased software products. The third, consists of those entered in partnership or joint venture and the fourth, consists of the expensing firms.

Also, if the capitalization method is allowed the effect of the new regulation on the intensity of spending on the software products as well as the R & D activities could be tested on a sample of those firms that will start to capitalize after the issuance of the new rule.

APPENDIX A

List Of Commentators

Accounting Firms or Groups (8)

Price Waterhouse
Arthur Andersen & Co.
Peat, Marwick, Mitchell & Co.
Coopers & Lybrand
Arthur Young
Laventhol & Horwath
Ernst & Whinney
National Association of Accountants

Government (2)

U.S. Small Business Administration
Senator Alfonse M. D'Amato

Analysts (1)

The Financial Analysts Federation
(Financial Accounting Policy Committee
and views of approximately 40 industry
specialists)

Industry and Related Groups (38)

The Association of Data Processing Service Organizations
National Electrical Manufacturers Association
The National Association of Bank Services
The Financial Executives Institute (Committee on Corporate
Reporting)
Honeywell, Inc.
Hewlett Packard
International Telephone and Telegraph Corporation
Standard Oil Company (Indiana)
International Business Machines Corporation
Creative Consulting Corporation, International
Conserv Corporation
BSL Technology
Dyatron Corporation
Sterling Software Inc.
CBS Inc.
Management Science America, Inc.
National Computer Analysts, Inc.
Consumer Systems Services Group, Inc.
Non-Procedural Systems
Construction Data Control, Inc.

Industry and Related Groups (38) (continued)

Louisiana Companies
Pentamation Enterprises, Inc.
Century Analysis Incorporated
Allied Data
Computer Task Group Inc.
Programming Services & Support
Applied Information Development, Inc.
Cytrol
Tremco Consultants
NMF, Inc.
SRS Programming Reserve, Inc.
Weidenhammer Systems Corporation
Integrated Computer Systems, Inc.
Dun & Bradstreet Corporation
Phoenix Computer Corporation
TOM, Inc.
McGraw-Hill, Inc.
Public Service Electric and Gas Company

APPENDIX B

The List of the Selected Sample

The Experimental Group: Capitalizers

G I: Industry 7370 - Computer and Other Data Processing Services

	<u>Listing</u>	<u>Fiscal Year</u>
1. AGS Computers Inc.	OTC*	12
2. Anacomp Inc.	NYS**	6
3. Astradyn Computer Industries Inc.	OS****	12
4. Auto Graphics Inc.	OTC	12
5. BDM International Inc.	AMS***	12
6. Computer Input Services Inc.	OTC	7
7. Comserv Corp.	OTC	12
8. Dyatron Corp.	OTC	12
9. First Financial Management Corp.	OTC	12
10. Fundsnet Inc.	OTC	12
11. Harris & Paulson Inc.	OTC	9
12. Infodata Systems Inc.	OTC	12
13. Lodgistix Inc.	OTC	6
14. MTX International Inc.	OTC	9
15. National Computer Analysts Inc.	OTC	12
16. National Data Communications Inc.	OTC	10
17. National Data Corp.	OTC	5
18. Network Inc.	OTC	12
19. Psych Systems Inc.	OTC	11
20. Universal Money Centers Inc.	OTC	1

G II: Industry 3570 - Office and Computing Machines

1. Arinco Computer Systems Inc.	OTC	12
2. BSL Technology.	OTC	9
3. Computer Designed Systems Inc.	OTC	8
4. Denelcor Inc.	OTC	12
5. International Business Machines Corp (IBM)	NYS	12
6. Interscience Systems Inc.	OTC	3
7. Laser Scan International Inc.	OTC	3
8. Modular Computer Systems Inc.	NYS	12
9. Syntech International Inc.	OTC	12
10. Wiltek Inc.	OTC	10
11. Zonic Corp.	OTC	3

The Control Group: "Expensers"

G I: Industry 7370 - Computer and Other Data
Processing Services

1. Advanced Computer Techniques Corp.	OTC	12
2. Algorex Corp.	OTC	6
3. American Management Systems, Inc.	OTC	12
4. American Software Inc.	OTC	4
5. Analysts International Corp.	OTC	6
6. Applied Data Research Inc.	AMS	12
7. ASK Computer Systems Inc.	OTC	6
8. Automatic Data Processing Inc.	NYS	6
9. Bolt Beranek & Newman Inc.	AMS	6
10. BPI Systems Inc.	OTC	3
11. Bradford National Corp.	AMS	12
12. Comarco Inc.	OTC	12
13. Computer Associates International Inc.	OTC	3
14. Computer Horizons Corp.	OTC	2
15. Computer Research Inc.	OTC	8
16. Computer Science Corp.	NYS	4
17. Computer Task Group Inc.	OTC	12
18. Computer Usage Co.	OTC	9
19. Comshare Inc.	OTC	6
20. Control Systems Inc.	OTC	8
21. Continuum Co. Inc. (The)	OTC	3
22. Convergent Technologies Inc.	OTC	12
23. Cook Data Services Inc.	OTC	12
24. Cullinane Database Systems Inc. (Cullinet)	NYS	4
25. Caycare Systems Inc.	OTC	12
26. Data Architechts Inc.	OS	11
27. Decision Systems Inc.	OTC	4
28. Dimis Inc.	OTC	12
29. DST Systems Inc.	OTC	12
30. Electronic Data Systems Corp.	NYS	6
31. Environmental Testing and Certification Corp.	OTC	12
32. Essex Corp.	OTC	12
33. Excalibur Technologies Corp.	OTC	1
34. GTS Corp.	OTC	12
35. HBO & Co.	OTC	12
36. Health Information Systems Inc.	OTC	6
37. Hogan Systems Inc.	OTC	3
38. Information Dialogues Inc.	OTC	6
39. Information Resources Inc.	OTC	12
40. Integrated Software Systems		

Corp.	OTC	12
41. Interactive Systems Corp.	OTC	12
42. Intermetrics Inc.	OTC	2
43. Keydata Corp.	OTC	7
44. Logican Inc.	AMS	3
45. Management Science America Inc.	OTC	12
46. Mathematical Applications Group Inc.	OTC	3
47. Monchik-Weber Corp. (The)	OTC	5
48. NCA Corp.	OTC	12
49. Octo Ltd.	OTC	6
50. On Line Software International Inc.	OTC	5
51. Pansophic Systems Inc.	OTC	4
52. PAR Technology Corp.	OTC	12
53. Pay Fone Systems Inc.	AMS	6
54. Rand Information Systems Inc.	OTC	2
55. Scientific Computers Inc.	OTC	6
56. Scientific Systems Services Inc.	OTC	12
57. SEI Corp.	OTC	12
58. Softech Inc.	OTC	5
59. Software AG Systems Group Inc.	OTC	5
60. Systematics Inc.	OTC	5
61. Systems & Computer Technology Corp.	OTC	9
62. Telerate Inc.	NYS	9
63. Tera Corp.	OTC	6
64. Time Energy Systems Inc.	OTC	6
65. Triad Systems Corp.	OTC	9
66. Tymshare Inc.	NYS	12
67. Ultimate Corp.	AMS	4
68. Wordtronics Corp.	OTC	6
69. Wyly Corp.	NYS	12

G II: Industry 3570 - Office and Computing Machines

1. Adage Inc.	OTC	4
2. Alpha Microsystems	OTC	2
3. Altos Computer Systems	OTC	6
4. Amdahl Corp.	AMS	12
5. Analogic Corp.	OTC	7
6. Anderson Jacobson Inc.	AMS	4
7. Apple Computer Inc.	OTC	9
8. Applied Magnetics Corp.	NYS	9
9. Auto-Trol Technology Corp.	OTC	12
10. Autodynamics Inc.	OTC	12
11. Automatix Inc.	OTC	12
12. AW Computer Systems Inc.	OTC	12
13. Banctec Inc.	OTC	3
14. Bedford Computer Corp.	OTC	12

15. Billings Corp.	OTC	12
16. Burroughs Corp.	NYS	12
17. Centronics Data Computer Corp.	NYS	1
18. Cipher Data Products Inc.	OTC	6
19. Cognitronics Corp.	AMS	12
20. Compuscan Inc.	OTC	5
21. Computer Automation Inc.	OTC	6
22. Computer Communications Inc.	OTC	6
23. Computer Consoles Inc.	AMS	12
24. Computer Entry Systems Corp.	OTC	12
25. Computer Memories Inc.	OTC	3
26. Computer Resources Inc.	OTC	9
27. Computer Terminal Systems Inc.	OTC	4
28. Computervision Corp.	NYS	12
29. Corvus Systems Inc.	OTC	5
30. CPT Corp.	OTC	6
31. Cray Research Inc.	NYS	12
32. C3 Inc.	NYS	3
33. Data General Corp.	NYS	9
34. Datametrics Corp.	OTC	10
35. Datapoint Corp.	NYS	7
36. Dataproducts Corp.	AMS	3
37. Datricon Corp	OTC	12
38. Datum Inc.	OTC	12
39. Decision Data Computer Corp.	OTC	11
40. Delta Data Systems Corp.	OTC	3
41. Discomed Corp.	OTC	12
42. Digilog Inc.	OTC	9
43. Digital Equipment Corp.	NYS	7
44. Docutal/Olivetti Corp.	OTC	12
45. Dynatech Corp.	OTC	3
46. Electronic Associates Inc.	NYS	12
47. Electronic Memories & Magnetic Corp.	NYS	12
48. EMF Corp.	OTC	6
49. Emulex Corp.	OTC	6
50. Evans & Sutherland Computer Corp.	OTC	12
51. Fingermatrix Inc.	OTC	5
52. Floating Point Systems Inc.	NYS	10
53. General Binding Corp.	OTC	12
54. Genisco Technology Corp.	AMS	9
55. Gerber Systems Technology Inc.	OTC	4
56. Hazeltine Corp.	NYS	12
57. Hetra Computer & Communications Industries	OTC	12
58. Hunt Manufacturing Co.	AMS	11
59. ICOT Corp.	OTC	7
60. Intergraph Corp.	OTC	12
61. Intertec Data System Corp.	AMS	3
62. KCR Technology Inc.	OTC	9

63.	Lanier Business Products Inc.	NYS	6
64.	Lee Data Corp	OTC	3
65.	Lexicon Corp.	OTC	8
66.	Litton Industries Inc.	NYS	7
67.	Lundy Electronics & Systems Inc.	AMS	6
68.	Management Assistance Inc.	NYS	9
69.	Megadata Corp.	OTC	10
70.	Micom Systems Inc.	OTC	3
71.	Micro General Corp.	OTC	12
72.	Mobot Corp.	OTC	3
73.	Mohawk Data Science Corp.	NYS	4
74.	MSI Data Corp.	AMS	3
75.	National Controls Inc.	OTC	12
76.	NBI Inc.	NYS	6
77.	NCR Corp.	NYS	12
78.	New World Computer Co. Inc.	OTC	7
79.	Object Recognition Systems Inc.	OTC	7
80.	Pitney Bowes Inc.	NYS	12
81.	Prime Computer Inc.	NYS	12
82.	Printronic Inc.	OTC	3
83.	Quality Micro Systems Inc.	OTC	9
84.	Raymond Engineering Inc.	OTC	12
85.	Reuter Inc.	OTC	12
86.	Rexon Inc.	OTC	9
87.	Reynolds & Reynolds Co.	OTC	9
88.	Rockaway Corp.	AMS	12
89.	Rolm Corp.	NYS	7
90.	Santec Corp.	OTC	12
91.	Scan Tron Corp.	OTC	6
92.	Sperry Corp.	NYS	12
93.	Storage Technology Corp.	NYS	12
94.	Sykes Datatronics Inc.	OTC	2
95.	Syntrex Inc.	OTC	10
96.	Syscon Corp.	OTC	11
97.	Tandem Computers Inc.	OTC	9
98.	Tandon Corp.	OTC	9
99.	TEC Inc.	AMS	6
100.	Tesdata Systems Corp.	OTC	12
101.	Timeplex Inc.	NYS	6
102.	Verbatim Corp.	AMS	7
103.	Wang Laboratories Inc.	AMS	6
104.	Wesper Corp.	AMS	6
105.	Zenetec Corp.	OTC	12

* Over-The-Counter

** New York Stock Exchange

*** American Stock Exchange

**** Others

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